### General Bulletin

**Case Western Reserve University**

#### Undergraduate Programs • Graduate Programs • Professional Programs

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University Mission

Case Western Reserve University’s mission is to serve society as a leading center for undergraduate, graduate, and professional education, for research that adds to society’s store of knowledge and addresses its priorities, and for active, responsible world and community citizenship. The students, faculty, staff, volunteers, alumni and others who constitute the University community pursue and represent this mission through their teaching, research, professional activities, and public service, all marked by a commitment to continuous learning.

Accreditation

Case Western Reserve University is accredited at the institutional level by the Higher Learning Commission and is a member of the North Central Association, 30 North LaSalle Street, Suite 2400, Chicago, Illinois 60602-2504; 312/263-0456; 800/621-7440; FAX: 312/263-7462; Internet: www.ncahigherlearningcommission.org. In addition, several of the University’s individual programs are accredited by nationally recognized professional associations, including:

• AACSB International – Association to Advance Collegiate Schools of Business (accountancy and business)
• Accreditation Board for Engineering and Technology, Computing Accreditation Commission (computer science)
• Accreditation Board for Engineering and Technology, Engineering Accreditation Commission (engineering programs)
• Accreditation Council for Cooperative Education (cooperative education programs)
• American Association of Nurse Anesthetists (nurse anesthesia)
• American Bar Association (law)
• American Board of Genetic Counseling (genetic counseling)
• American Chemical Society (chemistry)
• American Council of Nurse-Midwives (nurse midwifery)
• American Dental Association (dentistry)
• American Medical Association and Association of American Medical Colleges, Liaison Committee on Medical Education (medicine)
• American Psychological Association (clinical psychology)
• American Speech-Language-Hearing Association (speech pathology)
• Association of American Law Schools (law)
• Commission on Accreditation for Dietetics Education of the American Dietetic Association (dietetic internship)
• Commission on Accreditation of Allied Health Education Programs (anesthesiologist assistant)
• Council on Social Work Education (applied social sciences)
• National Association of Schools of Music (music)
• National League for Nursing (nursing)
• Ohio Department of Education, Division of Teacher Education and Licensure (art education and music education)

The University is chartered as an educational institution under the laws of the State of Ohio and holds a Certificate of Authorization from the Ohio Board of Regents.

For further information, contact the University’s Office of the Provost or the Office of Public Affairs.
The University
The University

Case Western Reserve University is one of the nation’s leading independent research universities, with programs that encompass the arts and sciences, engineering, the health sciences, law, management, and social work.

Although its origins date to 1826, the University in its present form is the result of the 1967 federation of Case Institute of Technology and Western Reserve University. The two institutions had shared adjacent campuses since the late nineteenth century, and were involved in cooperative efforts for many years. Western Reserve College was founded in 1826 in Hudson, Ohio, a town 26 miles southeast of Cleveland. The College took its name from that of the region, which at the time of the American Revolution, was known as the Western Reserve of Connecticut. In 1882, renamed Western Reserve University and boasting a medical school in addition to its undergraduate programs, the institution moved to the Cleveland site that later became known as University Circle. There it joined the Case School of Applied Science, founded in 1880 through the bequest of Leonard Case, Jr., a leading citizen of Cleveland. The name Case Institute of Technology was adopted in 1947 to reflect the institution’s growing stature in the sciences and engineering.

Academic Programs

The academic programs of the University are administered through the College of Arts and Sciences and seven professional schools, including applied social sciences, dentistry, engineering, law, management, medicine, and nursing, with coordination provided by the President and the Provost. The major academic divisions of the University are described below, along with a listing of their principal offerings. Note that several of these units cooperate to offer programs leading to joint degrees.

The College of Arts and Sciences (est. 1992, but tracing its origins to 1826) offers courses of study leading to B.A. and B.S. degrees in a full range of disciplines in the humanities, arts, social sciences, and natural sciences. Departmental faculty also conduct research and offer instruction leading to master’s and doctoral degrees in these fields. The College is also the academic home for some undergraduates pursuing major fields of concentration in disciplines included in the faculties of Management and Medicine.

The Case School of Engineering (est. 1992, but tracing its origins to 1880) offers curricula leading to the B.S. degree in a wide range of engineering disciplines. Departmental faculty also offer advanced instruction leading to the M.S. and the Ph.D. in these fields, conduct a substantial body of research, and maintain close ties to industry as well. The School also offers a practice-oriented degree, the Master of Engineering, tailored for employed engineers seeking to advance their knowledge. The Institute for the Integration of Management and Engineering, a joint venture of the Case School of Engineering and the Weatherhead School of Management, offers the Master of Engineering and Management degree.

The School of Graduate Studies (est. 1892) confers M.A., M.S., M.F.A., M.P.H., and Ph.D. degrees upon students who have completed advanced study in the arts and sciences and various professional fields. The School is an administrative unit, working closely with the deans and faculty in the University’s colleges and professional schools, who provide instruction and mentoring for graduate students.

The Mandel School of Applied Social Sciences (est. 1916) offers curricula leading to the M.S.S.A. (Master of Science in Social Administration) degree in social work, and to the Ph.D. degree in social welfare. In collaboration with the schools of law and management, the School administers the Mandel Center for Nonprofit Organizations. The Mandel School also operates a continuing education program for social-work practitioners in the community. Through the Mandel Center, the Mandel School and the School of Management offer a joint program leading to the degree of Master of Nonprofit Organizations (M.N.O.).

The School of Dentistry (est. 1892) offers a curriculum leading to the D.D.S. degree, and postdoctoral training in several dental specialties leading to the M.S.D. degree. In conjunction with its curriculum, the School also operates a dental clinic on campus where students provide faculty-supervised dental service to area residents.

The School of Law (est. 1892) offers a broad range of courses leading to the J.D. degree. The School also offers graduate instruction leading to the LL.M. in taxation and in U.S. legal studies. As part of its curriculum, the School operates a legal clinic in which law students, under faculty supervision, provide services to clients from the community. The School administers the Law-Medicine Center, the Canada-United States Law Institute, the Frederick K. Cox International Law Center, and a seminar for federal judges sponsored by the Federal Judicial Center, and participates in the Mandel Center for Nonprofit Organizations.

The Weatherhead School of Management (est. 1967) offers curricula leading to the B.S., M.S., M.Acc., M.B.A., E.D.M. (Executive Doctor of Management), and Ph.D. degrees in management, accounting, organizational behavior, operations research, and other areas of business administration. Members of the School’s faculty also provide instruction in economics for undergraduate students enrolled in the College of Arts and Sciences. The School offers a wide range of educational programs for professional managers and participates in the Mandel Center for Nonprofit Organizations and the Institute for the Integration of Management and Engineering.

The School of Medicine (est. 1843) offers a curriculum leading to the M.D. degree. This curriculum, developed at the School and emulated widely throughout the world, features an interdisciplinary approach to organ systems. The School’s pre-clinical departments offer instruction leading to the M.S., Ph.D., and M.D.-Ph.D. degrees in the biomedical sciences. Faculty in the School are extensively involved in biomedical research. Full-time faculty in the School’s clinical disciplines also have a major commitment to patient care and close supervision of medical students’ involvement in patient services in a network of affiliated hospitals and clinics.

The Frances Payne Bolton School of Nursing (est. 1923) offers curricula leading to professional degrees in nursing: the Bachelor of Science in Nursing (B.S.N.) degree, with an emphasis on acute care, and the Doctor of Nursing (N.D.) degree, a professional degree for students who already have baccalaureates in the liberal arts or sciences. The School also offers instruction leading to the M.S.N. degree in several nursing specialties and to the Ph.D. in nursing. The School’s faculty members maintain an active research program.

Cleveland

From a settlement that began nearly two centuries ago on the banks of the Cuyahoga River, Cleveland has grown into a metropolis of more than 2 million people. The heritage of this Great Lakes port includes industrial achievement as well as cultural and scientific advances. The Cleveland area is headquarters for many of the nation’s major corporations. The city is also a major banking center; the Fourth District Federal Reserve Bank, one of 12 in the nation, is located here.
Health care is another thriving Cleveland industry. Dozens of hospitals and medical centers are concentrated in the area. University Hospitals of Cleveland, the Cleveland Clinic, the MetroHealth Medical Center, and others are internationally recognized for outstanding patient care and contributions to medical research.

Greater Cleveland is dotted with shopping malls, theaters, and opportunities for sports and amusement. The latter include Lake Erie; the 17,000-acre Metropark system; professional teams in baseball, football, basketball, soccer, and hockey; and facilities for softball, skiing, hiking, cycling, picnics, and other activities. More than 60 ethnic groups are represented in Cleveland; summer festivals continue traditions brought to the region from throughout the world.

**University Circle**

Case Western Reserve University is located in University Circle, a 550-acre, park-like concentration of more than 40 cultural, medical, educational, religious, and social service institutions located at the eastern edge of the city. In addition to the University, which is the largest institution in University Circle, the community includes Severance Hall, home of the world-famous Cleveland Orchestra; the Cleveland Museum of Art, housing one of the nation’s finest collections; the Cleveland Institute of Music; the Cleveland Institute of Art; University Hospitals of Cleveland; the Western Reserve Historical Society; the Cleveland Botanical Garden; the Cleveland Museum of Natural History; and many others. All are within walking distance of the University.

University Circle attracts visitors from throughout the region to its concerts, theater performances, athletic events, art shows, public lectures, exhibits, and restaurants. Housing, shopping, and recreational facilities are all located in the area.

**University Facilities and Services**

**UCITE**

**University Center for Innovation in Teaching and Education**

122 Baker Building  
Phone 216-368-1224; Fax 216-368-0197  
e-mail: ucite@po.cwru.edu  
James Zull, Director; Mano Singham, Associate Director

The purpose of UCITE is to support and encourage change and innovation in teaching. It does this through a combination of informal seminars and workshops on topics in education and learning (about 50 per year) led by UCITE personnel and campus faculty; special programs with invited outside speakers of renown and expertise; and individualized services (such as learning to use the web, class videotaping, class visitation, mentoring, and consultation) to faculty who request them. UCITE also serves as a research, planning and implementation resource for the many education-related initiatives undertaken on campus.

UCITE also conducts programs for new faculty and these serve an important function in the faculty member’s development and socialization to the university culture, as well as to the growth of their teaching skills.

UCITE administers grants programs that are designed to encourage faculty members to develop and experiment with their teaching and education activities. The grants are funded in two different ways. The Glennan Fellows Program provides five stipends of $6,500 annually from the income of an endowment provided by the Glennan family. Selected Fellows must be tenure-track but untenured faculty members who exhibit outstanding talent as both teachers and scholars. Glennan fellows are nominated by their peers and awards are made on the basis of proposals which they submit following nominations. It is a significant honor to serve as a Glennan Fellow, and these junior faculty become recognized as leaders and role models for other junior faculty.

Other grants programs are not endowed but instead are supported by annual donations. For example, the family of Walter Nord has given $50,000 for each of the past five years for innovative courses, and this has provided support for five grants annually under that name. Additional support in the form of gifts and donations by alumni and friends is continually being sought. These funds are used to provide additional teaching grants to University faculty members.

UCITE is administered by a director who is a senior faculty member, and an associate director. The center has a full-time secretary.

**Information Services**

Information Services is the division of the University that is responsible for information technology. It is composed of several units that provide a wide variety of technology-related services, including customer service and satisfaction, administrative and desktop applications, network and infrastructure services, including telephone services and streaming video, instructional technology and academic computing, and University archives.

**Customer Service and Satisfication**

The University provides a complete range of technical support services. Services include:

- Operating a Help-Desk to provide telephone and walk-in support and troubleshooting to members of the University community 368-HELP.
- Dispatching student technical assistants to residence halls to resolve user problems that cannot be resolved over the telephone.
- Providing networked laser printers in the Wade and Fribley Commons buildings for use as high speed printers by users residing in the residence halls.

**Administrative and Desktop Applications**

The Software Center provides personal productivity and general purpose software packages (e.g., Microsoft Office Suite, virus protection, operating systems, desktop publishing tools, drawing, CAD, and painting packages, mathematical and statistical packages and tools, and programming languages); Faculty students and staff are eligible to download software packages over the University network (http://www.cwru.edu/softwarecenter)

- Courseware and collaborative tools providing online assessments and simulations, scanned images and digital movies (e.g., notes, exam keys, syllabi, text, and reference materials);
- Online databases providing reference works, locator materials, and a wide variety of both general purpose and specific databases;
- EuclidPLUS system (the University’s integrated online library catalog) providing the ability to search the electronic catalog of all University library holdings plus search and retrieve materials from the holdings of all higher education institutions in the state via the OhioLINK system;
- Electronic mail providing on-campus and worldwide Internet mail service;
- Enterprise calendaring services;
Network and Infrastructure Services

Case Western Reserve University has deployed one of the fastest networks in the world. The network delivers switched gigabit to the desktop across a massive campus backbone that exceeds half-a-terabit per second. Utilizing the University’s technologically advanced communication network, students, faculty and staff have access to computing and information resources both on-campus and distributed around the world. The network provides direct communication access from approximately 15,000 information outlets, or faceplates, located in residence hall rooms, Greek society houses, classrooms, offices, libraries, and laboratories and wireless access points throughout the campus.

Telephone Services

Services are provided to users who have telephones attached to the University Network. Telephone services provided include on-campus, local and long distance telephone calling. The student long-distance telephone program offers users significant discounts below the costs of other long distance methods, electronic access to account information, electronic billing and electronic payment. Additional services include voicemail and caller ID. Those who register for Voicemail will be notified of their messages via e-mail to their e-mail address. Users are also able to listen to their voicemail messages on their computer.

MediaVision: Video and Streaming Media

Services are provided to users who have cable-ready televisions or video receivers attached to the University Network. Currently MediaVision distributes 40 channels, including two of its own with locally originated programming. MediaVision is also responsible for architecting and deploying the University’s enterprise streaming media solution and production facilities.

Instructional Technology and Academic Computing (ITAC)

ITAC enables the innovation in the integration of technology into the learning and research spaces on the University campus and beyond. Services include:

- New Media Studio (NMS) is an advanced technology operation supporting multimedia integration into the teaching and learning environment. Videoconferencing and satellite downlink are additional services available through the NMS.

University Libraries

The University’s libraries are an integrated system comprised of the University Library, the Cleveland Health Sciences Library, the School of Law Library, and the Mandel School of Applied Social Science’s Lillian F. & Milford J. Harris Library. All Case Western Reserve libraries support the University’s undergraduate, graduate, and professional programs. Combined, their collections contain more than two million volumes. The libraries maintain individual World Wide Web sites to facilitate communication of their unique services to the University community. Collections of electronic databases and electronic journals are shared and available for all University faculty, staff, and students through the campus network, or authorized remote access.

University Library is open to all members of the university community, with collections and services supporting the faculty, staff, undergraduate and graduate students of the College of Arts & Sciences, the Case School of Engineering, and the Weatherhead School of Management. The main collection of the University Library, numbering approximately 1.4 million volumes, is housed in the Kelvin Smith Library in the center of campus. The Astronomy and Music Libraries are branches of the University Library, and are housed within their respective departments. The University Library currently subscribes to more than 9,000 serials and periodicals and has a particularly large retrospective collection. Its collection also includes audiovisual materials, government documents, special collections, and digital collections. Over 5,000 of the serials are in electronic formats and may be accessed via the campus network and authorized remote access.

The Mandel School of Applied Social Sciences has the distinction of being one of the few schools of social work that maintains a professional library for the use of its students, staff, faculty and alumni, as well as the general university community. The Lillian F. and Milford J. Harris Library contains approximately 40,000 volumes and subscriptions to some 260 periodicals and about 830 video and audio items to support these academic programs. The library also has a variety of electronic media and other materials which are available for classroom use by faculty. This library’s Web site provides information resources for social work students, faculty, practitioners, and other human service workers in the greater Cleveland area.

The Cleveland Health Sciences Library operates in two locations, the Allen Memorial Medical Library and the Health Center Library. The Cleveland Health Sciences Library collections support programs in the biological sciences, medicine, nursing, and dentistry, and are open to all University students, faculty, and staff. The CHSL total collections number over 390,000 volumes. The collection consists of books, over 1,600 print subscriptions to journals, theses, government documents, audiovisual items, and electronic resources, including access to approximately 5,000 electronic journals. The collection in the Dittrick Medical History Center contains archives, rare books, and artifacts for research in the history of medical technology.

The Law Library is located in the School of Law, and has more than 280,000 volumes including complete collections of statutory and case law, law reviews, the National Reporter System, state reports, administrative reports, and current law services. There is also an extensive British collection and special collections in taxation, labor law, and foreign investments. The Law Library’s Web site provides core links to legal information resources, government agencies, and legislative history resources.

EuclidPLUS is the University’s comprehensive online, public-access catalog, and also has holdings of the Cleveland Institute of Music and the Cleveland College of Jewish Studies. EuclidPLUS has search and display functions for the cataloging records of all volumes in the campus libraries, and is accessible through the World Wide Web. EuclidPLUS also provides quick links to the libraries’ Web sites, research database, electronic journals, consortium materials, and major local libraries. Computer workstations are located in each University library to facilitate use of all digital library information resources. Network access allows researchers to search the resources of the University’s libraries and the state consortium catalog from any port on the campus network, from the Kelvin Smith Library wireless network, or through University-authenticated remote access.

Case Western Reserve University is a founding member of the OhioLINK consortium, which provides a shared, unified catalog for 79 colleges and universities, as well as the State Library of Ohio. OhioLINK provides access to many electronic journals, media resources, and online databases. Authorized faculty, students, and staff enjoy automated online borrowing and
renews of book and media materials, as well as onsite borrowing privileges at OhioLINK member libraries.

Case Western Reserve University students may apply for a Cleveland Public Library CEVENET card, which expands access to many local city and county libraries in the area. Other libraries in University Circle include the Cleveland Institute of Art, the Cleveland Institute of Music, the Cleveland Museum of Art, the Western Reserve Historical Society, the Cleveland Museum of Natural History, and the Cleveland Botanical Garden Library.

The University is a member of the Association of Research Libraries (ARL) comprised of 123 North American research libraries. University Library is an OCLC library, and a member of Scholarly Publishing and Resource Coalition (SPARC). University Library

http://www.cwru.edu/UL/homepage.html
Cleveland Health Sciences Library
http://www.cwru.edu/chsl/homepage.htm
Law Library
http://lawwww.cwru.edu/library/
MSASS Mandel Library
http://msass.cwru.edu/library/
OhioLINK
http://www.ohiolink.edu
ARL
http://www.arl.org

University Farm

The University Farm, consisting of the Squire Valleevue and Valley Ridge properties, is located on Fairmount Boulevard about ten miles east of campus in the Village of Hunting Valley. It is a beautiful, University-owned, 389-acre property that includes within its boundaries forest, ravines, waterfalls, meadows, ponds, and a self-contained natural watershed. It is the site of several buildings designed for educational, research, and recreational purposes, and seven residences. The buildings accommodate research and instructional laboratories, classrooms, a large greenhouse, and in the Sheep Barn, Pink Pig (a lodge with overnight accommodations), and Manor House, facilities for conferences, retreats, and recreation. There is also a five-mile running (or cross country skiing) trail, a nature trail, several picnic areas, and playing fields for volleyball and softball.

Case Western Reserve activities, including academic courses, research, intercollegiate athletic events, picnics, continuing education, and retreats, take advantage of this facility. The University Farm is open and available to all students, faculty, staff, and alumni. Utilization of the buildings and large picnic shelters must be in accordance with Farm policies and is by reservation through the Farm office.

Dental Clinic

Phone 216-368-3600
School of Dentistry, Emergency Drive
The School of Dentistry of Case Western Reserve University maintains a clinic that provides complete dental services to students and faculty as well as the general public.

University Bookstore

Thwing Center
Phone 216-368-2650
Fax 216-368-5205
Website http://www.cwru.bkstore.com/cwru/
David Johncock, Manager

The University Bookstore, located in Thwing Center, serves as the source for all required and recommended course materials that include new and used textbooks and CWRU/notes (custom produced course packets designed by faculty for their classes). In addition to course books, the University Bookstore features complete reference sections and a large general book department, quality school and office products, the latest in computer software and accessories, a broad selection of clothing and gift items, and a variety of convenience foods and beverages. The University Bookstore also offers special book orders and custom orders of clothing and gift items for groups and organizations.

The University Bookstore is open 8:30 a.m. to 5:30 p.m. Monday to Thursday, and 8:30 a.m. to 5:00 p.m. on Friday. Saturday hours are 10 a.m. to 2 p.m. Hours are subject to change at the start of each semester, for summer, breaks and special events. Please check the website for current hours of operation.

http://www.cwru.bkstore.com/cwru/

The bookstore accepts cash, checks, major credit cards, CWRUcash, CWRU charge, and department requisitions.

Health Sciences Bookstore

School of Medicine, West Wing WB10
Phone 216-368-3464
Fax 216-368-6636
Website http://www.cwru-med.bkstore.com/cwru/
Amy Hogg, Manager

The Health Sciences Bookstore, located in the basement of the west wing in the School of Medicine, is the source for medical and dental texts, health sciences reference books, medical instruments and supplies. Additionally, there is a variety of imprinted gifts and clothing, convenience foods and beverages and film.

The Health Sciences Bookstore is open 9:30 a.m. to 5 p.m. Monday, Wednesday, Thursday, Friday; 9:30 a.m. to 6 p.m. Tuesdays; Saturdays 10 a.m. to 1 p.m. Hours are subject to change based on special events Please check the website:

http://www.cwru-med.bkstore.com/cwru/ for current hours of operation.

The bookstore accepts cash, checks, major credit cards, CWRUcash, CWRU charge and department requisitions.

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Business Office, Bindery
Phone 216-368-2550
Fax 216-368-5205
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Hours of Operation
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CWRU GENERAL BULLETIN 2002-2004
THE UNIVERSITY • 7
Transportation
A free shuttle bus system that runs on a continual schedule throughout the week serves the 550-acre University Circle area. In the evenings, a loop bus runs every 20 minutes over a specific campus route. Bus schedules are available in the Access Services Office, Thwing, and several other buildings. In addition, Regional Transit Authority bus routes run through the heart of University Circle, linking the campus with the greater community. Rapid Transit trains run directly from the campus to Cleveland Hopkins International Airport.

Campus Parking
All parking for Case Western Reserve University and University Hospitals is administered by University Circle, Inc. (UCI), which has also undertaken a program of increasing the space available for parking.

The privilege of parking on campus is granted first to students who must drive cars to reach the campus and to students who require cars because of physical disability or the special needs of their curricula. Parking privileges are then granted, as space permits, to other students. Students living in residence halls and fraternities must obtain parking permits if they maintain cars while in residence. Resident student parking is granted on a confirmed housing assignment, class seniority basis. Parking on campus is not allowed except by permit and then only in the areas for which the permit is valid.

Students may apply for fall parking permits in the previous spring. To the extent that space is available, full-time students who meet the above qualifications are eligible to purchase parking permits. Part-time students attending classes for fewer than 12 credit hours (undergraduate) or 9 credit hours (graduate) are eligible to purchase permits on the same basis as above at a lower cost. Graduate students registered for 651 or 701 courses must purchase full-time permits. Current proof of part-time registration is required when a request for a part-time parking permit is made. Summer session permits are also available.

Questions about the cost of permits may be directed on or after May 1 to Access Services, Crawford Hall, 10900 Euclid Avenue, Cleveland, Ohio 44106-7084 (216-368-2724).

Maps detailing the complete parking inventory of UCI will be issued with each permit.

All students registered at the University must abide by the parking rules of University Circle, Inc. (UCI). Complete copies of the rules are available at the University Circle Parking Department and at Access Services.

Violators are subject to fines, and, if fines are not paid, to towing. A person charged with a violation has the opportunity for a first written appeal to the University Circle Parking Department. In the event of an unsuccessful first written appeal, the alleged violator has the opportunity of reappealing in person, with counsel if desired, before the UCI Parking Appeals Committee. Failure to pay a fine will ultimately result in the withholding of transcripts.

Undergraduate Admission
Admission to Case Western Reserve University is competitive. All applicants are evaluated on the basis of high school performance, including class rank, level of courses completed, grades, recommendations, and personal accomplishments. Scores from the Scholastic Aptitude Test or the American College Testing Program are also an important consideration. Students are encouraged, but not required, to take three of the College Board SAT II Subject Tests. An admission interview is highly recommended. Students who have been out of high school several years may wish to consult the Office of Undergraduate Admission about entrance requirements.

Freshmen
Application Dates and Notification of Admission
The University operates on a two-semester calendar and has an abbreviated summer session. Students seeking to enroll in the fall may use any one of three application plans. Those for whom Case Western Reserve University is a clear first choice may apply for Early Decision by meeting a January 1 application deadline. They will be notified of the Admission Committee’s decision within three weeks of a completed application, and if admitted, will be required to withdraw all applications from other colleges and universities and commit themselves to enroll at Case Western Reserve within three weeks of the admission decision. Students who wish to be considered for the University’s Pre-Professional Scholars Program (PPSP) must submit their applications by December 15. They will be notified of the University’s decision on their admission in early March and PPSP results by April 15. The regular application deadline is February 1. Students meeting this deadline will be notified of their admission by April 1 and will be expected to indicate whether or not they will accept the University’s offer by May 1.

Applicants for the spring semester or summer session should have all admission credentials on file six weeks before the beginning of the term. Applicants for either term should realize that many programs require that courses be taken in a sequence. Because not all courses are offered every semester, the number available to freshmen entering in the spring or summer may be limited.

Offers of admission are contingent upon successful completion of secondary school work and graduation. Admitted students should arrange to have final semester grades sent to the Office of Undergraduate Admission.

Secondary School Preparation
All entering freshmen are expected to have completed 16 units of full-credit academic work in secondary school, including four years of English, three years of mathematics, and one year of laboratory science. Students expressing interest in some fields should present additional courses as part of their 16 units, since those courses provide appropriate background for college-level work in the area of their choice. A fourth year of mathematics is required of students planning to concentrate in mathematics, science, or engineering. Students planning to major in science or math or to pursue pre-medical studies must have at least two years of laboratory science, including chemistry, and, in some cases, courses in physics. Engineering applicants should have one year of chemistry and one year of physics. All applicants are encouraged to have completed two to four years of foreign language study.

Tests
Applicants must submit scores from either the American College Testing Program or the SAT I of the College Board. It is recommended that these tests be taken no later than December of the senior year.

For students planning to pursue degrees in engineering and science, the score in the mathematical part of the ACT or SAT I is of particular importance. The curriculum in science and mathematics is based on a student’s capacity to analyze and reason by means of mathematical logic. The University strongly recommends that applicants for admission take three College Board SAT II tests by December of their senior year. Results of the tests aid in the admission decision and in placement in freshman courses.
Students interested in science or engineering should take subject tests in English Composition, Mathematics Level I or II, Chemistry and/or Physics. Others should take English Composition and two other tests of their choice. Applicants for the Pre-Professional Scholars Program must submit either the SAT I and three SAT II test scores, including English Composition, or the ACT.

Interview
An interview is recommended as part of the admission process, but it is not required. Prospective students should schedule an interview appointment in advance. Parents are welcome. Guided tours of the campus and visits to classes are also arranged upon request. The Office of Undergraduate Admission is open for interviews by appointment from 9 a.m. to 5 p.m. on weekdays and for group information sessions from noon to 3 p.m. on selected Saturdays during the school year. The office is closed on holidays. Students may arrange appointments by writing, calling, or e-mail:

Case Western Reserve University
Office of Undergraduate Admission
103 Tomlinson Hall
Cleveland, Ohio 44106-7055
(216) 368-4450
admission@po.cwru.edu
www.cwru.edu

A campus map with directions will be sent with the appointment confirmation.

Application Process
Before an admission decision can be made, the applicant must submit the following:
1. An application form, completed and signed. A $35.00 application fee is required (Fee waivers are available).
2. The secondary school record, including class rank, courses and grades from school years 9 through 11, and senior year courses in progress. If class rank is not available, this should be noted on the high school transcript. It is the applicant’s responsibility to have the guidance counselor prepare and send the secondary school record to the Office of Undergraduate Admission.
3. Scores from the ACT or SAT I. Scores may be reported either through the testing agency or on the official high school transcript.
4. Written recommendations from a high school counselor (required) and a teacher (optional).

To aid the Admission Committee in its decision, applicants should submit, whenever possible, the following supporting materials: SAT II subject test results as noted above and grades for the first semester of the senior year.

Notification of Admission
All admission decisions will be mailed by April 1. Offers of admission are contingent upon successful completion of secondary school work and graduation. Admitted students should arrange to have final semester grades sent to the Office of Undergraduate Admission.

Acceptance of Admission
Case Western Reserve University subscribes to the College Board Candidate’s Reply Date Agreement. Under this agreement, accepted candidates (except Early Decision Candidates) have until May 1 to accept or decline the offer of admission. Students admitted under the Early Decision plan are required to withdraw applications from other colleges and universities and accept Case Western Reserve’s offer within three weeks of admission.

Note: Applicants who have been offered admission by a college or university that requires a response before May 1 should contact that college or university to ask for an immediate extension of its deadline until all the colleges applied to have responded. They should also contact the Office of Undergraduate Admission to inform the Admission Committee of the problem.

Case Western Reserve University subscribes to the National Association of College Admission Counselors’ Statement of Principles of Good Practice.

Enrollment Deposit
Students who accept the offer of admission must submit a non-refundable enrollment deposit of $200.00 to reserve a place in the entering class. If a student does not respond to the offer of admission by May 1 or does not make the appropriate deposit, the Office of Undergraduate Admission may release the student’s place to another applicant.

Advanced Placement and Proficiency Examinations
Case Western Reserve University grants degree credit and placement in advanced courses on the basis of the College Board Advanced Placement Examinations and the International Baccalaureate (IB) Diploma or the International Baccalaureate higher level examinations. The determination of credit and placement is made by the appropriate academic departments. An Advanced Placement score of 4 or higher or an IB higher level examination score of 5, 6, or 7 may receive favorable consideration. Students who are enrolled in high schools that do not offer Advanced Placement courses but who wish to take the examinations should contact their high school counselors for registration information. It is the student’s responsibility to have Advanced Placement scores sent to the Office of Undergraduate Admission. Students may also receive college credit on the basis of proficiency examinations administered by individual departments.

Transfer Students
Transfer applicants (any student who has enrolled in a college or university after graduation from high school is considered a transfer student) are considered for admission for the fall semester, spring semester, or summer session. In order to provide adequate time for evaluation, applications should be completed as early as possible and not later than six weeks before the beginning of each semester. The degree requirements for all students are established by the undergraduate colleges. For specific requirements for transfer students, please see the appropriate section under “Undergraduate Studies.” It is generally expected that the final two academic years will be taken in residence at the University.

Each transfer applicant is asked to submit:
1. An application form, completed and signed. An application fee of $35.00 is required (Fee waivers are available).
2. An official transcript of the high school record.
3. Official transcripts from each college attended.
4. The Statement of Good Standing completed and signed by a school official.
5. Typed or printed descriptions of each course completed in college, including those in which the student is currently enrolled, as well as those the student will complete before transferring. Such descriptions should include the name of the department offering the course, course number, number of credit hours, and, when possible, course syllabus and title and author of text.

6. If available, College Board SAT I and SAT II test scores or American College Test scores. The scores may be included with the high school transcript or sent directly to the University from the testing service. The applicant will be notified of the
admission decision as soon as the file is complete. Admitted students who accept the offer of admission must respond by submitting the same reservation deposits as those listed for freshmen (see above). Offers of admission are contingent upon satisfactory completion of work in progress at another college or university.

In order to evaluate transfer credit, the Office of Undergraduate Admission must receive a complete official transcript of all work taken and course descriptions.

Binary (3-2) Program
In cooperation with a number of liberal arts colleges, Case Western Reserve offers the Binary (3-2) Program in engineering, in which students complete three years of study in the liberal arts college and two years in engineering at the Case School of Engineering and receive degrees from both colleges. For further details, consult the program description found under "Undergraduate Studies."

Special Admission Programs
Students seeking admission to one of the University’s joint programs with the Cleveland Institute of Art or the Cleveland Institute of Music should consult the appropriate program descriptions elsewhere in this Bulletin. For information regarding admission as a transient student or adult non-degree student, admission to the Pre-Professional Scholars Program and Six-Year Dental Program, admission to the PreCollege Scholars Program, or admission to the Minority Engineers Industrial Opportunity Program, consult the appropriate section of this bulletin.

Registration
(Summer, Fall, and Spring)
Students register at the time indicated on the “Schedule of Classes” or as indicated by individual graduate/professional school registrars. Registration for fall begins in April and continues through the beginning of classes in August; registration for spring begins in November and continues through the beginning of classes in January. Only those students who have no outstanding financial obligations to the University are eligible to register. The University Controller bills those who register early for the next semester. At registration just prior to the beginning of classes, students must have paid all previous charges and be able to pay, or have financial aid equal to one half of that semester’s tuition and fees. Each student must have an ID number on record in the student information system. The social security number is used as the student ID number, and it appears on all documents and records. Students from other countries who do not have social security numbers are issued student ID numbers.

The “Schedule of Classes” is published once per semester and an electronic version is updated routinely to indicate changes and is available through the University Registrar’s website at: http://www.cwru.edu/provost/registrar/registrar.html. The University Registrar’s website includes the academic calendar, the dates for late registration and drop/add, and a complete listing of courses offered. Students are encouraged to use the on-line registration system (SOLAR) if available through their school. Alternatively, students may obtain course selection forms and instructions in their deans’ or registrars’ offices. If not using SOLAR, completed schedule forms are to be signed by the student’s advisor and/or dean, before the student goes to the registrar’s office. No zero credit only registrations (e.g. zero credit physical education courses) are allowed unless approved as part of ongoing degree programs. During any semester, students may not register in more than one school or college of the University.

Courses of Instruction
All courses at the University, except courses in the Medical School, Law School, School of Dentistry, and School of Nursing, are numbered according to the following plan

- 100-199 Elementary courses
- 200-299 Intermediate courses
- 300-399 Advanced undergraduate courses
- 400-499 Lower level graduate courses (some are open to undergraduates; consult with the appropriate department)
- 500-701 Advanced graduate courses

Roman numerals (I, II, etc.) after course titles indicate segments of a multi-course sequence. Arabic numerals in parentheses after course titles indicate the semester credit hours for each course.

Office of the Veterans’ Coordinator
The Office of the Veterans’ Coordinator, housed in the Office of the University Registrar, 110 Yost Hall, administers the regulations governing the educational benefits and opportunities open to veterans under various federal laws. The office maintains close contact with the Veterans Administration and is the only office authorized to verify veterans’ attendance. For information call 216-368-4510.

Grading System
The following grading system is used at Case Western Reserve University:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Meaning</th>
<th>Quality Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>Fair</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>Passing</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>Failure</td>
<td>0</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>Withdrawal from a class</td>
<td></td>
</tr>
<tr>
<td>WD</td>
<td>Withdrawal from all classes for a particular semester</td>
<td></td>
</tr>
<tr>
<td>WF</td>
<td>Withdrawn under Academic Regs. 5 &amp; 6 (Law School)</td>
<td></td>
</tr>
<tr>
<td>AD</td>
<td>Successful audit</td>
<td></td>
</tr>
<tr>
<td>NG</td>
<td>Unsuccessful audit</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Passing in a pass/no pass course</td>
<td></td>
</tr>
<tr>
<td>NP</td>
<td>Not passing in a pass/no pass course</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Honors in a pass/no pass course (Nursing and Law School only)</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>For courses that extend for more than one semester</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory (for master’s or doctoral thesis and E.M.B.A. seminar courses)</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Unsatisfactory (for master’s or doctoral thesis, E.M.B.A. seminar courses, and Law School only)</td>
<td></td>
</tr>
<tr>
<td>RPT</td>
<td>Repeated Course</td>
<td></td>
</tr>
</tbody>
</table>

The Freshman Year: For the first two semesters of full-time enrollment students who are beginning their college studies will earn credit and grades only for those courses completed with a grade of D or higher. Any courses for which a grade of F, W or NP is assigned will not be included in the computation of the grade point average and will not be posted on the official transcript. This grading policy is not applicable to part-time or transfer students and does not apply to the summer session.
Explanation of Grades

The responsibility for assigning grades rests exclusively with the instructor of a course or section, who must announce the general method of grading to his/her class at the beginning of the course. Grades in all courses are reported to the University Registrar at the end of each semester for all students and at midterm for undergraduates (midterm grades are not considered part of the student’s permanent academic record). Changes to student grades must be reported on grade change cards and have all required signatures.

I (Incomplete)
The grade of I is assigned at the discretion of an instructor provided that
1. There are extenuating circumstances, explained to the instructor before the assignment of the grade, which clearly justify an extension of time beyond the requirements established for other students in the class. It is the student’s responsibility to notify the instructor of the circumstances preventing completion.
2. The student has been passing the course and only a small segment of the course remains to be completed, such as a term paper, for which the extenuating circumstances justify a special exception.

An Incomplete grade may not be assigned if a student is absent from a final examination, unless the dean has authorized the absence. Unauthorized absence from a final examination will result in a failing grade. When the student completes the work, the Incomplete is changed to an A, B, C, D, P, F, or NP. (Note: not all schools award all of these grades, see first paragraph of “Grading System” above.)

For undergraduate students: All work for the Incomplete grade must be made up, and the change of grade recorded in the Office of the University Registrar, by the date specified by the instructor, but no later than the 11th week of the session following the one in which the Incomplete grade was received. In certain cases, (such as students on probation or graduating students) the dean may establish an earlier date for completion of courses with Incomplete grades. When a student fails to submit the work required for removing the Incomplete by the date established, the instructor shall transmit to the Registrar a final grade that assumes a failing performance for the missing work. In the absence of the assignment of a grade by the instructor the Registrar will convert the I to F when the deadline for making up Incomplete grades from a previous semester has passed. Failure to meet this deadline for removing the Incomplete will result in a failing grade. An instructor may elect to give the grade of F or NP if the Incomplete is not removed within the specified time limit. For students in the graduate and professional schools: In order to receive credit for a course marked incomplete the student must complete the work by the date specified by the instructor, and in no event later than the end of the next regular semester (fall or spring). If the student fails to remove the Incomplete within the specified time, he or she forfeits the privilege of completing the course for credit and the grade becomes a permanent incomplete unless the instructor elects to give a grade of F.

S (Satisfactory)
The grade of S given graduate students in the School of Graduate Studies indicates satisfactory progress in evaluating exclusively thesis and dissertation research. The grade S is not counted in determining quality averages. The alternative to a grade of S is U ( Unsatisfactory). The grade of I (Incomplete) may not be used in evaluating thesis and dissertation research. In other graduate/ professional schools, the grade of S may indicate passing performance in designated courses and advanced seminars.

R (Conditional)
The grade of R is used for work, such as undergraduate thesis and project laboratories, that extends more than one semester. The R grade will be replaced by the letter grade finally reported for the completed work.

AD (Audit) and NG (Unsuccessful Audit)
The grade of AD (audit) will be given when a student has officially registered to audit a course and has satisfied the requirements specified by the instructor for this grade. The grade of NG (unsuccessful audit, graduate and professional schools only) will be given when a student has officially registered to audit a course and has not satisfied the requirements specified by the instructor for this grade.

Undergraduate Students
A student may audit a course with the dean’s or advisor’s approval and the consent of the instructor of the course. An auditor receives no credit for the course.

Registration in a course cannot be changed from audit to credit or the reverse after the end of the drop/add period. At the beginning of the course, the student and instructor should reach agreement regarding the requirements to be met for a grade of AD. The grade of AD is entered on the student’s transcript if approved by the instructor of the course. If the instructor does not approve the grade AD, the enrollment is not posted on the transcript. A student may take for credit a course he or she audited in an earlier semester.

Graduate/Professional Students
Dental students: Courses towards degree programs in the dental school may not be audited.

The following statements apply to the schools of Graduate Studies and Management: The instructor may designate that the student has not completed all requirements for auditing the course and that NG (Unsuccessful Audit) be recorded on the student’s transcript. A course once audited may not be repeated for credit, nor may any course for which credit has been given be repeated for credit toward degree requirements. Students will be permitted to change their registration in a course from credit to audit (AD), or the reverse, with written consent of their advisor and the instructor only if the change is officially made on or before the date specified in the academic calendar for the given term.

Other graduate and professional schools: Please refer to individual school sections of this publication, or to individual school student handbooks.

W (Partial Withdrawal)
The grade of W will be given if a student officially withdraws from a course on or before the date specified in the academic calendar for the given term. This procedure necessitates completion of a form that must be signed by the dean and/or faculty advisor and submitted to the University Registrar. After this date, the grade as determined by the instructor will be posted.

WD (Complete Withdrawal)
The grade WD is assigned by the University Registrar for complete withdrawal from all course work for the semester. All withdrawal forms are to be submitted to the University Registrar prior to the last day of class.

Grade-Point Averages
Grade-point averages are calculated by multiplying the number equivalent of the letter grade by the number of credit hours for the course. The semester grade-point average is computed by dividing the total number of grade points earned at the University
during a given semester by the sum of the credit hours for all courses in which the student received letter grades of A, B, C, D, or F taken at the University during that same semester. (Not all of these grades are given by all schools.)

For the purpose of semester grade calculations, grade points earned when a grade of Incomplete is replaced by the appropriate course grade are credited to the semester in which the incomplete grade was received, but status action (separation, probation, or restoration to good standing) taken at the end of that semester is not affected unless the grade change occurs by the first day of classes of the following semester. Qualification for honors is based on the same terms.

For students on probation, except those enrolled at the Weatherhead School of Management, grade points earned in a summer session are credited to the preceding spring semester, with a corresponding re-evaluation of probationary status. For Weatherhead students, probation is in effect for the next semester in which the student registers for classes. The cumulative grade-point average is computed by dividing the total grade points earned at the University by the sum of the credit hours for all courses included in the grade-point calculation.

Pass-No Pass
See specific colleges and schools for information about courses that may be taken on a pass-no pass basis and similar options.

Student Records
The Family Educational Rights and Privacy Act of 1974 (FERPA) contains several provisions that are important to students. First, the University may not release personally identifiable student records to a third party, with certain specific exceptions, unless the third party has requested the information in writing and the student has consented, again in writing, to its release. The University may release directory information about a student, however, unless the student submits a written request that any or all such information not be released. Second, a student may request, in writing, an opportunity to inspect and review the student’s official files and records maintained by the University and may, if appropriate, challenge the accuracy of those records. The University is permitted a reasonable time, not to exceed 45 days, to respond to such a request. Third, a student may file with the Family Policy and Regulations Office of the U.S. Department of Education a complaint concerning what he or she believes to be the University’s failure to comply with FERPA. Finally, a student may obtain from the Office of the Provost a copy of the policy which the University has adopted to meet the requirements of FERPA. The information below is presented in compliance with the provisions of FERPA, which require the University to notify students annually of their rights and the University’s policies and procedures. Specific procedures may vary slightly among the schools and colleges of the University, and each student is encouraged to inquire at his or her own dean’s office if any question arises.

Educational Records Maintained

Deans’ Offices
The following records are generally maintained for each student in the office of his or her dean in order to facilitate and document the student’s academic work. Access to these records is normally limited to the staff of the dean’s office and to other academic and administrative officers of the University who are judged to have legitimate and appropriate reasons for access.

- Directory information
- Application materials
- Preadmission and other test scores
- Letters of recommendation (however, letters of recommendation received in confidence before January 1, 1975, are not among those materials to which students are provided access by FERPA)
- Transcripts of current and past academic work
- Copies of correspondence between the student and the dean’s office
- Application review record
- Reports on the student’s academic progress
- Copies of letters of appointment and related payroll information for a student named to a fellowship or assistantship
- Letters presenting medical reasons for a student’s absence
- Materials related to academic or disciplinary probation, if applicable (notation of certain forms of disciplinary action is not retained in the student’s permanent record)
- Reports from Educational Support Services
- A record of financial aid awards, if applicable
- A photograph of the student, if furnished

Financial Aid Offices
The following records are maintained for students in order to administer the University’s programs of financial assistance. For undergraduate, graduate, and professional students, these records are maintained in the University Office of Financial Aid; for the School of Medicine, records are maintained in the office of the dean. Access to these files is normally limited to authorized personnel, to other academic and administrative officers of the University who have legitimate and appropriate reasons for access, and to other individuals who must review a student’s records when the student applies for externally funded financial assistance. Items marked with an asterisk are not among those to which the student may have access under the provisions of FERPA.

- Parents’ financial information*
- Student’s financial information
- University Financial Aid Application
- Parents’ federal income tax return (IRS form 1040, 1040A, or 1040EZ)*
- Student’s federal income tax return (IRS form 1040, 1040A, or 1040EZ)
- Parents’ statement of nonsupport (independent students only)
- Financial Aid Transcript (graduate and transfer students)
- Verification Forms (Dependent and Independent students)
- Copies of application for Stafford Student Loan, Supplemental Loan, or Parent Loan
- Copies of student’s financial aid award
- Statements regarding assistance from outside sources
- Copies of all correspondence and interview notes related to requests for financial assistance
- Student’s employment records
- Copies of draft registration compliance form
- Ohio Student Choice Grant Program Eligibility form
- Correspondence from a parent including a specific request that it be withheld from student*

Registrar’s Office
The University Registrar’s Office files contain current schedules and grade reports. In addition, the Registrar’s Office maintains the complete historical permanent record of courses and grades on microfilm and on paper for all students who have attended the University. The registrar regularly provides the deans’ offices with copies of permanent student records for student files, advisors, and students.
Departmental Files
An academic department may maintain a semipermanent file for a student whose course of study is under the direction of members of that department. The student should check with the chairperson of his or her department with respect to any such file.

Access to Files
A student may request, in writing, an opportunity to review the contents of the student’s educational file. Certain materials are excluded from review as specified in FERPA. Among these are:

- Records kept in the sole possession of faculty, staff, and other personnel, used only as a personal memory aid, and not accessible to any other person except a temporary substitute for the maker of the record.
- Records created and maintained by law enforcement units solely for law enforcement purposes that are not maintained by persons other than law enforcement officials.
- Records created and maintained by a physician, psychiatrist, psychologist, or other professional or paraprofessional acting in that capacity in connection with the provision of treatment to a student. Such records can, of course, be reviewed by a physician or other appropriate professional of the student’s choice.
- Employment records of a student made and maintained in the normal course of business.
- Financial records of a student’s parents, or any information contained therein.
- Confidential letters and statements of recommendation placed in the file before January 1, 1975.
- Records for which the student previously waived his or her right of access.
- Records that contain only information about a person after that person is no longer a student, such as alumni records.

The office to which the request is made will arrange an appointment within a reasonable period of time (not to exceed 45 days) for the student to review the file in the presence of a member of the office staff.

If, during the course of this review, the student questions the accuracy of a record contained in the file, the staff member will attempt to resolve the problem informally. Should this attempt at resolution be unsuccessful, a formal hearing will be set up and a decision made by a University official or other party chosen by the University who does not have a direct interest in the outcome of the hearing. At this hearing, the student will be given a full and fair opportunity to present evidence relevant to the issue under consideration, and the decision will be given in writing within a reasonable period of time after the hearing.

If, as a result of the hearing, the University decides that the information is inaccurate, misleading, or otherwise in violation of the privacy or other rights of the student, it will amend the educational records of the student accordingly and so inform the student in writing. If, as a result of the hearing, the University decides that the information is not inaccurate, misleading, or otherwise in violation of the privacy or other rights of the student, it will inform the student of the right to place in the student’s educational records a statement commenting on the information in the records or setting forth any reasons for disagreeing with the University’s decision.

The purpose of this provision of FERPA is to “insure that records are not inaccurate, misleading, or otherwise in violation of the privacy or other rights of students, and to provide an opportunity for the correction or deletion of any such inaccurate, misleading, or otherwise inappropriate data contained therein and to insert into such records a written explanation . . . respecting the content of such records.” This provision of the act was not intended, in the words of the Secretary of Health, Education, and Welfare, “to overturn established standards and procedures for the challenge of substantive decisions made by the institution,” nor “to permit a parent or student to contest the grade given the student’s performance in a course.”

The student may request copies of those records to which he or she has access under the terms of FERPA. The student will be charged a nominal fee per page for these copies.

Release of Personally Identifiable Records
In general, the University will not release personally identifiable student record information to a third party unless the information has been specifically requested in writing and the student has consented to its release in writing. At the student’s request and expense, the University will furnish a copy of the information whose release has been requested. FERPA provides for certain exceptions to the requirement of prior student consent for the release of student record information. These include the release of information:

- To other University officials who are determined by the University to have legitimate educational interests. University officials are persons who are employed by the University and whose job descriptions include duties the performance of which may require access to student files. The University considers a legitimate educational interest to be any interest that is reasonably related to the educational process and overall functioning of the University.
- To officials of other schools in which the student wishes or intends to enroll, upon written authorization by the student, provided that the student is notified of the transfer, receives a copy of the record if desired, and has an opportunity to challenge the content of the record.
- In connection with financial aid for which the student has applied or which he or she has received, in order to determine eligibility, amount of or conditions for aid or enforce these conditions.
- To a victim of an alleged perpetrator of a crime of violence or a non-forcible sex offense, as to the final results of a disciplinary proceeding.
- In connection with a disciplinary proceeding against a student who is an alleged perpetrator of a crime of violence.
- To authorized representatives of the Comptroller General of the United States, the Attorney General of the United States, Secretary of Education, to certain state or local officials under certain circumstances.
- To organizations conducting studies for educational agencies or institutions, provided that these studies are conducted in a manner that will not permit the personal identification of students or their parents by persons other than representatives of these organizations.
- To accrediting organizations that need the information to carry out their accrediting functions.
- To the parents of a dependent student, as defined in the Internal Revenue Code of 1954.
- To the parent or legal guardian of a student under the age of 21 regarding the student’s violation of a law, rule or institutional policy pertaining to use or possession of alcohol or controlled substances, under certain conditions.
- In compliance with judicial order or subpoena, provided that the student is notified in advance of compliance except in those cases where notification is not permitted.
• To appropriate persons in connection with an emergency, if the knowledge of such information is necessary to protect the health or safety of a student or other persons.
• To a court if the student or his or her parent(s) initiates legal action against the University or the University initiates legal action against the student.
• As specified under “Directory Information” below.

Under the terms listed above, personal information will be released from a student’s file to a third party only on the condition that the third party will not share the information with any other party without the written consent of the student except as otherwise prohibited by law. Case Western Reserve University will maintain a record of request for access to and disclosure of personally identifiable information.

Directory Information

For the convenience of faculty and fellow students, FERPA provides for a category known as directory information which may be released without requesting the student’s or parent’s specific prior consent. Rather, the act requires that students be notified annually of the types of information included in this category and be given an appropriate period in which to express, in writing, any preference that such information about themselves not be released. For this purpose, directory information is defined to include
• Name (including both maiden name and married name, where applicable)
• Address, telephone listing and electronic mail address
• Date and place of birth
• Major field of study
• Anticipated graduate date
• Enrollment Status (undergraduate or graduate, full-time or part-time)
• Dates of attendance
• Degrees and awards received
• Participation in officially recognized sports and activities
• Weight and height (members of athletic teams)

Any student who would prefer that the University not release such information about himself or herself should so notify the Office of the University Registrar, in writing, prior to the first week of classes in the fall semester. The student should also inform the Office of News Services, Adelbert Hall (368-4440), in writing, as it is the responsibility of that office to provide the student’s hometown newspapers with news stories. Students entering the University at midyear may submit such notice during the first week of classes of the spring semester.

Transcripts

A transcript of grades will be released only upon written request of the student, either in person or by mail. A fee is charged for each transcript copy. Transcripts will not be issued to, or on behalf of, students who have not discharged all delinquent obligations to the University.

Policy on Sexual Harassment

It is the policy of Case Western Reserve University to provide a positive, discrimination-free educational and working environment. Sexual harassment is unacceptable conduct which will not be tolerated. All members of the University community share responsibility for avoiding, discouraging, and reporting any form of sexual harassment.

Members of the University community found in violation of this policy may be disciplined, up to and including being discharged for cause or being expelled from the University. Retaliation against persons raising concerns about sexual harassment is prohibited and will constitute separate grounds for disciplinary action, up to and including discharge or expulsion from the University.

This policy and the accompanying procedures shall serve as the only internal University forum of resolution and appeal of sexual harassment complaints.

The University has passed and disseminated to all parties on this campus—students, faculty and staff—a detailed statement titled Policies and Procedures Regarding Sexual Harassment and Sexual Assault. Copies are available in the Provost’s Office, all the deans’ offices and at many of the University offices throughout the campus. Consultation and advice are available in the offices of the Provost, Affirmative Action, and Student Affairs. See the section, “Student Affairs,” for policies and procedures regarding sexual assault.

Student Right to Know

The Student Right to Know and Campus Security Act requires that universities throughout the country produce statistics and/or information on the following subjects: 1) retention and graduation rates; 2) financial assistance available to students and requirements and restrictions imposed on title IV aid; 3) crime statistics on campus; 4) athletic program participation rates and financial support; and 5) other institutional information including: the cost of attendance; accreditation and academic program data; facilities and services available to disabled students; and withdrawal and refund policies.

Data on retention and graduation rates is available in the Office of the Provost in Adelbert Hall (216-368-4388) and is posted on the Registrar’s website at: http://www.cwru.edu/provost/registrar/gradrate.html. Information on financial assistance, including descriptions of application procedures and forms, may be obtained from the Office of University Financial Aid, Yost Hall, (216-368-4530). Information concerning athletic program participation and financial support may be obtained from The Physical Education and Athletics Department, Veale Center, (216-368-2867). Other institutional information, such as that listed in number 5, above, may be obtained from the Office of the Provost and in the various undergraduate, graduate and professional schools’ registrars’ offices.

Case Western Reserve University’s annual security report includes statistics for the previous three years concerning reported crimes that occurred on campus; in certain off-campus buildings owned or controlled by the University; and on public property within, or immediately adjacent to and accessible from the campus. The report also includes institutional policies concerning alcohol and drug use, crime prevention, the reporting of crimes, sexual assault and other matters. You can obtain a copy of this report by contacting the Protective Services Office at 216-368-2908, or by accessing the following website: http://www.cwru.edu/finadmin/security/secmain.htm.

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(August 2002)

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Interim Vice President for Development and Alumni Affairs

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Vice President for Campus Planning and Operations

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Vice President for Public Affairs
Mark E. Coticchia
Vice President for Research and Technology Management
Lev S. Gonick
Vice President for Information Services/Chief Information Officer
Glenn Nicholls
Vice President for Student Affairs
Hossein Sadid
Vice President for Finance and Administration and Controller

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Associate Vice Provost for Planning and Assessment

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Associate Vice President for Human Resources

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Laura E. Tanski
University Director for Budget and Financial Planning

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Secretary of the Corporation and Secretary of the Faculty

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(August 2002)

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Grover C. Gilmore
Dean of the Mandel School of Applied Social Sciences

Jerold S. Goldberg
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Dean of the School of Graduate Studies

Gerald Korngold
Dean of the School of Law

Margaret B. Robinson
Dean of Undergraduate Studies

Samuel M. Savin
Dean of the College of Arts and Sciences

Robert F. Savinell
Dean of the Case School of Engineering

May L. Wykle
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(August 2002)

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Financial Information
Financial Information

All financial obligations to the University must be discharged before a student can graduate and obtain a degree. A student will not be considered to have registered in the University until all tuition and fees have been paid in full or deferred in accordance with the deferred payment plan outlined at the end of this section. Checks and money orders should be made payable to Case Western Reserve University and should show the name and social security number of the student for whom payment is made.

Tuition Charges

Students registered in all colleges and schools except dentistry, law, management, social work, and medicine will be charged tuition according to the following schedule for 2002-2003:

- 1 to 11 credit hours (credit or audit)
  - $938.00 per semester hour
- 12 or more credit hours (credit or audit) - undergraduate students, and 12 to 17 credit hours (credit or audit) - graduate students:
  - $11,250 per semester.
- More than 17 credit hours (credit or audit) - $11,250 + $938 per semester hour in excess of 17 credit hours (graduate students only). The tuition rate for students enrolled in 18 hours of course 702 (2 semesters) will be $1,776 for 2002-2003.
- Students enrolled in undergraduate courses for the summer semester will be charged at a rate, which is one-half of the previous semester’s per credit hour charge. Registration in the fall or spring semester for more than 9 credit hours of dissertation research or more than a total 16 graduate credit hours requires special permission of the Dean of Graduate Studies. Such permission is also necessary for summer session registration in excess of 6 graduate credit hours.

Dentistry

Students registered in the School of Dentistry will be charged $30,735 for the 2002-2003 academic year, one-half of which is payable each semester. Dentistry students pay additional tuition for each summer clinic. For summer 2002, this amount is $1,750.

Medicine

The School of Medicine has implemented a fixed, four-year rate for each entering class effective with the 1997-98 academic year. The tuition rate for students entering in Fall 2002 is $35,000. Students who entered in Fall 2001 will be charged $33,735 in tuition. Students who entered in Fall 2000 will be charged $32,130 in tuition. Students who entered in fall 1999 will be charged $30,600 in tuition.

Management

Full-time students registered in the various masters programs of the Weatherhead School of Management will be charged $26,460 for the 2002-2003 academic year with a part-time rate of $1102.50 per credit hour. Students entering the School of Law in Fall 2002 will be charged $25,900 for full time study (10 credit hours or more).

Mandel School

In the Mandel School of Applied Social Sciences, a student in the master’s program will be charged $10,920 for the 2002-2003 academic year with a part-time rate of $728. Full time students enrolled for credit hours in excess of 16 will be assessed an additional $728 per credit hour. Doctoral candidates will be charged $938.00 per credit hour to a maximum of $11,250 per semester for registrations of 12-17 credit hours. Students enrolled in the Mandel Center for Nonprofit Organizations will be charged $938.00 per credit hour to a maximum of $11,250 per semester for 12-17 credit hours. There are no activity fees.

Special Fees—Not Refundable

Application Fees

Required with all applications for admission. This fee is payable at the time of filing the application. It is not refundable and no portion will be applied to tuition.

Applied Social Sciences: $25
Dentistry: $45
Graduate Studies: $25 (not required for non-degree students)
Law: $40
Management: $50
Medicine: $60
Nursing: $75 (N.D. & M.S.N.)

Health Service and Medical Insurance Fee:

Health Service and Medical Insurance Fee: $437/semester

The University’s Medical Plan fee is automatically billed at the beginning of the fall semester and spring semester (spring semester coverage extends through the summer) to all students registered for one or more credit hours. The Medical Plan provides coverage for medical care not available at the University Health Service. Students registered for one or more credit hours are eligible to use the University Health Service regardless of their participation with the Medical Plan. Students who have alternate medical insurance may waive the University’s Medical Plan fee each semester by completing a waiver form, which is available at the University Health Service (216-368-2450). The deadline date for returning the completed waiver form is stated on the top of the waiver form. Remember, this fee is billed twice a year; therefore, a waiver must be completed twice a year. Completed waivers may be returned to Student Accounts Receivable in Yost Hall or to the University Health Service.

Late Registration Fee

Required of students who register after classes have begun: $25

Transcript Fee

There is a $5 fee assessed for each transcript request.

Student Activities Fee

Undergraduate: $90 per semester
Dentistry: $80 per semester
Graduate: $5 per semester
Law: $5 per semester
Nursing: $15 per semester (N.D. & M.S.N); $7.50 per semester (Ph.D.)
Medicine: $15 per semester

Co-op Fee
First time participants: $150
Subsequent placements: $75

Clinical Practice Fee
All nursing undergraduates are charged a clinical practice fee in the fall semester of each year. For the 2002-2003 academic year, the clinical practice fee is $150.

Laboratory Fee
Dentistry: $212.50 per semester

Graduation Fee
Doctor of Philosophy: $120
This fee for the doctorate includes the cost of microfilming the doctoral dissertation by University Microfilms, Ann Arbor, Michigan, which is a requirement for the degree.

In Absentia Fee
Paid by undergraduate degree candidates who are registered in an approved program at another institution: $500.

Junior Year Abroad
Undergraduates: $500.

Tuition Deposit
Mandel School of Applied Social Sciences: $100 (non-refundable)
Dentistry: $1,000 (non-refundable)
Nursing (NS, ND, N.G): $200 (non-refundable)
Law: $150 spring deposit and $250 summer deposit (both non-refundable)
Management: $500 (non-refundable)
Undergraduate: $200 enrollment deposit (non-refundable)

Special Nursing Fees
Professional and personal liability insurance ($1,000,000 limit): $79-$158
FPB/NSNA insurance, N.D. students: $35 per year

Other Expenses (Estimated)
Books, Supplies, and Equipment
Nursing—Level I: $1,510; Level II: $960; Levels III and IV: $880
Medicine—$1,000 year (students must also supply their own microscopes; contact School of Medicine for requirements)
Dentistry—first year: $8,895; second year: $5,100; third year: $2,395; fourth year: $2,080
Law: $980 per year
Management: $1130 for first year students; $980 for second year students

Housing and Meals (On Campus)
See “Office of Housing and Residence Life” in the Student Affairs section of this Bulletin.

Personal Property Insurance
Students are responsible for their personal property while on campus. The University assumes no responsibility for loss of or damage to a student’s personal property, and the University insurance program does not cover such losses. Many “homeowner policies” purchased by a student’s family provide coverage for such perils as fire, water, and theft. If this coverage does not exist, the student may wish to consider the purchase of a separate policy.

Policy for Tuition Payment
Students enrolled in fall, spring, and summer terms for courses of full term length may arrange to pay bills for tuition and fees in two installments. At least one-half of the total bill must be paid at registration; the remainder must be paid by October 15 for the fall semester, March 15 for the spring semester, and July 15 for the summer session. Any remainder after the dates specified will be considered delinquent and will be assessed a late payment charge of 1.5% per month. Students registering as transient from another institution must pay the tuition and fees in full at the time of registration. Case Western Reserve University provides a Tuition Made E-Z Payment Plan. This ACH process will automatically debit a designated checking account on a monthly basis and apply the credits electronically to the student’s account. This process will eliminate the need for writing checks and the cost of postage.

Refunds
It is the policy of Case Western Reserve University that a refund from a scholarship, a grant, a loan or other assistance will be issued only after all charges payable to the University for an entire semester have been satisfied. If the gift assistance and loans for a semester exceed the student’s charges for that semester, a refund will be issued during that semester. Since a refund cannot be processed until after the end of the late registration/drop/add period, there is a delay of approximately two weeks after the costs and aid are confirmed. Any student, who is anticipating a refund, should make provision to cover costs to be incurred prior to the issuance of the refund check. (Please note that any form of aid designated as Pending is not considered to be received until the pending designation is removed and the credit has been applied to the student’s account.)

Complete Withdrawal
A student who completely withdraws from a fall or spring semester must pay a percentage of the tuition charge. The percentage charged is based on the number of weeks classes have been in session at the time of withdrawal.

<table>
<thead>
<tr>
<th>Week</th>
<th>Amount of Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>2-3</td>
<td>12%</td>
</tr>
<tr>
<td>4-5</td>
<td>25%</td>
</tr>
<tr>
<td>6-7</td>
<td>37%</td>
</tr>
<tr>
<td>8-10</td>
<td>50%</td>
</tr>
<tr>
<td>After 10th week</td>
<td>100%</td>
</tr>
</tbody>
</table>

There is no tuition refund after the tenth week of classes.

A student who completely withdraws from a summer session must likewise pay a percentage of the tuition charge. The amount is based on the number of weeks classes have been in session at the time of withdrawal.

<table>
<thead>
<tr>
<th>Week</th>
<th>Amount of Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>14%</td>
</tr>
<tr>
<td>3</td>
<td>26%</td>
</tr>
<tr>
<td>4</td>
<td>39%</td>
</tr>
<tr>
<td>5-6</td>
<td>50%</td>
</tr>
<tr>
<td>After 6th week</td>
<td>100%</td>
</tr>
</tbody>
</table>

There is no tuition refund after the sixth week of classes.
The University will refund any tuition paid for a semester by any student in good standing who is inducted into the armed forces before the end of that semester and who does not receive credit for the work completed during that semester.

**Return of Federal and Institutional Student Aid Funds**

This policy applies to students who withdraw or are dismissed and refunds for these students are determined according to the following policy:

1) The term “Federal Student Aid Funds” refers to the Federal financial aid programs authorized under the Higher Education Act of 1965 (as amended) and includes the following programs: unsubsidized FFEL Loans, subsidized FFEL Loans, unsubsidized Federal Direct Loans, subsidized Federal Direct Loans, Federal Perkins Loans, FFEL PLUS Loans, Federal Direct PLUS Loans, Federal Pell Grants, Federal Supplemental Educational Opportunity Grant.

2) A student’s withdrawal date is the date the student began the institution’s withdrawal process by submitting a completed withdrawal form to the University Registrar. The form must be signed by representatives of all specified departments, including a representative of the Dean’s Office of the school of enrollment. Students who leave the University without official notification will be considered to have withdrawn as of the midpoint of the semester or the last date of attendance at an academically related activity as documented by the University.

3) Refunds on tuition and room and board, if contracted with the University, will be prorated on a weekly basis based upon the University calendar up to the 60% point of the semester. There are no refunds after that time.

4) Federal aid and institutional aid is earned in a prorated manner on a per diem basis based upon the University calendar up to the 60% point in the semester. Federal and all other aid is viewed as 100% earned after that date.

5) In accordance with Federal regulations, when financial aid is involved, refunds are allocated in the following order:
- Unsubsidized FFEL Loans
- Subsidized FFEL Loans
- Federal Perkins Loans
- FFEL PLUS Loans
- Federal Pell Grants
- Federal Supplemental Educational Opportunity Grants
- other Title IV Federal assistance
- other Federal sources of aid
- other state, private, institutional aid
- and the student.

6) Any funds received in excess of the amount earned must be returned to the funding source. If the return of unearned Federal assistance causes any portion of the student’s tuition and other charges to be unpaid, the student will be billed by the University.

7) Refunds and adjusted bills will be sent to the student’s home address following withdrawal.

**Partial Withdrawal**

A student who withdraws from a course or courses after the normal drop/add period without completely withdrawing from the university is not entitled to a tuition refund for the course or courses dropped. At the discretion of the dean of a school, a partial tuition refund may be authorized in cases in which unforeseen and unavoidable circumstances necessitate that a student withdraws from a course or courses, and the student does not wish to withdraw completely. Federal, state or institutional aid may be adjusted to reflect the adjusted tuition cost in accordance with federal, state and institutional rules, regulations and policies. These may require a minimum level of enrollment to receive any assistance from a specific program.

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**Financial Assistance**

An important consideration for nearly every student is how much higher education will cost and how much the student will be expected to provide toward that cost. Students should not assume that they will be unable to attend Case Western Reserve University for financial reasons. Each year more than half of the entering class receives financial assistance. Sources of support are many and varied. Students and parents are encouraged to investigate the financial aid opportunities at Case Western Reserve University. For undergraduate students, in addition to a comprehensive program of financial assistance based on a student’s demonstrated need, the University offers academic awards based solely on academic merit. Individual students may be eligible for the Financial Aid Program or the Academic Awards Program, or both. Scholarship and university-controlled grant support are restricted to tuition only, unless otherwise noted. An individual student may not receive gift assistance from university programs or scholarship funds in excess of full tuition.

Case Western Reserve University has established academic prizes to recognize the outstanding academic achievement of its students in the pursuit of their educational programs and objectives. These prizes are announced at honors assemblies at the conclusion of each academic year. In recognition of its commitment to scholarship and research excellence, Case Western Reserve University permits the first $500 of any academic prize received at the honors assemblies to be awarded to a student without affecting other University scholarship or grant assistance. In instances in which federal or state regulations would mandate a reduction in need-based assistance, financial aid and scholarship policy will result in a reduction of up to $500 in self-help assistance (loan and job), if possible, before any grant or scholarship assistance will be adjusted.

For graduate and professional students, in addition to extensive loan assistance and in some cases opportunities for employment, a number of schools and departments offer assistantships and/or grant and scholarship aid. Financial aid information may be found on-line at http://finaid.cwru.edu/. Information regarding application procedures, eligibility criteria, financial aid definitions, University scholarships and grants, student employment, and the Tuition Stabilization Plan is currently available. The University’s Financial Aid home page has direct links to other financial aid Web pages that provide current financial aid publications. Prospective and current students can search for external scholarships by connecting to the fastWEB free scholarship search home page. Students may direct specific questions to the University Office of Financial Aid using the “Ask the Financial Aid Counselor” link. One of the counselors will respond via the Internet.
Need-Based Aid Policy

Case Western Reserve University assumes that a student’s family will make available from its income and assets a reasonable contribution toward the cost of attending the University. The University will assist a family to make up the difference between the family’s contribution and the cost of attendance. In its effort to employ an equitable method of evaluating requests for financial assistance, the University requires that all new undergraduate students complete the Free Application for Federal Student Aid (FAFSA) and the supplemental Financial Aid Profile Form of the College Scholarship Service, which together provide the University with an objective means of determining a reasonable educational contribution. All continuing undergraduate students are requested to submit the FAFSA to the processing center and send other documents directly to the Office of University Financial Aid for use in determining eligibility and the amount of financial aid to be awarded. Graduate and professional students are required to complete the FAFSA and submit the other documents directly to the Office of University Financial Aid.

The analysis of the application documents considers the family’s annual income and accumulated assets, with allowances for family size, the number of dependent family members attending postsecondary educational institutions, retirement needs, and other factors. A determination is also made of the amount a student may be expected reasonably to contribute toward college expenses from savings and employment. Financial need is computed by subtracting the student and parental contributions from the cost of attendance, also called student’s budget. This budget includes the actual cost of tuition and fees, an allowance for housing and meals, books and supplies, miscellaneous personal and incidental expenses, and transportation. An undergraduate student’s financial aid award consists generally of three basic types of financial assistance non-repayable gift or grant assistance, repayable loans, and student employment during the school year. A graduate or professional student’s financial aid award is primarily in the form of loan assistance, although other types of aid may be awarded. Most gift assistance is in the form of assistantships, fellowships, or scholarships. Case Western Reserve University adheres to the principle that a student’s need-based financial assistance may not exceed demonstrated financial need.

Because financial aid is initially awarded without regard to any other aid a student may receive from other sources (University or non-University), a student’s financial aid may be adjusted if additional assistance is received. It is the obligation of each financial aid recipient to report the amount, terms, and sources of other assistance not included in the University’s financial aid award. This includes any work, loan, or gift assistance not incorporated in the financial aid package. Any significant change in the family’s financial circumstances (an increase or decrease of $300 or more in income or assets) should be reported to the Office of Financial Aid. The amount of an individual’s financial aid will vary from year to year as the individual’s financial need varies. The determination of eligibility for financial aid is usually based on the prior calendar year’s income. Normally, financial aid is awarded with the expectation that it will be renewed each year upon reapplication on the basis of funds available, continued demonstrated financial need, and satisfactory academic performance and conduct. Each applicant will be considered for all programs of financial assistance for which he or she is eligible.

In most cases, students who are classified as independent are not required to provide information on their parents’ finances. For purposes of receiving financial aid, a student is considered independent who is:
1. 24 years of age or older by December 31 of the year for which aid is requested; or
2. An orphan or ward of the court at age 18; or
3. A veteran; or
4. Married; or
5. A graduate or professional student; or
6. Not married but with legal dependents.

Even though a student is classified as independent, the Office of Financial Aid may make an objective determination of the total resources available to the student from all sources, including parents.

Application Procedures

Undergraduate Students

The Free Application For Federal Student Aid (all students) and the Profile Form of the College Scholarship Service (new undergraduate students only), available at the applicant’s secondary school or from the Office of University Financial Aid, should be submitted to the Federal Processor and College Scholarship Service respectively. Return address envelopes are included in each application packet. Applications may be completed on-line at www.fafsa.ed.gov for the Free Application For Federal Student Aid and www.collegeboard.com for the Profile. Submission of these forms by February 1 is strongly recommended because it takes approximately four weeks to analyze and forward the information to the University. Case Western Reserve University’s school code for the Profile is 1105. The Federal code for the FAFSA is 003137 for all undergraduates. Case Western Reserve University also requires as part of the application for financial aid a signed photocopy of the parents’ Internal Revenue Service Form 1040, including all schedules and W-2 forms, for the latest calendar year. The student’s name, Social Security number, and the college in which the student will be enrolled should be printed clearly at the top of the form. The IRS form should be sent directly to:
University Office of Financial Aid
Case Western Reserve University
Yost Hall, Room 417A
10900 Euclid Avenue
Cleveland, Ohio 44106-7049
Fax (216) 368-5054

If the student filed a federal tax return for the previous year, a signed copy, along with all W-2 forms from employers, must be submitted to the University Office of Financial Aid. If the student did not file a tax return, a Student Statement of Income must be completed and submitted to the University Office of Financial Aid. This form is available from the University Office of Financial Aid. In addition, all sophomore, junior, and senior applicants must obtain and complete a Case Western Reserve University Financial Aid Application. This form should be returned directly to the Office of University Financial Aid.

Transfer students are evaluated for all sources of financial aid. Transfer students must submit the Free Application For Federal Student Aid, the Profile Form, and IRS forms as noted above. In addition, transfer students must complete a Case Western Reserve University Application for Financial Aid. Undergraduate students admitted to either the Integrated Graduate Studies or the Bachelor of Science/Master of Science program must include a memorandum of departmental financial support with their annual application. To maintain continued eligibility for undergraduate aid, the student must register for a 12-credit-hour, full-time undergraduate course load and meet all other requirements of undergraduate aid.
awards. Undergraduate financial aid eligibility including federal, state, and institutional gift assistance normally terminates after ten semesters of enrollment, regardless of degree completion.

Students selected for Verification by the Federal Processor or the Office of Financial Aid will be sent a Verification Form by the University. Applicants should respond promptly to the request for completion of the Verification Form because Federal regulations prevent the disbursement of any Federal funds until the verification process has been completed.

For more information about application procedures, request the booklet "Undergraduate Financial Aid and Scholarships" from:

University Office of Financial Aid
Case Western Reserve University
Yost Hall, Room 417A
10900 Euclid Avenue
Cleveland, Ohio 44106-7049

Graduate and Professional Students

Following is a summary of procedures for applying for need-based assistance by school. For more detailed and specific information, request the booklet "Financing Graduate and Professional Education at Case Western Reserve University" from:

University Office of Financial Aid
Case Western Reserve University
Yost Hall, Room 417A
10900 Euclid Avenue
Cleveland, Ohio 44106-7049

Students in the School of Medicine should contact the Financial Aid Office in the School of Medicine. In most instances it is the policy of the University Office of Financial Aid to meet the first $8,500 of financial need with a Stafford Loan. All financial aid application forms are available from the admission offices of the various schools or the University Office of Financial Aid. Some schools may have specific application forms for institutional funds. Check with the Admissions Office of the graduate/professional school for information on the application procedures and forms. (Students of the School of Medicine should obtain all application forms from the School of Medicine’s Financial Aid Office.)

Each student in or applying to a dual-degree program must request and provide the University Office of Financial Aid with a completed Student/Spouse Statement of Income. All financial aid applicants must submit:

- A Case Western Reserve Application for Financial Aid.
- A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
- A memorandum from the Mandel School of Applied Social Sciences specifying the amount and types of aid, if any, the student will be receiving from the School.

Mandel School of Applied Social Sciences

First-year students or first-time financial aid applicants must submit:

1. A Free Application for Federal Student Aid (FAFSA) Federal Code E00080
2. To the University Office of Financial Aid:
   b. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   c. A memorandum from the Mandel School of Applied Social Sciences specifying the amount and types of aid, if any, the student will be receiving from the School.

Continuing students must submit:

2. To the University Office of Financial Aid:
   b. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.

School of Graduate Studies

New and continuing students must submit a Free Application for Federal Student Aid (FAFSA) Federal Codes E00680-Engineering Students; E00681-Arts & Science Students.

All applicants for financial aid, other than that awarded by the department, must submit to the Office of Financial Aid:

1. A Case Western Reserve Application for Financial Aid.
2. A signed copy of the parents’ prior year federal income tax return and W-2 forms.
3. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
4. A financial aid transcript from any previous U.S. dental school attended (transfer students and applicants to the graduate master’s programs only).

School of Law

All applicants for financial aid must submit:

2. To the University Office of Financial Aid:
   b. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   c. A memorandum from the School of Law to the University Office of Financial Aid will be submitted on behalf of each student, indicating the amount and kind of assistance, if any, the student will receive from the School of Law.

Weatherhead School of Management

All financial aid applicants must submit the following documents:

1. New and continuing students: A Free Application for Federal Student Aid (FAFSA) Federal Code E00080
2. To the Office of University Financial Aid:
   a. A Case Western Reserve Financial Aid Application form.
   b. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms. If a tax return was not filed, a Student/Spouse Statement of Income is necessary.
2. To the University Office of Financial Aid.

3. All new and continuing students must submit to the University Office of Financial Aid: a. a Case Western Reserve Application for Financial Aid; b. a signed or certified copy of the student’s and spouse’s (if applicable) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income; c. a memorandum from the Mandel Center for Nonprofit Organizations specifying the amount and types of aid, if any, the student will receive from the school.

School of Medicine

All financial aid applicants must submit a Free Application for Federal Student Aid (FAFSA) Federal Code E00079 and complete the electronic Need Access application provided by the Access Group. Other required documentation should be sent directly to the School of Medicine.

Frances Payne Bolton School of Nursing

Graduate Programs

The following procedures must be observed for all Doctor of Nursing (N.D.), M.S.N., and Ph.D. students seeking financial aid based on need:
1. All new and continuing students must submit a Free Application for Federal Student Aid (FAFSA) Federal Code E00083.
2. Some new students may be required to submit a Financial Aid Transcript from the college or university previously attended. The transcripts are to be sent to the University Office of Financial Aid at Case Western Reserve University.
3. All new and continuing students must submit to the University Office of Financial Aid:
   a. a Case Western Reserve Financial Aid Application;
   b. a signed or certified copy of the student’s and spouse’s (if applicable) prior year federal income tax return and W-2 forms. If a tax return was not filed, a completed Student/Spouse Statement of Income;
4. For all students the School of Nursing must submit to the University Office of Financial Aid a Memo of Assistance indicating the number of credits the student will be taking during each period of enrollment during the academic year, and the amount and kind of assistance awarded for each term.

Mandel Center for Nonprofit Organizations

Students applying for scholarships must apply directly to the Mandel Center. One application is sufficient to apply for any scholarship available. The following procedure applies to those students who wish to borrow through the educational loan programs, in addition to any scholarship(s) received. Students must be enrolled at least halftime to qualify for Federal educational loans.

All financial aid applicants must submit
1. New and continuing students: A Free Application for Federal Student Aid (FAFSA) Federal Code E00080
2. To the University Office of Financial Aid:
   a. a Case Western Reserve Application for Financial Aid.
   b. a signed or certified copy of the student’s and spouse’s (where applicable) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   c. a memorandum from the Mandel Center for Nonprofit Organizations specifying the amount and types of aid, if any, the student will receive from the school.

Types of Aid

Gift and Scholarship Aid

Aid Available to Undergraduate, Graduate, and Professional Students

Ukrainian Student Assistance Fund Scholarship

Available to students in the College of Engineering, the College of Arts and Sciences, the School of Graduate Studies, and each of the professional schools, this scholarship stipulates that the applicant must be a full-time student in good standing, must demonstrate financial need, and normally must have at least one parent or grandparent who was born in the Ukraine. The student must be a U.S. Citizen or Permanent Resident and must be otherwise eligible for need-based financial assistance.

Undergraduate Aid related to Academic Achievement or Potential, Awarded by Case Western Reserve University

(A follow the application procedures indicated above, unless otherwise indicated.)

Academic Awards Program

The following academic awards, honoring distinguished faculty, alumni, and benefactors of the University, are offered to qualified applicants for admission as freshmen. Transfer students are ineligible. These awards are renewable for each of the four years of undergraduate study, provided high academic achievement is maintained.

Three full-tuition Albert W. Smith Scholarships for freshmen accepted in engineering, science, or mathematics.

Two full-tuition Treuhaft Scholarships for freshmen accepted in engineering, science, or mathematics.

Up to five $3,000 Materials Science and Engineering Scholarships for entering freshmen who are interested in majoring in materials science and engineering.

Four full-tuition Andrew Squire Scholarships for freshmen accepted in the arts, humanities, natural sciences, and behavioral sciences, management and accountancy.

Two full-tuition Adelbert Alumni Scholarships for freshmen accepted in the arts, humanities, natural sciences, and behavioral sciences, management and accountancy.

One $16,000 Curtis Lee Smith Scholarship every four years for a freshman accepted in the arts, humanities, natural sciences, and behavioral sciences, management and accountancy.

A Trustee’s Scholarship for freshmen entering the College of Arts and Sciences or the Case School of Engineering who rank in the top 10% of their high school graduating class and have composite SAT scores of at least 1500, or a composite ACT score of at least 35. (Value for freshmen entering in 2002 is $21,000.)

A President’s Scholarship for freshmen entering the College of Arts and Sciences or the Case School of Engineering who rank in the top 10% of their high school graduating class and have composite SAT scores of at least 1400, or a composite ACT score of at least 33. (Value for freshmen entering in 2002 is $16,000.)
The University may establish annual limits on the number of President’s Scholarships to be offered. A Provost’s Scholarship for freshmen entering the College of Arts and Sciences or the Case School of Engineering who rank in the top 15% of their high school graduating class and have composite SAT scores of at least 1300, or a composite ACT score of at least 31. (Value for freshmen entering in 2000 is $11,000.) The University may establish annual limits on the number of Provost’s Scholarships to be offered. Up to 16 Provost’s Special Scholarships for freshmen entering the College of Arts and Sciences or the Case School of Engineering who demonstrate superior academic performance (rank in the top 15% of high school graduating class and have composite SAT scores of at least 1,200 or composite ACT scores of at least 28), and who have encountered economic or educational obstacles that affected their college preparation. Applicants from inner city and remote rural schools, including Indian Reservations, and members of underrepresented minority groups are encouraged to apply. Students with special talents and significant extracurricular and community activities are encouraged to apply as well. (Value for freshmen entering in 2002 is $13,500.)

The dollar value of the Trustee’s, President’s, and Provost’s Scholarships each year will be the prevailing dollar value of the scholarship at year of entry at the University minus the value of any gift assistance from a state entity designed to offset the tuition difference between private and publicly assisted colleges in that state. The Ohio Student Choice Grant is an example of such a grant.

Renewal of Trustee’s, President’s, and Provost’s Scholarships

Scholarships are renewable for each year of undergraduate study provided that the student meets the renewal criteria established for the student’s class. A student may receive scholarship assistance for no more than eight (8) semesters of continuous undergraduate course work or until the student completes the number of continuous semesters of full-time undergraduate course work to receive a degree, whichever is less.

Student records are reviewed at the end of each academic year for renewal of scholarship assistance regardless of the number of semesters for which the student was enrolled during the academic year. The student must meet both a qualitative and quantitative standard for scholarship renewal.

The minimum standards for continuation are:

a) Cumulative hours earned after matriculation at Case Western Reserve (not including AP/IB/transfer or Pre-College Scholar credit earned prior to matriculation at the University)

At end of first year ........................................ 21 semester hours
At end of the second year ................................ 54 semester hours*
At end of the third year .................................... 84 semester hours*

*For students participating in an approved off-campus program (Cooperative Education, Practicum, Junior Year Abroad, or Washington Semester) an adjustment is made in the number of hours expected.

b) A cumulative scholarship grade point average of 1.75 at the end of the first year, and a cumulative scholarship grade point average of 3.00 thereafter.**

**Scholarship Grade Point Average: No courses are eliminated from a student’s record for the purpose of calculating the “Scholarship G.P.A.” The “Scholarship G.P.A.” is the student’s cumulative G.P.A.; unless the student has used the Repeat Option or has earned any F grades in the freshman year that do not appear on the official transcript. If a scholarship recipient has used the Repeat Option for any course or has earned any F grades that do not appear on the official transcript, the original grades will be included in the computation of the cumulative grade average for the purpose of determining eligibility for scholarship continuation.

If a scholarship recipient’s achievement falls below the standard, or the student does not enroll at Case Western Reserve University in a semester for which the scholarship recipient would receive the scholarship, the scholarship is terminated.

Students should consult the Handbook for Undergraduate Students for complete details regarding the renewal of the scholarships.

Ohio Leadership Awards Program

Minimum of twelve awards of up to $5,000 to freshmen admitted to the undergraduate colleges. Academic and leadership qualities required. Selection is on basis of nomination by high school teacher and interview.

Cleveland Plain Dealer Scholarship Program

The Cleveland Plain Dealer Scholarship Program provides two $1,000 scholarships to incoming freshmen who intend to concentrate in business management or print journalism, and are residents of Northeast Ohio. They must have demonstrated high academic achievement in their high school record and be determined by the Office of Financial Aid to have financial need. Scholarship availability is contingent upon annual funding levels. Interested students should contact the Office of University Financial Aid.

Creative Achievement Awards Program

Three scholarships for entering freshmen who demonstrate outstanding creative ability and achievement in the arts. Each applicant is required to submit a portfolio of original work. An on-campus interview is required. The scholarship is valued at $11,000 for students entering in 2002.

Minority Scholars Program

A special program of academic preparation, career counseling, internships, and mentoring is offered for selected minority students. Program participants may qualify for special financial assistance designated for low income or disadvantaged students. To apply, a student must identify himself or herself as an underrepresented minority to the Office of Undergraduate Admission. Minorities who are underrepresented in higher education include Native Americans, African Americans, Mexican Americans, Puerto Ricans, Native Alaskans, and Native Pacific Islanders.

National Merit Scholarships

Case Western Reserve University sponsors at least 25 four-year scholarships for National Merit Scholarship Corporation finalists who have listed Case Western Reserve University as their first-choice institution. Scholarships range from $500 to $2,000 per year.

Case School of Engineering Alumni Association Scholarships

The Case School of Engineering Alumni Association provides scholarship assistance to selected juniors and seniors who have demonstrated outstanding academic achievement and participation in extracurricular activities.

Alden Undergraduate Fellowship in Systems Engineering

Several scholarships of varying amounts are offered for the junior and senior years to students in Case School of Engineering who have declared a major in systems engineering. Contact the Department for further details.
James Dysart Magee Scholarships

Two or more scholarships are awarded annually to seniors in the Integrated Graduate Studies programs in economics and the social and behavioral sciences.

Trustee’s, President’s, and Provost’s Scholarships for Upperclassmen

The President has authorized the awarding of a limited number of scholarships to upper-class students beginning in the fall 2002. Recipients will be chosen from students not previously receiving these or similar scholarships. All first, second, and third year students will be eligible for consideration during the 2002-2003 and 2003-2004 academic years provided that the student has achieved a minimum 3.75 cumulative grade point average at the University and has earned at least 30, 60, or 90 credit hours respectively at Case Western Reserve after the freshman, sophomore, or junior year of study. AP credit and Transfer Credit will not be considered. Recipients will be selected by the Committee on Academic Standing. Beginning in the 2004-2005 academic year, scholarships will be available to students only upon completion of their first year at Case Western Reserve.

The following scholarships will be available beginning in the 2002-2003 academic year:

- One Trustee’s Scholarship
- Two President’s Scholarships
- Four Provost’s Scholarships

Students may obtain an application after February 15th in the Office of Undergraduate Studies or the Office of University Financial Aid. Applicants must submit the completed application and a letter of recommendation from a faculty member by April 15th to the Office of Undergraduate Studies.

The scholarships are renewable through the fourth year of undergraduate study or completion of the undergraduate degree, whichever comes first. A student must achieve a cumulative 3.0 grade point average, full time undergraduate status, and earn at least thirty additional credit hours during each subsequent year to retain the scholarship.

Undergraduate Aid Based on Financial Need and Contingent upon Satisfactory Academic Progress, Awarded by Case Western Reserve University

(Follow the application procedures outlined above, unless otherwise indicated.)

Grants-in-Aid from the Schools

Grants-in-aid comprise non-repayable gift assistance which vary according to the amount of unmet financial need but which may not exceed tuition.

Federal Supplemental Educational Opportunity Grants (FSEOG)

Students with financial need may receive a Federal Supplemental Educational Opportunity Grant. The FSEOG is awarded to students with great financial need who would be unable to attend the University without this grant. Grants may range from $200 to $4,000 per year.

Undergraduate Aid Awarded Outside Case Western Reserve University

Federal Pell Grant

The Federal Pell Grant program is a Federal grant program through which a student can receive a maximum of $4,000 (for 2002-2003). The student must apply for the Federal Pell Grant by completing the Free Application for Federal Student Aid (FAFSA). Within four to six weeks of filing, the student will receive a Student Aid Report, and the Office of University Financial Aid will receive the results electronically. The amount of Federal Pell Grant the student is eligible to receive will be determined according to Federal payment tables that are updated annually. The U.S. Department of Education requires that eligibility for a Federal Pell Grant be determined before any other Federal aid can be awarded.

Ohio Instructional Grant (OIG)

Ohio residents who will be enrolled as undergraduate students at an eligible Ohio or Pennsylvania college or university may apply for an Ohio Instructional Grant. Application is made through completion of the Free Application for Federal Student Aid (FAFSA). The student will receive an Award Certificate or letter of denial by return mail, and the Office of University Financial Aid will receive a roster of eligible students.

Ohio Student Choice Grant

All full-time undergraduate students who are residents of Ohio and were not full-time students at a college or university on or prior to July 1, 1984, are eligible to receive this grant. For 2002-2003 the amount is $1038.

Ohio Academic Scholarship Program

The State of Ohio has established the Ohio Academic Scholarship Program, through which 1,000 scholarships of $2,205 each are offered each year. Each high school in the State of Ohio is guaranteed at least one Ohio Scholarship each year. The scholarships are renewable for each of four consecutive years of undergraduate or graduate study, beginning with the freshman year, provided that satisfactory academic progress toward a degree is maintained. Individual applications to the State of Ohio are submitted through the student’s high school. The high school record and composite score on the American College Test (ACT) will be used to select the winners of the scholarships. Students should see their high school guidance counselors for additional information.

War Orphans Scholarship Program

The State of Ohio provides scholarship assistance to children of veterans who were killed in action during times of war, who received a service-connected disability of at least 60 percent, or who are totally disabled. The veteran must have entered the service as a resident of Ohio. The scholarship provides a sum of money equal to the average of tuition and fees of state-assisted institutions to students who attend eligible private institutions in the state of Ohio. Students should contact the Student Assistance Office of the Ohio Board of Regents for further details.
Other State Scholarship and Grant Programs

The states of Delaware, Maryland, Michigan, Pennsylvania, Rhode Island, and Vermont have state scholarship or grant programs for residents. The recipients of these state scholarship or grant programs may use this assistance at any eligible college or university. Students should contact their high school guidance directors or the appropriate state agency for further information.

ROTC

U.S. Army and Air Force Scholarships are available on a competitive basis. The scholarships pay a portion or all of the recipient’s tuition, laboratory, textbook, and incidental fees. Recipients also receive a tax-free stipend ranging from $250 to $400 on a monthly basis during the academic year. Students compete for three or four year scholarships. Case Western Reserve University provides matching grants to assist with tuition for up to ten new students each year.

Other Grants and Scholarships

Many students receive grants or scholarships from companies, community organizations, ethnic or religious groups, or fraternal organizations. Students are encouraged to seek such outside assistance. It is a condition of receiving financial assistance from the University that the student notify the University Office of Financial Aid of all assistance received from outside the University, whether paid directly to the University or to the student.

Mandel School of Applied Social Sciences

Direct Mandel SASS Grants

Grants are awarded to students in varying amounts, as determined by financial need and academic merit. These grants are renewable provided the recipient meets eligibility requirements and availability of funds.

Scholarships

Alumni Scholarships in varying amounts are awarded to one or more second-year students based on outstanding performance and financial need. Two Full Time Full Tuition Scholarships are awarded annually. Two Intensive Semester Half Tuition Scholarships are awarded annually. Three International Student Scholarships are awarded annually.

School of Dentistry

Alumni Scholarships

The School of Dentistry, with the support of the Alumni Association, awards a number of four-year partial tuition scholarships to entering students of outstanding achievement and potential.

American Dental Association (ADA) Endowment and Assistance Fund

The ADA provides competitive scholarships to second year Dental students. Selection criteria include U.S. citizenship; demonstrated need of at least $2,500; cumulative grade point average of 3.0 on a 4.0 scale. Applications are available through the School of Dentistry. The application deadline is June 15.

American Dental Association (ADA) Endowment Fund Minority Dental Student Scholarship Program

The ADA offers scholarships for second year minority Dental students. Selection criteria include demonstration of financial need and cumulative grade point average of 2.5 on a 4.0 scale. Applications and information are available through the School of Dentistry.

Armed Services Scholarship Program

The Army, Navy, and Air Force permit selected students to be commissioned as officers in their programs. Terms and conditions of each branch scholarship program are available from the nearest ROTC director or the appropriate state agency for further information.

Other Financial Assistance

There are several loan programs, both public and private, which offer educational assistance to supplement Federal and university loans. Among the programs currently available for Dentistry are Dental Access, Medfunds, AADS DEAL, and Sallie Mae Signature Loan. Further information and application forms are available from the Office of University Financial Aid or the Financial Aid Advisor in the School of Dentistry.

It is suggested that applicants check with local fraternal and community organizations and with their local dental societies.

School of Graduate Studies

Fellowships, Traineeships, Assistantships, and Awards

The University has approximately 1,000 competitive awards for the support of full-time study in the School of Graduate Studies. These include a variety of fellowships, traineeships, and assistantships, and are assigned through most of the departments offering graduate degree programs. Most awards are granted for study beginning in the fall semester. New students are eligible for award consideration at the time they apply for admission. The general deadline for completed applications for admission with financial aid consideration is March 1 for the following semester.

Other Resources

The Office of Research Administration has access to a terminal-based data system (SPIN) that can provide information on a variety of additional public and private sources for financial assistance.

School of Law

Law School Scholarships

Each year 10 full-tuition scholarships are awarded to entering students on the basis of merit. The scholarship is renewable provided the recipient maintains the requisite grade point average. Funds for these scholarships are provided from the generous support of alumni and friends of the law school. Other scholarships are awarded in varying amounts up to full-tuition, depending upon academic performance and availability of funds.

Weatherhead School of Management

In addition to participating in Federal financial aid programs, the Weatherhead School of Management sponsors its own programs of financial assistance for qualified M.B.A. and M.Acct. students. The
Weatherhead School programs include scholarships, grants, and loans. All requests for financial aid should be submitted no later than April 1. Because the availability of financial aid is limited, students are encouraged to apply as early as possible for such aid. Decisions concerning admission and financial aid are made independently of one another. Applying for financial aid will neither help nor hinder an applicant’s chances for admission.

To apply for any of the Weatherhead Scholarships, check the appropriate space on the application for admission. Scholarship decisions are made on a rolling basis until funds are exhausted.

Scholarships

The Weatherhead School awards a limited number of scholarships each year to entering full-time M.B.A. and M.Acct. students. Primary consideration is given to students who have demonstrated a high level of academic achievement in undergraduate studies in conjunction with outstanding scores on the GMAT. Relevant work experience is also evaluated in the award decision. Special fellowships and scholarships are awarded to full-time M.B.A. candidates who add to the diversity of the student body. The Weatherhead Alumni Association awards an annual full-tuition scholarship to an outstanding full-time M.B.A. candidate, with a minimum of two years’ work experience. The student must demonstrate outstanding academic achievement and GMAT test results. Internships, extracurricular activities, community service, and the application essay will also be considered in determining management and leadership potential.

School of Medicine

Scholarship Funds

It is the policy of the School of Medicine to use its limited scholarship funds to assist those students whose financial needs are so great that, if they were all met by loans, the burden of indebtedness would be extreme. No scholarships are granted merely because of academic excellence to students whose personal and family resources are adequate to meet the costs of a medical education. Minority group students selected for admission to the medical school are eligible to apply for aid from:

- National Medical Fellowships, Inc.
  110 West 32nd St.
  New York, NY 10001-3205
- It is desirable for eligible students (African-Americans, Mexican-Americans, mainland Puerto Ricans, and Native Americans) to initiate such applications promptly after they are accepted.

Fellowships

Many students seek opportunities to devote vacation months to intensive study of some subject in which they have become interested. Summer research fellowships are made available to students to enable them to engage in such investigations under the supervision of a faculty sponsor. The present policy is to provide, insofar as possible, a stipend of $1,200, with the requirement that the student devote a minimum of two months of full-time effort to the project. Support for the vacation research fellowship program comes from many sources.

Federal Scholarship Programs

Branches of the military service and the National Health Service Corps offer scholarship benefits to recipients including tuition, fees, and a stipend. Participants are obligated for a full year of service for each year of benefits with a minimum obligation of two years. Further information about these programs may be obtained from the local recruiting office of the armed forces or through the financial aid officer of the medical school.

Frances Payne Bolton School of Nursing

Doctorate of Nursing (N.D.)

Grants-in-Aid are awarded to full-time students in the N.D. program who demonstrate financial need and maintain satisfactory academic progress. Some of these are from endowments but the majority are contributions from alumni of the School.

The Ohio League for Nursing (OLN) provides a scholarship and loan program for full-time students who are pursuing the first Nursing degree (B.S.N. or N.D.) who are residents of Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, or Summit Counties in Ohio. For information write to:

Ohio League for Nursing, Greater Cleveland Area
2800 Euclid Avenue, Suite 235
Cleveland, Ohio 44115

M.S.N. and Ph.D. Students

The following grants and scholarships are available through the School of Nursing:

- Professional Nurse Traineeships are Federal traineeships designed for full-time graduate students preparing for teaching, administration, or specialization in a particular field of nursing practice. Students must be enrolled full-time both fall and spring semesters to qualify. Students entering in the spring will qualify if they commit to full-time enrollment thereafter. Professional Nurse Traineeships may be used for master’s study for up to 18 months. The current level of funding pays for approximately 1 to 1 1/2 credit hours per semester.
- National Research Service Awards for Individual Predoctoral Nurse Fellowships are awarded under the authority of the Public Health Service Act to nurses for predoctoral training in specified areas of nursing. These awards are made to individuals selected in national competition. Applicants must be enrolled for study leading to the Ph.D. in nursing and be sponsored by faculty of the School of Nursing.
- Research and/or teaching graduate fellowships/assistantships may be available to full-time students who are Registered Nurses based on academic merit and prior relevant academic and/or work experience. A fellowship/assistantship carries a remission of tuition for 9 hours each semester plus a monthly stipend competitive with those at other major private universities in exchange for 17-1/2 hours of work a week by the student. To apply for a fellowship/assistantship, check the appropriate space on the School of Nursing’s application form.

Loan Assistance

Loans Awarded by Case Western Reserve University Office of Financial Aid

These loans are awarded on the basis of financial need. A loan will probably be a part of a package awarded in response to an application for financial assistance.

Federal Perkins Loan

Perkins Loans enable students to borrow up to $40,000 through graduate school (up to $20,000 as an undergraduate). Repayment begins six months after graduation or after the student ceases
enrollment on at least a half-time basis. To be eligible a student must be a citizen of the United States or have a permanent resident visa, be at least a half-time student making satisfactory progress toward a degree, and establish financial need for the loan. The Federal Perkins Loan may be awarded to undergraduate students and graduate and professional students in all programs except the School of Medicine.

Health Profession Student Loans (HPSL)

Awarded to students in the School of Dentistry and School of Medicine who demonstrate financial need, HPSL is a federal loan that makes eligible students to borrow at 5 percent simple interest, with repayment made over a 10-year period. Parental information must be provided by all students wishing consideration for these funds.

Federal Nursing Loan Program

Only N.D. and M.S.N. students in the School of Nursing are being awarded the limited federal loans provided under the Nursing Student Loan Program. They may receive up to $4,000 per year, depending upon financial need and availability of funds. Interest is 5%, and repayment begins when the student completes the program or ceases enrollment on at least a half-time basis.

University Loans

A university loan is a low-interest long-term loan provided to a student to assist with educational expenses. Repayment is made over a ten-year period after graduation or over a ten-year period after the student ceases enrollment on at least a half-time basis. Interest is 8%.

a) Undergraduate

Forty-eight loan funds have been established for undergraduate students. Loans are awarded by the Office of Financial Aid on the basis of need.

b) Graduate and Professional

The Mandel School of Applied Social Sciences has a small amount of loan money available to meet financial need after Federal loan availability has been exhausted. These loans are awarded by the University Office of Financial Aid.

A number of loan funds have been established for students in the School of Dentistry. Loans from these funds are awarded only to meet cases of exceptional need that cannot be met by other funding, and some of these funds are restricted to certain classes and categories of students.

The School of Law provides low-interest, long-term loans to students with unmet need who have exhausted all other available assistance.

The Weatherhead School of Management has loan funds for M.B.A. students who demonstrate financial need. Loans are available to students in the School of Medicine from funds given to the School of Medicine for that purpose. The Medical Alumni Association Rotating Loan Fund, augmented each year by contributions from graduates of the school, is a major source of aid for currently enrolled students.

The Frances Payne Bolton School of Nursing has several loans funds available to assist students with exceptional financial need as determined by the Office of Financial Aid.

Loans Awarded by Agencies

Outside the University

The following loans are available to all undergraduate, graduate, and professional students who are enrolled on at least a half time basis, hold U.S. citizenship or permanent resident status, and are admitted to or enrolled in a degree-seeking program.

Subsidized Loans

Case Western Reserve University participates in the Federal Stafford Loan program. The Federal Stafford Loan program lends money through private lenders, including Case Western Reserve University, to students in certain graduate and professional schools.

Students must be enrolled half time (6 credit hours per semester) and demonstrate financial need. The variable interest rate is adjusted annually and is capped at 8.25%. The interest is subsidized (paid) by the Federal Government as long as the student remains enrolled at least half time (6 credit hours per semester). A student making satisfactory academic progress may borrow up to $2,625 for the first year of undergraduate study, up to $3,500 for the second year, $4,500 for each year of subsequent undergraduate study, and $6,500 for each year of graduate study, with an aggregate maximum of $23,000 undergraduate and $65,000 undergraduate and graduate. Repayment begins six months after the student ceases enrollment on at least a half-time basis. No principal or interest must be paid while the student is enrolled half time or more. All students must demonstrate financial need as determined by the University Office of Financial Aid in accordance with criteria established by the Federal Government. All undergraduate students must apply for the Federal Pell Grant. Application forms for the Federal Stafford Loan Program may be obtained from a bank or other lending institution, or from the University Office of Financial Aid. The appropriate forms must then be submitted to the University Office of Financial Aid. All applicants for Stafford Loans must submit the following:

1. A Free Application for Federal Student Aid (FAFSA). New undergraduate students must complete the Profile Form of College Scholarship Service as well.

2. To the Office of University Financial Aid:


b. A signed copy of the parents' prior year federal income tax return, including all schedules and W-2 forms (in the case of dependent students).

c. A signed copy of the student's prior year federal income tax return, including all schedules and W-2 forms (where appropriate, the student's spouse's), or, if a tax return was not filed, a completed Student/Spouse Statement of Income.

d. In the case of students enrolled or admitted to the Mandel School of Applied Social Sciences, School of Graduate Studies, School of Law, Weatherhead School of Management, Mandel Center for Nonprofit Organizations, or the N.D., M.S.N. or Ph.D. program of the Frances Payne Bolton School of Nursing, the Office of University Financial Aid also requires a memorandum from the school specifying the admission status, number of credit hours enrolled for each term, current academic standing, and the amount of other financial assistance, if any, being awarded. The student should allow at least 8 to 10 weeks between submission of the forms to the Office of University Financial Aid and receipt of the loan proceeds.

Unsubsidized Loans

Unsubsidized Federal Stafford Loans require the same enrollment criteria and feature the same interest rates as their subsidized counterparts. Borrowers are responsible for paying the interest during the in-school and deferment periods. Borrowers may choose to make periodic interest payments to the lender/servicer, or opt to have the accrued interest capitalized (added on to) the
principal loan amount. Borrowers who do not qualify for the maximum amount under a subsidized loan may borrow an unsubsidized loan up to the maximum allowable loan amount. The maximum allowable loan amounts for dependent students are $2,625 per year for freshmen, $3,500 per year for sophomores, $5,500 per year for juniors and seniors, and $8,500 per year for graduate students. Independent undergraduate students are eligible for an additional unsubsidized loan in the amounts of $4,000 per year for freshmen and sophomores, $5,000 per year for juniors and seniors, and $10,000 per year for graduate students. Students enrolled in the Schools of Medicine and Dentistry are eligible to borrow an additional $20,000 annually. The application process is identical to that for the subsidized loans. Undergraduate students must apply for and have eligibility determined for the Federal Pell Grant and all students must have eligibility for the subsidized loan determined before borrowing an unsubsidized loan. Promissory notes are mailed to the student by the University Office of Financial Aid. Stafford Loan applications are available from lenders and the University Office of Financial Aid.

Federal Parent Loans for Undergraduate Students (FPLUS)

Many lending institutions participate in the FPLUS program, through which a parent may borrow on behalf of a dependent undergraduate student up to the difference between the cost of education and any other financial assistance awarded. Students must be enrolled at least half time (6 credit hours per semester), be admitted to or enrolled in a degree seeking program, and be making satisfactory academic progress. Interest and repayment begin 60 days after disbursement of the loan. The interest rate is variable and cannot exceed 9 percent. There is no aggregate borrowing limit. Eligibility is not based on need, but the loan application and a Case Western Reserve Application for Financial Aid must be submitted to the Office of University Financial Aid. The loan applications may be obtained from lending institutions such as banks, credit unions, and savings and loan associations. The student should allow at least 8 to 10 weeks between submission of the forms to the Office of Financial Aid and receipt of the loan.

Federal Consolidation Loans

Borrowers with outstanding indebtedness through the William D. Ford Federal Direct Loan Program, Federal Stafford Loan, Unsubsidized Stafford Loan, Federal Supplemental Loan for Students, National Direct Student Loan, Federal Perkins Loan, or Health Professions Student Loan programs may consolidate their loans, provided the loans are not in default or if in default, the borrower must have made satisfactory repayment arrangements with the lender. Consolidation may occur during the repayment period or the grace period preceding repayment.

Limited deferments of principal are available. The variable interest rate is capped at 8.25%. Repayment terms may include graduated or income-sensitive repayment schedules. The repayment period is tied to the amount consolidated and may extend up to 30 years.

Interested borrowers should contact their lenders for additional information and referrals to participating agencies. Borrowers under the William D. Ford Federal Direct Loan program may contact the Servicing Center’s Consolidation Department or the University Office of Financial Aid.

Outside Loan Programs

Case Western Reserve University, in partnership with the Student Loan Marketing Association (Sallie Mae), offers low interest educational loans to students and/or parents. These loans are in addition to or alternatives to the Federal Stafford and PLUS Programs. Interest rates are variable, based on the Prime Rate. Interest payments may be paid during the in-school period or capitalized upon repayment. Students in the schools of medicine and law may use other loan programs and should consult their school of enrollment for additional information and application materials.

Frances Payne Bolton School of Nursing

Ohio Nurse Education Assistance Loan Program (NEALP)

This program was created to assist the State of Ohio in meeting nursing shortages by providing assistance to students enrolled in approved nurse education programs and to encourage these students to remain in Ohio as they enter the nursing profession. These loans are available to students pursuing the B.S.N. and N.D. degrees.

Eligibility requirements include
1. Ohio residency
2. U.S. citizenship or permanent residency
3. Acceptance or enrollment in an approved R.N. nurse education program.
4. Demonstration of intent to practice nursing within the State of Ohio after graduation.
5. Owes no refund nor be in default on any state or Federal educational loan or grant.
6. Satisfactory academic record that places student in good academic standing.

NEALP loans are limited to $3,000 per year with an aggregate limit of $12,000. Financial need must be demonstrated through the filing of the Free Application for Federal Student Aid (FAFSA). Upon graduation, a student may be eligible for debt cancellation at the rate of twenty percent (20%) per year for a maximum of four years (80%) if the borrower is employed in the clinical practice of nursing within the State of Ohio.

Borrowers who complete the entire service obligation will be required to repay twenty percent (20%) of the loan plus interest. Borrowers who do not complete the service obligation must repay the entire outstanding loan balance plus interest. Applications are available from the University Office of Financial Aid. The application deadline is June 1st.

Student Employment

Case Western Reserve University offers a variety of part-time employment opportunities to its students and recognizes that student employment is a valuable form of financial assistance as well as a practical learning experience. The University has made a commitment to utilize student employees whenever possible. To fulfill this commitment, the Office of Student Employment, a division of the Office of Financial Aid, has been established to centralize information about employment opportunities, provide standardized practices and procedures for employment, prevent discrimination, and increase the number and variety of available jobs on campus and in the community.

Federal College Work Study Program

The Federal College Work Study Program is a Federally sponsored employment program designed to aid students with financial
need. A Federal Work-Study award is awarded as part of the financial aid package and provides the opportunity for job placement and a maximum level of earnings. The Office of Financial Aid determines a student’s eligibility and the amount of the work award. The employer pays a portion of the student’s salary and the Federal government subsidizes the remainder. Employment opportunities are available on campus and with non-profit agencies in the surrounding community.

Campus Jobs

This program is funded by the University through departments on campus and offers part-time employment to students. Students not demonstrating financial need but interested in securing on-campus employment may apply to the Office of Student Employment. Students not on financial aid who obtain jobs on campus on their own initiative are permitted to work provided there is no student with a financial need qualified and willing to take the job offered. All students working on campus must clear their employment with the Student Employment Office.

Tuition, Room, and Board Stabilization

Case Western Reserve University offers a plan through which students and/or parents are able to protect themselves against future increases in tuition and room and board by prepaying all or a portion of the current tuition and room and board (double room and Carte Blanche meal plan) for the remaining years until graduation. There are two options within the plan:

1. The participant may prepay the remaining years of tuition for the current degree program at the current rate. The tuition rate only in the examples below is for the 2002-2003 academic year and is subject to change:

Undergraduate
4 years @ $22,500 = $90,000

Sophomore
3 years @ $22,500 = $67,500

Junior
2 years @ $22,500 = $45,00

School of Law
3 years @ $25,900 = $77,000
2 years @ $25,900 = $51,800

Weatherhead School of Management (M.B.A., M. Acc.)
2 years @ $26,460 = $52,920

School of Dentistry
4 years @ $30,325 = $121,300
3 years @ $30,325 = $90,975
2 years @ $30,325 = $60,650

2. Case Western Reserve University will lend the borrower the required amount to prepay the tuition or any portion thereof. The loan repayment schedule is based on the number of years for which tuition is stabilized, and the rate of interest is fixed for the life of the loan. The current rate is 7.50% but is subject to change.

Students who are receiving student financial aid may stabilize a portion of the tuition and fees which is equal to the current tuition and room and board charges less the grants, scholarships, and loans which the student will receive for the first year of the stabilization program, multiplied by the number of years remaining for the current degree program to be completed.

For further information about Tuition Stabilization, contact: Donald W. Chenelle, Director-Tuition Stabilization Plan, 216/368-3866 e-mail dwc2@po.cwru.edu.

Satisfactory Academic Progress for Financial Aid

Case Western Reserve University has established guidelines for determining whether students are making satisfactory academic progress for financial aid purposes.

Federal regulations require that in order to receive Title IV assistance, all students must maintain a standard of satisfactory academic progress, as determined by the University. Title IV assistance comprises the following:

Federal Pell Grants, Federal Supplemental Educational Opportunity Grants, Federal Perkins Loans, Federal College Work Study awards, Federal Stafford Loans (subsidized and unsubsidized), loans under the FPLUS program, and any state grants funded by the State Student Incentive Grant program.

A Case Western Reserve University undergraduate student must satisfy the minimum number of semester hours and earn the minimum cumulative grade point average listed in the table below. A half-time student must have successfully completed one-half of the minimum number of semester hours with at least the minimum cumulative grade-point average in the table below:

<table>
<thead>
<tr>
<th>Year at the University</th>
<th>Semester Hours Completed</th>
<th>Cumulative Grade-Point Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
<td>1.75</td>
</tr>
<tr>
<td>2</td>
<td>43</td>
<td>2.00</td>
</tr>
<tr>
<td>3</td>
<td>67</td>
<td>2.00</td>
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<tr>
<td>4</td>
<td>91</td>
<td>2.00</td>
</tr>
<tr>
<td>5</td>
<td>115</td>
<td>2.00</td>
</tr>
<tr>
<td>6</td>
<td>139</td>
<td>2.00</td>
</tr>
</tbody>
</table>

(If a student has an uneven number of semesters, then the midpoint between the necessary semester hours completed for the year before and the year after will be the appropriate expectation. For example, if a student has completed five semesters and a determination is required of hours completed, then 55 would be considered satisfactory, i.e., the midpoint between 43 and 67.)

Procedure: If, after two semesters at Case Western Reserve, the student fails to meet the criteria for satisfactory academic progress, the student is placed on financial aid warning. While on Financial Aid Warning, a student may continue to receive Title IV aid for one semester. At the end of that semester, if the student is still not meeting the criteria, he or she is placed on financial aid probation. While on Financial Aid Probation, a student may not receive any Title IV aid but may be eligible for other assistance, including university grants-in-aid. If, after a semester on financial aid probation, the student still does not meet the criteria for satisfactory academic progress, the student is removed from all institutional financial aid. A student will be restored to good standing if found to be making satisfactory academic progress at the end of a semester on warning, probation, or separation. However, aid may be restored only once following financial aid separation. Students in financial aid good standing will have their satisfactory academic progress reviewed at the end of the spring semester. Students below good standing will have their status reviewed each semester.

Appeals may be made on grounds of mitigating circumstances; such appeals should be addressed to the associate director of financial aid.

For further details of financial aid policy and procedure regarding Satisfactory Academic Progress, consult the University’s Office of Financial Aid.
Graduate and Professional Students

Since each graduate/professional school of the University differs in length of program and in method of evaluation, there is a different method of measuring Satisfactory Academic Progress for Title IV aid for each school, although the same general principles and procedures apply as indicated above. For specific information about how satisfactory academic progress is determined for an individual school or program, please consult the University Office of Financial Aid.
Student Affairs
Office of Student Affairs

110 Adelbert Hall
Phone 216-368-2020

The University Office of Student Affairs provides leadership in the development of services and programs that supplement the classroom experiences of university students and enrich student life. The staff of the Office of Student Affairs attempts to promote an environment which provides positive, developmental experiences for all students. Additionally, the office serves as an ombudsman, focusing attention on the rights and responsibilities of students within the University community. The Office of Student Affairs is a central source of information about University policies and procedures that affect student life and co-curricular programs and services. Students should feel free to contact the Office of Student Affairs for resolution of specific problems and for referral to other University offices and campus agencies. Services that the Vice President’s office itself offers include orientation, minority affairs, Cleveland Orchestra ticket drawings, crisis intervention, and services designed to assist upper-class students in their decision making process.

Student Affairs Administration

Glenn Nicholls, M.A.R. (Asbury Theological Seminary)
Vice President for Student Affairs
Clay Barnard, M.S. (Miami University)
Assistant Vice President for Student Affairs
G. Dean Patterson, M.S. (Case Western Reserve University)
Assistant Vice President for Student Affairs
Cynthia Applin, M.A. (Ohio State University)
Director of Career Center
Edith Berger,
Director of International Student Services
Mayo Bulloch, M.A. (Case Western Reserve University)
Director of Educational Support Services
Eleanor Davidson, M.D. (University of Michigan Medical School)
Director of University Health Services
David Hutter, Ph.D. (Ohio State University)
Chair of the Department of Physical Education and Athletics and Professor
Donald J. Kamalsky, M.S. (State University of New York, Albany)
Director of Housing and Residence Life
Dorothy Pijan, Ed.D. (Texas Tech University)
Director of Thwing Center/Student Activities
Carrie Reeves, M.A. (Case Western Reserve University)
Director of Upward Bound
Dennis Rupert, M.A. (Edinboro University of Pennsylvania)
Director of Finance and Administration
Jes Sellers, Ph.D. (University of Florida)
Director of University Counseling Services
Kent Smith, Ph.D. (University of Colorado)
Director of Multicultural Affairs

Housing and Residence Life

4 Yost Hall
10900 Euclid Avenue
Cleveland, Ohio 44106-7061
Phone 216-368-3780; Fax 216-368-6658
E-mail: housing@po.cwru.edu
http://housing.cwru.edu

Undergraduate Housing

Living on campus provides students with many benefits. Because of this, all undergraduate students who do not live with their parents live in a residence hall or University-recognized fraternity or sorority house. In addition to the opportunities to meet new people and to develop a sense of campus community, students appreciate the convenience of being close to classrooms, libraries, laboratories, and other campus facilities.

To enrich the college experience, the Housing and Residence Life Program is designed to meet the needs of residential students throughout their time on campus. The program is designed to meet the specific needs of first year, second year and upper class students by exploring the academic and social expectations students experience as they progress through their University education.

Each residence hall is staffed with trained undergraduate students (residence assistants and learning assistants), graduate students (resident directors), and professional staff (coordinators of residence education). In addition to administering the daily operation of the buildings, the staff works to meet the academic, interpersonal, social and community needs of their populations. Staff members also work with students in developing quality programs, projects, and social activities in the residence halls. Through a variety of programs, students explore personal and social issues, make new friends, and discover opportunities for personal growth. The staff members know the University community resources and are committed to helping each student benefit to the fullest extent from their college experience.

The First Year Experience at Case Western Reserve

The first year at the University is the beginning of an exciting time of learning about the many opportunities and resources available on campus, in University Circle, and beyond. To facilitate and maximize this learning, all first year students who reside in University Housing live together in the North Residential Village and benefit from programs designed specifically to meet their needs.

The Second Year and Upperclass Experiences

The second year at Case Western Reserve is often a time of continued social and academic adjustment, and a time when students are expected to commit to a particular academic major. Therefore, the focus of the Second Year Experience is to utilize the knowledge and skills developed during the first year to enhance the many academic, leadership and social opportunities available to students during their second year.

Upper-class students are faced with many questions and decisions regarding their future. The Upper-class Experience is designed to ease the transition to life after graduation. In collaboration with numerous other Student Affairs and academic offices, the Residence Life Staff works to provided information and services designed to assist upper-class students in their decision making process.

North Residential Village

All first year students are housed in the North Residential Village which is situated just a few blocks from Cleveland’s renowned museums, cultural centers, and the humanities and social sciences classroom buildings. Eleven residence halls, together with their beautifully landscaped outdoor quad areas, recreational fields and dining commons make up the North Residential Village and offer students a variety of living arrangements convenient to classes and community resources. Norton, Raymond, Sherman, Smith, Taft and Tyler make up the Mather area. These buildings feature double rooms with an open-corridor design on each floor which allows easy access to the community bathroom and floor lounge.
These four-story buildings house students on the upper three floors with one floor of women and two floors of men. The ground floor of the Mather buildings provides excellent space for community interaction. A comfortable TV lounge with cable TV, a kitchen and laundry room caters to a wide range of residents' needs.

Carder, Hitchcock, Pierce, and Storrs and Clarke Tower are located just east of the Mather complex in the residential area known as the Adelbert Quad. All of these buildings, with the exception of Clarke Tower feature a quad design on the upper three floors with four clusters of five rooms and two community bathrooms. Quads are paired with a common bathroom on the same side of the floor, allowing some floors to house both men and women. Just outside the entrance to each quad is a lounge. One is equipped with study tables and the other with couches and chairs. These floor lounges provide the residents with opportunities to socialize and to study. The ground floor of the Adelbert buildings feature a large TV lounge with cable TV in which many residents take time to relax or enjoy social and educational programs offered in the hall. A laundry room, kitchenette and a mailroom are located around the corner from the TV lounge.

Clarke Tower is an eleven-story building at the edge of the village which houses upper-class students. The floors are designed in a suite layout with four suites of four rooms per floor. Each suite includes two singles and two double rooms that share a living room, bathroom, and kitchenette (sink, small refrigerator, and microwave).

In the center of the North Village community, students can find Leutner Commons, which houses Leutner Dining Commons, where meals are served for all North Village residents. Wade Commons houses a fireplace lounge in which students can study or meet with friends, a tutoring center, that is open for walk-in tutoring several nights each week and the Wade Area Office for the North Village. The Wade Area Office is the central location for package pickup, filing maintenance requests and room key distribution for the North Village residence halls. The Green Room, a game room with pool tables, ping pong table, and a large screen TV, Club W, a fitness room with weight and rowing machines, bicycles and Stairmasters, and a convenience store, round out the Wade Commons facility.

South Residential Village

A mix of second year and upper-class students live in the seven residence halls, located on Murray Hill Road and Carlton Road that make up the South Residential Village. Glaser, Kusch and Michelson are three high-rise undergraduate halls located on Carlton Road and are known as the Carlton Quad. The three halls are similar in design; each building has six floors with four suites per floor. A suite has six private bedrooms that are arranged off a corridor. The suite shares a furnished living room with bathroom facilities located off the living area. Students gather in the lounges (located on the first floor of each building) to socialize, for programs or other hall activities and to watch cable TV. Additional facilities in each hall include a kitchen, vending machines and a laundry room. One of the greatest attractions to the Carlton Road buildings is the magnificent view of the Cleveland skyline.

Alumni, Howe, Staley, and Tippit are located on Murray Hill Road and are known as the Murray Hill Quad. Similar in structure, Howe and Staley have two suites on each of nine floors. The floor plan for each suite has the bathroom facilities in the center of the suite surrounded by six individual bedrooms and a furnished living room. Alumni and Tippit are the only low-rise buildings in the South Village. Each building has four floors with five suites per floor. Each suite has six private bedrooms that share a furnished living room area and bathroom. The six rooms are arranged in a corridor-style design with the bathroom located off the living room. The four Murray Hill buildings have entrances off a red brick courtyard. Each building has a lounge and recreation area on the first floor where students can gather to watch cable TV or participate in hall activities. Additional facilities include a kitchen, vending machines and a laundry room.

At the end of Murray Hill Quad is Fribley Commons, which houses Fribley Dining Commons, where meals are served for all South Village residents. Also located in the commons are the Fribley Area Office, a fireside lounge and convenience store. The Fribley Area Office is the central location for package pick-up, filing maintenance requests and distribution of room keys for South Village residents.

How to Apply

To apply for a room in the residence halls for the coming year, complete and return a housing application. New room assignments are made (and preferences considered) in the order in which applications are received. Therefore, it is important that once you make your decision to attend Case Western Reserve University, you return the application as soon as possible. If your application is received after all rooms have been assigned, you will be offered a temporary assignment until a permanent assignment is available. If your plans change and you will not be attending Case Western Reserve University, we ask that you notify the Office of Housing and Residence Life. Your deposit is refundable if we receive written notification for refund by August 1.

Students with Disabilities

Should you have a disability requires special accommodations, contact the Coordinator of Disability Services at 216-368-5230.

Room Rates for 2002-2003

<table>
<thead>
<tr>
<th>Room Type</th>
<th>Monthly Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single (South Village)</td>
<td>$4,680 per year</td>
</tr>
<tr>
<td>Double (South Village)</td>
<td>$4,210 per year</td>
</tr>
<tr>
<td>Single (North Village)</td>
<td>$4,600 per year</td>
</tr>
<tr>
<td>Double (North Village)</td>
<td>$4,050 per year</td>
</tr>
<tr>
<td>Single (Clarke Tower)</td>
<td>$4,760 per year</td>
</tr>
<tr>
<td>Double (Clarke Tower)</td>
<td>$4,120 per year</td>
</tr>
</tbody>
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Additional housing information is available at http://housing.cwru.edu.

Meal Plan Rates for 2002-2003

<table>
<thead>
<tr>
<th>Meal Plan</th>
<th>Annual Rate</th>
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<tbody>
<tr>
<td>10 Flex + 250 (10 meals/week)</td>
<td>$2,574 per year</td>
</tr>
<tr>
<td>17 Flex + 150 (17 meals/week)</td>
<td>$2,500 per year</td>
</tr>
<tr>
<td>200 dining dollars/semester</td>
<td>$2,700 per year</td>
</tr>
<tr>
<td>200 dining points/semester</td>
<td>$2,700 per year</td>
</tr>
</tbody>
</table>

Additional meal plan information can be found at http://www.cwru.edu/finadmin/security/auxiliary/mealplan.htm.

Graduate Housing

The availability of graduate housing on campus is determined by our undergraduate enrollment and therefore may not be offered every year. Please check our website at http://housing.cwru.edu for current availability.

To assist graduate students in identifying off-campus housing, the Office of Housing and Residence Life publishes an Off-Campus Housing Bulletin. The bulletin contains apartment and housing listings, roommate wanted advertisements, etc. that are located within a short distance from campus. The bulletin is updated each Friday at noon and can be viewed online at http://housing.cwru.edu/offcampus.
Facilities

Thwing Center
11111 Euclid Avenue
Phone 216-368-2660

From its prominent position in the very center of Cleveland’s University Circle, Thwing Center overlooks the campus of Case Western Reserve University and Euclid Avenue. The facility is named for Charles Franklin Thwing, who was president of Western Reserve University from 1890 until 1921. Thwing Center provides space for a variety of programs, services, and facilities. The center houses meeting rooms; Charlie’s Place, a cafeteria-style snack bar; the Mather Gallery; the University Bookstore; a postal substation; an elegant ballroom with a vaulted ceiling; lounges for study and programs; the commuter lounge; a share-a-ride board; and the Student Activities Office.

Student Organizations and Activities

Student activities and leadership opportunities are available in a multitude of ways. Students may become involved within the Undergraduate Student Government or in planning University traditions with the University Program Board. Approximately one hundred student clubs exist offering a large number of opportunities to implement or simply participate in a variety of social, cultural, and recreational events.

Publications

Students may practice journalism and management on any of seven different publications. The undergraduate student newspaper on campus, the Observer, is published weekly. Other campus publications include the yearbook; a literary magazine, Case Reserve Review; a technical magazine, the Engineering and Science Review; an online news magazine/forum, CWRU Triumph, and a humor magazine, the Athenian.

Broadcasting

The University’s student-operated radio station, WRUW-FM 91.1, which operates at 15,000 watts, offers opportunities for any student interested in radio broadcasting and engineering. The Amateur Radio Club also allows students to participate in radio.

The Arts

Students interested in the arts have numerous opportunities for involvement. Eldred Theater offers dance and drama activities. Students interested in the visual arts may work with the Mather Gallery Committee. Students with musical interests may participate in several performing organizations, including the Case Western Reserve University Marching Band, two jazz bands, the Wind Ensemble, the University Circle Chorale, the Collegium Musicum, the Glee Club, and the University Circle Chamber Orchestra. The Department of Music has information on auditions.

Athletics

The department sponsors a variety of intercollegiate and intramural activities. Intercollegiate varsity sports for men are football, soccer, cross country, basketball, wrestling, swimming, fencing, golf, baseball, tennis, and indoor and outdoor track.

Intercollegiate varsity sports for women are volleyball, basketball, swimming, indoor and outdoor track, fencing, tennis, cross country, soccer, and softball. The University is a charter member of the University Athletic Association. Competition in all sports in the Association is available to men and women. The University Athletic Association includes Brandeis University, Carnegie Mellon University, Emory University, New York University, University of Chicago, University of Rochester, and Washington University.

Aikido, archery, crew, cycling, volleyball, tae kwon do, badminton, ultimate frisbee, and ice hockey sport clubs are available to all students, faculty, and staff. Intramural competition is available in more than 40 activities, and more than one-half of the undergraduates participate for relaxation, physical fitness, or a chance to improve skills.

Religious Activities

The three staffed campus ministries recognized by the University are the Newman Catholic Campus Ministry, the Hillel Foundation, and the United Protestant Campus Ministries. These centers sponsor worship services and religious education activities, as well as general programs oriented to the interest of all students. In addition, the campus has several other religious organizations open to all students.

Films

An unusually large number of films is shown at the University. The Film Society shows outstanding motion pictures four times weekly, from popular films to foreign art films. The Film Society publishes a calendar of offerings each semester. The Film Society uses Strosacker Auditorium. It is one of the few university film societies to show films in 70 mm and Dolby stereo. Other student organizations also show films centering on their interests or for special events.

Campus Leadership

The Office of Student Activities has made a commitment to providing a variety of leadership opportunities to students. The Undergraduate Student Government holds elections each fall for student class representatives of residence hall, commuters, class officers, and fraternity and sorority constituencies. The student government acts as a liaison between the students and the faculty, administration, and other appropriate groups and fulfills legislative and executive functions. The Executive Committee plans the agenda for assembly meetings every other week and sets long-range goals. The Finance Committee recommends recognition and budget allocations for undergraduate student organizations. The Finance Committee also advises the student government on the management of special project funds. The Development Committee works to improve the quality of co-curricular life on campus and maintains a grievance process whereby students may express their opinions. An elected undergraduate representative serves as a voting member of the university-wide Faculty Senate. The Media Board supervises and reviews the operations of all undergraduate student publications and broadcast media. The Media Board, made up of students and faculty advisors, is coordinated by the Thwing Center Administrative Office. The University Program Board (UPB) presents all-campus social, educational, cultural, and recreational activities. Committees made up of undergraduate volunteers program activities in accord with their interests. The Entertainment Committee selects and sponsors singers, bands, and comedians at the Spot, Rough Rider Room, and Thwing Center. The Fine Arts Committee presents jazz, dance, visual arts, and other performing arts programs. The Lecture Committee plans and
sponsors lectures by national speakers on topics of significance. The Diversity Programs Committee presents social and educational programs to increase cross-cultural understanding as well as cultural and educational programs concerning racial, sexual, and disabled minority interests. Traditional annual events such as Homecoming, and Family Weekend are planned and presented by the Special Events Committee. All campus events and concerts are planned by the Concert Committee. The Recreation and Development Committee co-sponsors educational programs as well as tickets to major sporting attractions and our annual Hudson Relays weekend. The Interfraternity Congress/Panhellenic Council oversees the activities of the Greek social organizations on campus. In the spring, they plan Greek Week activities and an all-campus party. The Thwing Center Advisory Board serves as an advisor to the director of Thwing Center in making policy and developing facilities. Students, staff, faculty, and alumni serve as members of the Advisory Board. Each undergraduate class elects officers to plan class activities, and each of the more than 100 student organizations also has officers. The undergraduate residence halls have governments which plan group activities and carry out other responsibilities.

Fraternities and Sororities

Greek life is the largest campus activity at the University, involving 30 percent of the undergraduate population in the 23 fraternity and sorority chapters. All of the chapters belong to one of the two umbrella organizations which govern the Greek community and link the chapters to the campus. The Panhellenic Council coordinates the activities of the five sororities while the Interfraternity Congress governs the 18 fraternities. The Greek community also supports the Order of Omega, a society which recognizes outstanding Greek leaders, and Gamma Sigma Alpha, a scholastic honor society for Greeks with a grade point average above 3.60. The director of Greek life is a full-time staff member who offers administrative, supervisory, counseling and related services to all facets of Greek life. The Black Greek Council (BGC) is the governing organization of the eight historically Black Greek fraternities and sororities represented at Case Western Reserve. The four national sororities are Alpha Chi Omega, Alpha Phi, Alpha Xi Delta, and Phi Mu; and there is one local sorority, Sigma Psi. The 18 national fraternities are Beta Theta Pi, Delta Kappa Epsilon, Delta Tau Delta, Delta Upsilon, Phi Delta Theta, Gamma Delta, Phi Kappa Psi, Delta Phi Epsilon, Sigma Chi, Mu Sigma Nu, Phi Epsilon, Delta Chi, Zeta Beta Tau, and Zeta Psi. Alpha Epsilon Pi and Phi Kappa Tau are colony members of the IFC. Eighteen chapters reside in houses on either the north or south campus. The other 5 chapters reside in residence halls.

Honorary Societies

Case Western Reserve has four major undergraduate honoraries. Several more are based on specific fields of interest. Tau Beta Pi and Eta Kappa Nu are engineering honoraries. Mortar Board, a national honorary society for full-time senior students, recognizes scholarship leadership, and service. Phi Beta Kappa, a national honorary society, recognizes outstanding scholarship in the liberal arts and sciences. Outstanding students may qualify for election to membership in the second semester of the senior year. A few specially gifted students may be elected to membership as juniors.

Commuter Life

Commuter services for undergraduate commuting students are provided through the office of Educational Support Services (ESS). A Commuter Assistant (CA) team spearheads commuter services by hosting commuter events, advocating for commuter concerns, sending a weekly electronic newsletter, and maintaining the Rock Bottom Lounge, located in the basement of Thwing Center West. The CA team also publishes the annual Commuter Guide, plans special commuter orientation activities, and organizes the Annual Commuter Appreciation Day.

The Rock Bottom Lounge is open daily from 7 am to 1 am. Commuters may have card access to the lounge’s exterior door by stopping the ESS office during business hours. The exterior entrance is located on the bookstore side of the Thing Center. All commuters and residents are welcome to use the lounge, which contains lockers, a pool table, a television and VCR, and a kitchenette with refrigerator and microwave oven.

Disability Services

Disability services are available through Educational Support Services, which serves as the resource center and ombudsmen for University students with disabilities. Students with physical disabilities, whether permanent or temporary, can be helped with appropriate supplies and with special arrangements including responsive transportation. Students with diagnosed learning disabilities, attention deficit disorder, and chronic illnesses are eligible for classroom accommodations as well as individual support and advising. The ESS Sight Enhancement Center provides adaptive equipment for students (and Kelvin Smith Library patrons) with visual-impairments and learning disabilities.

Student Community Service

The Office of Student Community Service (OSCS) coordinates community service projects that promote student volunteerism and student service learning. The OSCS staff facilitates various service opportunities in the Cleveland community including individual placements, group projects, curricular options, community-based Work Study, and national service (AmeriCorps) opportunities. Supported by foundation, corporate, and federal funding, going OSCS projects focus on the environmental, health-related, and educational needs of the local community and frequently address these needs through partnerships with community-based agencies.

University Counseling Services

Sears Library Building, 2nd floor
Phone 216-368-5872

Mental Health Service
University Health Service
Phone 216-368-2510

University Counseling Services (UCS) provides individual, group and couples counseling, psychological/learning disabilities testing and referrals for all undergraduate, graduate, and professional school students and their spouses or partners. In general, these services are offered on a short-term basis (usually 12 or fewer sessions) to help students make adjustments in their personal, social, and educational areas of life. The staff understands the need to maintain confidentiality. Therefore, the UCS will not disclose information to any other party, e.g., faculty, parents, future employers without written permission from the student; the release of information without written consent would occur only in cases of imminent harm to one’s self or to another adult or child, or when compelled by law or court ruling to do so.
Career Center

206 Sears Library Building
Phone 216-368-4446; Fax 216-368-4759
www.cwru.edu/staff/careers

The Career Center offers individualized assistance, programs, and technologically advanced resources to educate students in the development of lifelong career management skills, the attainment of work experience, and the integration of academic and career plans.

The Career Center offers programs and resources to address career development issues such as:
- Identifying career interests and related options
- Learning more about specific career fields
- Choosing a major and setting career goals
- Applying for admission to graduate and professional schools
- Obtaining relevant work experience through Internships, Practica, and summer employment
- Targeting and researching prospective employers
- Preparing effective cover letters, resumes, and other written communications
- Identifying current job openings
- Preparing for interviews

Specific services and resources include:
- Individual career counseling and job search guidance
- Career exploration programming and special services for 1st-year and undecided students
- Accenture Career Resource Library
- Occupational information, career references, computer workstations, and more
- www.cwru.edu/staff/careers
- Comprehensive website of career/employment resources
- CareerSearch.net online database of nearly 1.5 million prospective employers nationwide
- Career Network ~ mentoring, shadowing and networking program for students to connect with alumni
- Videotaped mock interviews
- On-campus interviewing opportunities, resume referrals, and annual job fairs
- Women Initiatives in Leadership and Learning (WILL) ~ Externship Program for women students
- Practicum and Internship Programs
- Credential files service for graduate/professional school or employment

Disability Services

105 Kelvin Smith Library
Phone 216-368-5230; Fax 216-368-8826
http://ess.cwru.edu

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The CA team also publishes the annual Commuter Guide, plans special commuter orientation activities, and organizes the Annual Commuter Appreciation Day.

The Rock Bottom Lounge is open daily from 7 am to 1 am. Commuters may have card access to the lounge’s exterior door by stopping the ESS office during business hours. The exterior entrance is located on the bookstore side of the Thing Center. All commuters and residents are welcome to use the lounge, which contains lockers, a pool table, a television and VCR, and a kitchenette with refrigerator and microwave oven.

Educational Support Services

105 Kelvin Smith Library
Phone 216-368-5230; Fax 216-368-8826

Educational Support Services (ESS) assists students in all phases of their academic development. Through advising, tutoring, group programs, and individual consultation, the ESS staff provides opportunities for academic assessment and self-improvement. ESS also coordinates programs addressing the academic and adjustment needs of specific student populations, first-year students, participants in the University’s Minority Scholars Program (MSP), commuting students, and students with special needs. ESS utilizes a large team of trained student paraprofessionals. Learning Assistants (LAs) serve as ESS representatives in the residence halls, working with Residence Life staff to provide special support and outreach to residential students. Technical Assistance Center (TAC) assistants lead programs and help residence hall students with computer-related questions. Commuter Assistants (Cas) address the needs of first-year commuting students through individual contacts, programs, and newsletters. Peer Assistants (PAs) work together to plan and coordinate activities for their assigned PA families, groups of first-year Minority Scholars Program students. In addition, ESS employs a large corps of carefully selected and trained student tutors who function as individual tutors, walk-in tutors, and supplemental instruction leaders.

The Office of Student Community Service (OSCS) coordinates community service projects that promote student volunteerism and student service learning.

The ESS Plain Dealer Electronic Learning Center (PDELC), a center in Kelvin Smith Library that houses fully networked computers and printers, is staffed by trained student assistants. The PDELC is open to all University students, providing access as well as assistance. The PDELC student assistants are trained to be able to provide information and assistance on a range of software applications. Two student groups, students participating in MSP and students who commute to campus, are eligible to reserve PDELC computing systems and to receive free academic printing.

The Office of Commuter Services serves undergraduate commuting students offering programs, activities, regular e-mail correspondence, and a Commuter Lounge in Thwing Center.

There are two locations where appointments can be made. The Counseling Service in the Sears Library Bldg., 2nd floor (368-5872) or the Mental Health Service at the University Health Service (368-2510). Both services are staffed with professional social workers, counselors, psychologists, psychiatrists, and substance abuse intervention and prevention specialists who are experienced in helping college students.

Free workshops and seminars are also offered each semester on topics including test anxiety management, stress reduction, couples enrichment, overcoming shyness, and eating disorders. Also, the annual Sex, Drugs, and Rock n’ Roll Conference is a unique presentation of this office.
Peer tutoring is offered, without charge, in all undergraduate course work. Tutors are undergraduate and graduate students. These student-tutors must demonstrate excellence in their academic subject area, have a faculty recommendation, and attend training sessions in basic study skill techniques, test-taking tips, and time management ideas. Individual tutoring is available in undergraduate courses. In many subjects, tutoring appointments can be scheduled on-line at http://ess.cwru.edu/tutor. Walk-in tutoring clinics, staffed by experienced tutors able to assist with selected core courses, operate evenings in the residence halls. In addition, ESS provides Supplemental Instruction (SI) sessions for designated courses. SI leaders are carefully selected student tutors who attend the assigned course and lead interactive review sessions.

Disability services are available through Educational Support Services, which serves as the resource center and ombudsman for University students with disabilities.

Graduate tutoring at Case Western Reserve is overseen by ESS, which oversees computer-based testing for Educational Testing Service as well as various paper and pencil exams. ESS provides information and application materials for the GRE, GMAT, MCAT, LSAT, Miller Analogies Test, and the TOEFL.

ACES, the Academic and Computing Excellence Seminar, is a noncredit program developed by the Office of Educational Support Services. The course is offered in the summer and at the beginning of each semester and helps students develop effective study strategies and confidence using CWRUnet. The course includes assessment, classroom instruction, and use of the PDELC. Summer ACES is a residential program designed for incoming freshmen.

University Studies (UNIV) 400 is the non-credit course required for all graduate students who assume (or will assume) instructional responsibilities for any undergraduate course at the University. Educational Support Services coordinates UNIV 400.

UNIV 400A. Professional Development for Graduate Teaching Assistants (0)
An orientation and a series of seminars for new TAs designed to develop skills in communication and teaching. Successful completion requires attending the campuswide TA orientation and a minimum of three of the seminars offered throughout the year. Required of students with graduate appointments that include instructional responsibilities.

UNIV 400B. Professional Development for Int'l Graduate Teaching Assistants (0)
In addition to satisfying the requirements of UNIV 400A, ITAs are required to attend a special half-day ITA orientation and to participate in an evaluation of spoken English, the SPEAK evaluation.

UNIV 400C. ITA Communication Skill Development (0)
Small group, interactive course that concentrates on American culture, pronunciation, idiomatic usage, and English grammar. Required of all new ITAs who do not meet the minimum requirements on the SPEAK evaluation.

University Health Services

2145 Adelbert Rd
Phone 216-368-2450

Hours:
M,T,W,F .................................................... 8:30 am - 4:30 pm
Thurs ......................................................... 9:30 am - 4:30 pm
Closed weekends and holidays
Appointments 216-368-4539
On Call Phone 216-368-2450

University Health Service (UHS) is served by health care professionals whose special interest is in college health. These include board certified nurse practitioners and physician-specialists (internal medicine, pediatrics, family practice), psychologists, psychiatrists, registered nurses, social workers and a licensed dietician.

All students registered for one or more credit hours may use any of the services offered within UHS at no charge. Students who choose to waive the Student Medical Plan are still eligible to use our services without charge. If laboratory tests or x-rays are ordered, then the student will receive a bill from the provider of these services (usually University Hospitals of Cleveland), and they must submit these bills to their own insurance for consideration of reimbursement.

**Primary Care**

Care for most episodic illnesses (infections, injuries, etc) is delivered by the staff of the Primary Care Clinic. Students are seen by appointment (there are urgent, same day appointments available every day - the earlier a student calls, the more likely they can be seen the same day.) Whenever possible, we try to have the student receive care from the same provider at each visit, in order to improve continuity of care.

There are several specialty clinics available within UHS during the regular school year. These include Women’s Clinic (for annual gynecologic exams and comprehensive women’s health concerns), Skin Clinic (for treatment of acne, warts, mole removal, etc), and Allergy Clinic. If more subspecialized care is required, students are referred to appropriate physicians in the Cleveland metropolitan area.

**Labs/X-ray/Emergency Room**

For any of these services that are provided outside UHS (usually by University Hospitals of Cleveland), a student will receive a bill. They must submit a copy of the itemized bill to the University Medical Plan or their own insurance for consideration of payment.

**Medications**

In some cases, over the counter medications or frequently prescribed drugs are provided without charge to students but only when part of the prescribed treatment plan (we’re not a pharmacy). In other cases, students may receive a written prescription for medications that they may fill at a nearby pharmacy of their choice. If they have the Student Medical Plan, they would pay for these drugs at the time of receipt, and file a claim for possible reimbursement via the Plan benefits.

**Hospitalization**

In those unusual situations when students require inpatient care, they will be referred to one of the multiple excellent facilities available in the Cleveland metropolitan area. Where this occurs will depend on their medical needs as well as their medical insurance requirements. In occasional instances following hospitalization, a student may be required to meet with a member of the University Counseling Service or UHS staff to determine their ability to return to full campus life.

**Notification of Illness**

UHS staff will notify a student’s immediate family in case of illness or injury after consent has been obtained from the student. Specific medical information about a student’s illness is confidential and privileged. In cases of life threatening emergencies, notification will be made without prior consent. In other cases,
the UHS staff will work with the student to have the student notify their family members, whenever possible. At the student’s request, UHS will also notify the appropriate Dean’s Office about their illness.

On Call/After Hours
A nurse, physician, and counselor are available by beeper, 24 hours a day, 7 days a week during the regular fall and spring semesters. They can be reached by calling the main UHS phone at (216) 368-2450. This will reach the Answering Service who can page them. The on-call staff assists students in making decisions about what situations are truly medical emergencies and where best they can access the services that they need. In case of obvious severe illness or injury, students should proceed directly to the nearest Emergency Room and then notify the Health Service later. Students will be billed directly for the services they receive. It is their responsibility to initiate insurance claims for these expenses. Assistance in filing claims for those enrolled in the Student Medical Plan is available within UHS.

Medical Records
Information from a student’s medical record is only available to staff within UHS and not to anyone outside of UHS, without the express written consent of the student. A parent may not access information in this record without the same express written consent of the student.

University Counseling Services records are maintained separately and are only released in accordance with their own policies and procedures. The student’s written authorization is required, except in the case of life-threatening emergencies.

Excuses
If a student must miss a class, a laboratory, or an exam because of illness, it is the student’s responsibility to notify the relevant faculty member directly. UHS does not issue excuses. In circumstances of prolonged illness or hospitalization, UHS (with the student’s permission) may notify the appropriate academic dean.

What We Need from Each New Student
Each new student should receive in the mail a copy of the Medical History and Immunization forms. They should complete these and return them to the Health Service by the deadline noted on the form. (It would be helpful to keep a copy of the Immunization History for your future records, for travel abroad, etc.) The Immunization History may be completed by a family physician, or students may send a copy of their school immunization record. A tuberculin skin test (Mantoux) is required of all students in the healthcare professions (medicine, dentistry, nursing, applied social sciences, podiatry) as well as all international students. These will be provided without charge after arrival on campus, unless appropriate testing within the past 6 months is documented by a physician.

Students who have not been immunized because of illness or religious beliefs should document that for our records. In some instances, they might be excluded from classes and residence halls in the event of an outbreak of a vaccine-preventable disease.

Student Medical Plan
The Student Medical Plan provides coverage, within the stated guidelines, for medical services rendered outside the University Health Service (typically lab tests, x-rays, prescriptions, hospitalization, etc). A fee for this Plan is automatically billed each fall and spring semester to all students enrolled for one or more credit hours. Students with alternative coverage for such expenses may waive the Student Medical Plan by indicating this as they register for courses online or by signing a waiver form, noting their insurance on the waiver form. Waivers may be obtained in the Student Accounts Receivable (SAR) Office or at UHS. Waivers must be submitted each semester and received by SAR prior to the deadline stated for that semester.

When a student is enrolled for the Medical Plan in the spring semester, coverage automatically applies through the summer until mid August.

Students taking a leave of absence because of a personal medical condition may be eligible to extend that coverage one additional semester, if already covered by the Plan (inquire at UHS for further information 216-368-3050).

For additional information about the Student Medical Plan, go to the UHS website (www.cwru.edu) or telephone us at (216)-368-3050. All students should receive a brochure about the current Student Medical Plan yearly. Additional copies may be obtained by calling 216-368-3050.

Dependent Coverage
Information regarding optional medical coverage for dependent spouse, domestic partner, or children is available at UHS.

International Student Services

International Student Services
Room 210, Sears Library Building
Phone 216-368-2517

The Office of International Student Services (ISS) assists all foreign students with non-academic concerns. The office acts as a liaison with off-campus agencies, such as the U.S. Immigration and Naturalization Service, the U.S. Department of State, embassies, educational consular offices, the International Institute of Education, and Fulbright-Hays grant offices. ISS staff members serve as advocates for international students, with the goal of ensuring that each student has the best possible educational, cultural, and personal experience at Case Western Reserve University. Another goal of the office is to ensure that interaction occurs among all members of the academic community. More than 80 different countries are represented on campus. Every fall, a special orientation is held for newly arrived international students, and a year-long program is designed to enhance the lives of all international students. The ISS Office sponsors an International Club, an annual international dinner, cross-cultural workshops, a student lounge and study room, field trips, and several social gatherings. A newsletter is published each semester, and an electronic newslist keeps students up to date on immigration policies, special events on campus and in the community, and other matters of particular interest to international students. Many nationality-based student organizations provide additional opportunities for international students to meet others with similar interests and experiences.

Case Western Reserve University has been authorized under federal law to enroll non-immigrant alien students on both F-1 and J-1 visas.
The Office of Multicultural Affairs (OMA)

116 Baker Building
Phone 216-368-3750

The Office of Multicultural Affairs (OMA) is a University-wide strategy for underrepresented recruitment, retention, and advancement into graduate and professional schools. OMA provides a network of student services available throughout the University, but centrally administered and coordinated to ensure that underrepresented students' interests and needs are addressed. The basic elements of the OMA include a pre-freshman summer program, fall orientation, educational support services, individual tutoring, master tutor study groups, a reading and learning strategies course, student tracking and referral, counseling, social and cultural enrichment programs, and professional career preparation. The OMA permeates the entire University. It involves students, faculty, administrators, and staff working together to create a campus environment that promotes intellectual development, independent thinking, self-confidence, and appreciation of racial and cultural diversity.

Minority Engineers Industrial Opportunity Program

The Minority Engineers Industrial Opportunity Program (MEIOP) is part of a national effort to increase the number of underrepresented engineers. The undergraduate phase of MEIOP provides incoming freshmen: study laboratories, workshops, counseling, and tutoring. Financial assistance and summer employment opportunities are offered to students selected by the industrial sponsors of MEIOP. Although the program cannot guarantee all participants a summer job or an industrial sponsor, most receive some form of financial assistance through the program or the Incentive Grants Program of the National Action Council for Minorities in Engineering (NACME, Inc.). Individual awards generally range from $250 to $2,000 per year. These grants are considered part of the student's financial resources in the determination of his or her financial need. Details of available financial assistance can be obtained from the Office of Financial Aid. MEIOP provides a strong support system for its participants. Its goals are to attract talented underrepresented students to the engineering profession and to ensure the academic success of those who pursue engineering degrees in the University.

Industrial Sponsorship

A company that chooses to sponsor a MEIOP student will provide:
1. Summer work experience in engineering.
2. Grants-in-aid of up to $1,000 during each of the first two years of the student's study at Case Western Reserve University, and
3. Grants-in-aid of up to $2,000 during each of the student's last two years; also support for one additional semester if required by the student to complete the B.S. degree.

Eligibility

Any underrepresented student pursuing an engineering degree may apply for admission to the undergraduate phase of MEIOP. For purposes of these programs, underrepresented students are defined as Native Americans (American Indians), African Americans, and Hispanics—those groups under-represented in engineer-

ing. Information concerning application and admission to MEIOP can be obtained by writing to the Director of Multicultural Affairs or by calling 216-368-2904.

Access/TRIO Programs

(Upward Bound/SPPSHS and Talent Search)
131 Yost Hall
216-368-3750
216-368-6640

Upward Bound/SPPSHS

The Upward Bound/Special Program for Preprofessional Students in the Health Sciences (SPPSHS) is the oldest of the existing minority programs at Case Western Reserve University. Established in 1966, the program is designed to prepare low-income and potential first-generation-college high school students for successful postsecondary studies directed toward professional health careers. High school students, grades nine through twelve, attending Cleveland and East Cleveland Public Schools are eligible for participation in the program. The program is year-round and includes a six-week summer residential component and a well developed academic year component.

During the summer, in a simulated college environment, students reside in University residence halls, receive intensive academic instruction in mathematics, natural sciences with laboratory, English, reading, study skills, computer science, and foreign languages, and participate in the Health Careers Internship Project (summer jobs at local health facilities) or a community service project. During the academic year, students participate in the Saturday Enrichment Program (academic courses), attend weekly tutorials, and participate in rap sessions directed toward personal growth and development. New students entering mid-year participate in the Health Careers Exposure Program (career exposure) and tutorials. College planning and placement assistance, the SAT/ACT Review Program (Math and English components), instruction directed toward the Ohio Ninth Grade Proficiency Test, cultural activities, and counseling and advising (personal, academic, and career, both individually and in groups) are active areas of the program year-round.

Talent Search

The Talent Search Program is an educational program at Case Western Reserve University designed to (1) identify qualified youths with potential for education at the postsecondary level and encourage them to complete secondary school and undertake a program of postsecondary education and (2) to publicize the availability of student financial assistance for persons who seek to pursue postsecondary education. Talent Search is the newest of the pre-college programs at the University, having been first funded September, 1998.

Project objectives are accomplished through a carefully planned program of identification, selection, assessment, counseling and advising (personal, career, and academic), academic and cultural enrichment activities, college planning and placement assistance, tutoring, mentoring services, career exploration, and Ohio Ninth Grade Proficiency instruction. The college planning and placement component includes assisting participants in completing college admissions and financial aid applications; academic advising and assistance in secondary school and college course selection; assistance in preparing for college entrance examinations (SAT and ACT); information on financial aid resources; and college visitations.
The Project is funded to serve 600 middle and high school students (elementary, middle, and high schools) grades six through 12, inclusive, who reside in East Cleveland and attend East Cleveland City Schools. Two-thirds of the participants must be potential first-generation college students (the parent(s) with whom the student lives does not have a bachelor’s degree) and from low-income families. All participants must demonstrate a need for services provided by the University’s Talent Search Project. Although the Project seeks the participation of all eligible youth, the recruitment and participation of males is encouraged. Services are free.

The Early Initiative Intervention efforts are directed at sixth graders at the District’s six elementary schools - Caledonia, Chambers, Mayfair, Prospect, Rozelle, and Superior - and seventh and eighth graders at the District’s middle school - Kirk Middle School. Services are also offered to the District’s 9th through 12th graders at Shaw High School. Project staff provide services on site in the schools providing greater accessibility to participants. Services will also be provided at Case Western Reserve University.

Student Rights and Responsibilities

The following rules are designed to preserve freedom of expression and association on the Case Western Reserve campus and to reaffirm the civil, personal, and property rights of the University and its members. University members who violate one or more of these rules will be subject to disciplinary action. Conduct which is subject to University disciplinary action includes

1. Interference with freedom of speech or movement, or intentional disruption or obstruction of teaching, research, administration, or other functions on University property.
2. Actual or threatened physical or mental HARM OR abuse of any person on University premises or at functions sponsored or supervised by the University.
3. Refusal to comply with the directions of University officials, instructional or administrative, acting in performance of their duties.
4. Theft or vandalism of University property or that of a member of the University community or a campus visitor.
5. All forms of dishonesty, including cheating, plagiarism, knowingly furnishing false information to the University, forgery, and the alteration or misuse of University documents, records, or instruments of identification.
6. Unauthorized carrying or possession on University premises of firearms or of any weapon with which injury, death, or destruction may be inflicted.
7. Violations of civil law on University premises or in connection with University functions.
8. Violation of published University rules and regulations.

There are also other specific rules and regulations within the University and its several components, violations of which are subject to disciplinary action. Any member of the University community accused of violating a rule or regulation is entitled to adequate notice of all charges and to a fair hearing. While the University’s rules and regulations exist to affirm the special values and functions of the academic community, it should be noted that, as citizens, all members of the University are subject to civil laws, including those governing the use of alcohol and drugs.

Academic Integrity Policy

Students, faculty, and administrators share responsibility for the determination and preservation of standards of academic integrity. Not only must they adhere to their own personal codes of integrity but they must also be prepared to educate others about the importance of academic integrity, to exercise reasonable precaution to discourage violations of academic integrity, and to adjudicate violations. The Academic Integrity Statement may found in the Student Services Guide and in the Undergraduate Studies section of this Bulletin.

Guidelines on Alcohol

The University will conform to all state and local laws controlling the sale and use of alcoholic beverages. It is illegal to sell, provide, or serve beer, wine, or liquor to anyone who is under the legal age (21). Servers of alcohol and sponsors of social events must be aware of and comply with all state statutes and with University policies and procedures. The following regulations apply to all events at which students are present.

1. The sponsors of events where alcohol is served must file an Alcohol Use Permit in the Office of Student Affairs at least three business days prior to the event. A copy of this form will be needed for student groups to reserve any University facility for events where alcohol is served.
2. Open containers of alcoholic beverages are generally prohibited in public places according to state law and are specifically restricted in some University areas including Squire Valleeve Farm, Harkness and Amasa Stone Chapels, and at University athletic events.
3. At all events where alcohol is served, an effective procedure must be established and adhered to for certifying those legally of age to drink. To obtain alcoholic beverages a valid driver’s license or other valid legal document showing proof of age must be presented. A Case Western Reserve I.D. card may be required for admission.
4. The quantity of alcohol will be determined by using the following formula (no. of servings=no. of legal drinkers in attendance x hours of event). This also applies to BYOB events.
5. When alcohol is sold, temporary F or F-2 permits will be required in accordance with state laws. The sale of alcohol is defined to include such methods for defraying the cost of the beverage or event as sale by the glass or container, advance ticket sales, and cover charges at the door.
6. At all events where alcohol is served, non-alcoholic beverages must be provided by the sponsor of the event. The amount of alcoholic beverage provided should reflect the proportion of those attending the event who are legally eligible to drink; the amount of non-alcoholic beverages provided should be sufficient to serve the number of people attending the event who are too young to drink or choose not to drink alcohol.
7. No one should be coerced, even subtly, to drink or overindulge, and the rights of those who choose to abstain must be respected.
8. When alcohol is served, food must be provided by the sponsor of the event in adequate amounts to last through the event.
9. The kind and amount of security required for an event will be determined according to the following factors: the nature of the event, the number of people attending the event, whether an alcoholic beverage is served, and whether cash will be on hand.
10. Social events which encourage drinking or drunkenness as themes and the advertisement of such events are considered inappropriate and will not be permitted. Neither the cost nor brand of alcoholic beverage may be advertised in Ohio.
11. When beer is provided, it must be served to individuals in single servings in containers of 16 ounces or less. When wine
or liquor is provided, it must also be served in appropriately sized glasses.
12. The serving of alcohol must cease at least one-half hour before the scheduled end of an event.
13. When entertainment is included in the event, the type of entertainment and the duration must be listed on the Alcohol Use Permit.
14. The gift of alcohol as a reward for any student activity or contest is prohibited.
15. Individuals or groups violating state law or University student alcohol policy will be subject to disciplinary action. Additional information on the Student Alcohol Policy and the University’s commitment and expectation are included in the Student Services Guide.

Grievance Procedure
Case Western Reserve University has established a mechanism whereby students of the University may express a grievance against the actions of other students or members of the faculty. Details of the grievance procedure are included in the Student Services Guide, an annual publication of the University Office of Student Affairs. Students who wish to have a specific problem reviewed should contact Student Affairs.

University Appeals Board
The University Appeals Board has jurisdiction over student appeals of disciplinary actions. Appeals to the board must be presented in writing to the Vice President of Student Affairs. The board normally reviews the case on the record alone.

Drug Policy
Case Western Reserve University has the responsibility to provide its students, employees, and the public with the safest environment possible. The University also has an interest in promoting the highest standard of health and welfare among its students, staff, and faculty. It is therefore the policy of Case Western Reserve University to discourage the use of controlled substances. The unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited in and on property owned or operated by Case Western Reserve University. Further information regarding the University’s drug policy is available in the Student Services Guide.

University Policy on E-mail Communications with Students
Official communications from the University may be sent electronically using the student’s University-assigned e-mail address. The University expects that students will read such official University communications in a timely fashion. Students who choose to forward e-mail from their University account to another e-mail address remain responsible for receiving and reading official University communications.

Sexual Assault Policy
Case Western Reserve University is a community dependent upon trust and respect for its constituent members—students, faculty and staff. Sexual assault is a violation of that trust and respect—it will not be tolerated. The University strongly encourages persons who have been sexually assaulted to report the assault, to seek assistance and to pursue judicial action or sanctions for their own protection and that of the entire campus community.

Complete details on the University’s policy and reporting procedure are included in the Student Services Guide, published annually by the University Office of Student Affairs.

Smoking Policy
As a matter of public policy, the University is dedicated to providing a safe and healthful environment. In addition, the University has substantial commitments to health-related research and teaching. Thus, the Case Western Reserve University community has a particular obligation to be sensitive to health-protection issues. Case Western Reserve University permits no smoking in its facilities with the exception of residence hall rooms. Smoking is permitted in residence hall rooms only if it is acceptable to all of the assigned occupants. It is permissible to smoke on campus grounds; smokers are asked to use urns provided for ash and butt disposal and to respect the rights of non-smokers at public gatherings on the grounds.

Students from Other Countries
Case Western Reserve University will consider for admission highly qualified students who are not citizens of the United States. An international student who is admitted to study at the University generally faces problems of living in a different cultural environment under an unfamiliar academic system. It is anticipated that the student can solve these problems if he or she has an excellent academic record, understands rapidly spoken English and can speak, read, and write English with facility. In addition to completing the regular application materials, a student from another country must take several additional steps.

Financial Resources
Each applicant must submit a financial plan itemizing sources of funds for education, including maintenance and expenses, exclusive of transportation, or a one-year period. Funds may come from scholarships, fellowships, assistantships, sponsoring agencies, the student’s family, or any other dependable source. As a guide to budgeting, the University has established a figure of $10,500 (U.S.) as the minimum needed to meet the total cost of one calendar year of study, not including tuition. At the present time, the only financial aid available to graduate students from other countries is a limited number of tuition grants and assistantships provided by certain departments of the University. These grants are made available only to unusually well-qualified students. A decision on these awards is made only after a decision on acceptance to the University. Case Western Reserve does not grant any financial assistance to undergraduate international students. An international student may want to arrange for a sponsor who will provide full financial assistance. Such a sponsor must document fully his or her ability to support the student, including the cost of tuition and fees, room and meals, books, incidentals, and travel expenses. The University cannot predict what individual expenses will be. Refer to the “Financial Information” section of this Bulletin. Costs for tuition and room and board are subject to change and do not reflect travel costs.

Transfer of Funds
Before the student leaves his or her home country, it is very important to inquire about the regulations regarding the transfer of funds. In addition to expenditures for travel, the student should have at least $1,200 (U.S.) on arrival in Cleveland to meet initial
expenses. Foreign bank drafts made out to Case Western Reserve University may take as long as one month to redeem (cash) at this university. It is advisable to draw a draft on a bank located in the United States. Traveler’s cheques are recommended in place of currency.

**Employment**

International students on F-1 or J-1 visas may work on campus provided they (1) maintain status and (2) do not work more than a total of 20 hours per week while school is in session. They may be employed on campus full-time during holidays and vacation periods provided they are eligible and intend to register for the next school term.

**English Requirement**

Applicants from other countries must be able to speak, read, write, and comprehend English. A score of at least 550 on the Test of English as a Foreign Language (TOEFL) or completion of ELS Language Center, Level 109, at Case Western Reserve University is a mandatory requirement for admission and must be on file before registration will be permitted. Students may be retested on arrival at the University. The TOEFL test was introduced as a computer-based test in July 1998 in many parts of the world. Sylvan Learning Systems, Inc. administers the computer-based test year-round at permanent testing centers throughout the world. In addition, testing is offered at supplemental centers on specific dates or during specific time periods. For testing at supplemental centers, students must obtain the “Information Bulletin for Supplemental TOEFL Administrations” from TOEFL Services.

TOEFL Services
P. O. Box 6151
Princeton, New Jersey 08541-6151
U.S.A.
http://www.toefl.org

Information bulletins are also available overseas at the Institute of International Education overseas branch offices; at the American-Korean Foundation in Seoul, Korea; at many U.S. embassies, binational centers and USIS centers; and at many universities. Applicants are exempt from the TOEFL requirements if they (1) speak English as their native language; (2) have completed a bachelor’s degree or higher at a foreign university where the instruction was in English; (3) qualify for admission on the basis of U.S. high school graduation (rank in class and SAT scores); (4) have completed six semester hours of sophomore level English literature in a U.S. college or university; or (5) have earned a bachelor’s degree or higher in a U.S. college or university with instruction in the English language. Applicants who are required to submit TOEFL scores may be tested again for English placement before they are permitted to register.

**Medical Insurance**

All students must carry medical insurance. No exceptions are allowed. Refer to “University Health Service” for details.

**Passports and Visas**

When accepted by the University, the student will be sent a letter of admission and the appropriate form by which he or she may obtain a student visa for entry into the United States. The form for the U.S. visa will be issued by the Office of International Student Services only on receipt of a statement indicating sufficient financial support (for example, a letter of award of scholarship, a bank statement of deposited funds, or an affidavit of support) for one full year of tuition and living expenses. Students who are admitted as transfers from other U.S. colleges will be contacted by the Office of International Student Services as to the procedures to be followed. To meet U. S. government regulations, a graduate student on an F-1 or J-1 visa must take at least nine semester hours of University work for credit. An undergraduate must register for at least 12 credit hours.

**Application**

An application should be submitted by May 1st for Fall admittance and by November 1st for Spring admittance. Certified translations of academic credentials into English should be submitted with the official copies of all credentials. Initial undergraduate inquiries should be submitted to Office of Undergraduate Admissions
Case Western Reserve University
10900 Euclid Ave.
Cleveland, Ohio 44106-7055
U.S.A.

**The ELS Language Center**

Case Western Reserve University has an ELS Language Center that offers intensive four-week sessions in English as a second language to college-bound students from other countries. Every week students receive a total of 30 hours of instruction, providing a rich language learning experience. The four-week duration of each session makes scheduling the programs easy and allows each person to enroll for as long as he or she needs four weeks, eight weeks, or more. Admission to courses is open to persons who can devote full time to an intensive language-learning program. Only persons who can give evidence of suitable academic background, adequate financial resources to cover living and school expenses, and seriousness of purpose will be approved for admission. The ELS Language Center is authorized to enroll non-immigrant foreign students. On approval of an application, a Form I-20 (Certificate of Eligibility) will be sent, which, upon receipt, should be taken to the nearest U.S. embassy or consulate to apply for a student visa. For more information check our website at http://www.els.com/cleveland.htm or e-mail us at Cle@els.com

Address mail inquiries to:
ELS Language Center
Case Western Reserve University
Stone Commons
10900 Euclid Ave.
Cleveland, Ohio 44106-7059

**Specific Schools and Colleges**

**Management**

Only those applicants from other countries who have an undergraduate educational equivalent to that required for a bachelor’s degree from an accredited institution in the United States will be considered for admission to the Weatherhead School of Management. Candidates with a three-year bachelor’s degree will not be considered for admission unless they have also completed further education for which they have received a degree or diploma, or have completed significant professional work experience (minimum five years). The school does not accept applications from candidates who have already completed a Master of Business Administration (MBA) from another college/university.

The school requires the results of performance on the Graduate Management Admission Test (GMAT) and the Test of English as a
Foreign Language (TOEFL). The TOEFL requirement is waived if a student has completed his/her undergraduate education at a college/university where the language of instruction was English. The GMAT and the TOEFL are administered daily at testing centers throughout the world. Application forms and information bulletins can be obtained by writing to:

Graduate Management Admission Test or Test of English as a Foreign Language
Educational Testing Service
Box 966
Princeton, New Jersey 08540
or visiting their website at:
http://www.gmat.org

All applicants from other countries are required to pay the $50 application fee. Requests for application materials and all correspondence, transcripts, and documents supportive of an application should be forwarded to:

Admission Office
310 Enterprise Hall
Weatherhead School of Management
Case Western Reserve University
10900 Euclid Ave.
Cleveland, Ohio 44106-7235
(216) 368-2030

Applicants to the J.D./M.B.A. program must meet all of the admission requirements of both the School of Law and the School of Management. These applicants should write the admission offices of both schools for bulletins and application forms and should indicate on both applications that they are applying for the joint J.D./M.B.A. program. Separate application fees of $50 (by the School of Management) and $40 (by the School of Law) are charged. Candidates must take the Law School Admission Test (LSAT) as well as the GMAT. The results of the LSAT are sent to the School of Law and the results of the GMAT are sent to the School of Management. Information about the LSAT may be obtained from:

Law School Admission Council
Box 2000
Newtown, Pennsylvania 18940
or check their website at http://www.lsac.org or from the School of Law.
Academic Programs
### Degree Programs Offered

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<tr>
<th>Field of Study</th>
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<th>Professional/Graduate</th>
<th>Combined</th>
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* Admission suspended
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a. Joint program with Cleveland Institute of Art.
b. Available only as a second major.
c. Joint program with Cleveland Institute of Music.
d. Includes dietetics.
e. See clinical (child) psychology, clinical (adult) psychology, developmental psychology, experimental psychology, and mental retardation research psychology.
g. The Medical Scientist Training Program.
h. Combined degree by special arrangement for selected students who hold acceptances in the School of Medicine.
i. Degrees conferred jointly by the Mandel School of Applied Social Sciences and the Weatherhead School of Management.
j. Available as the undergraduate portion of the Bachelor of Science in Engineering/Master of Science program.
k. Available as the graduate portion of the Bachelor of Science in Engineering/Master of Science program.
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<sup>a</sup> Joint program with Cleveland Institute of Art.
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School of Graduate Studies
School of Graduate Studies

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The School of Graduate Studies is the unit through which Case Western Reserve University offers graduate programs in the humanities and social sciences, biological and physical sciences, engineering, and selected disciplines related to professional fields. These programs lead to the degrees of Master of Arts, Master of Fine Arts (theater and dance), Master of Science, Master of Public Health, Master of Engineering and Management, Doctor of Musical Arts, and Doctor of Philosophy. Several programs offered jointly with the professional schools and local affiliated institutions lead to dual degrees such as M.A./J.D., M.S./M.D., M.A./M.S.N., M.S.S.A./Ph.D. Ph.D./M.P.H., J.D./M.P.H., M.S.N./M.P.H., M.B.A./M.P.H., M.D./M.P.H., and M.D./Ph.D. There are also two combined undergraduate and graduate programs, IGS (Integrated Graduate Studies) and B.S./M.S., which allows undergraduates to enter graduate study before they complete their undergraduate programs. The School of Graduate Studies, overseeing university-wide standards of quality in admission and performance, presently awards graduate degrees in 70 basic disciplines with Ph.D. programs and 15 others in which the highest degree is the M.A., M.F.A., or M.S. Enrollment in the School of Graduate Studies for Fall 2001, excluding non-degree registrants, totaled 1885, of which 993 were men, 892 were women, and 655 were international. Of those registrants 599 were new students, 995 were full-time students, and 890 were part-time students. During the academic year 2000-01, the school awarded 327 master's degrees and 196 doctorates.

Administration of the School

Lenore A. Kola, Ph.D. (Boston University)  
Dean of Graduate Studies

Graduate Committee

General responsibility for overseeing programs of graduate study and for academic and other general regulations applicable to all graduate students and programs is delegated to the University Faculty Senate Committee on Graduate Studies. Each department, school, or interdisciplinary committee is responsible for its particular graduate programs within the framework of the general regulations. The Committee on Graduate Studies consists of the Dean of Graduate Studies, Associate Dean of Graduate Studies, nine faculty members elected by the University Faculty Senate and three graduate students elected by the Graduate Student Senate.

Graduate Student Senate

Students in the School of Graduate Studies are represented by a Graduate Student Senate, which consists of one student elected from each department that offers graduate programs. The officers of the senate are elected by the graduate student senators, who also select graduate student representatives to the University Faculty Senate and various campus committees.

Financial Information

For financial aid information see the “Financial Information” section of this Bulletin.

Admission to Graduate Study

Applicants with good academic records from fully accredited universities and colleges will be considered for admission to graduate study at Case Western Reserve University. Admission must be recommended by the department or professional school of the university in which the applicant proposes to work and must be approved by the Dean of Graduate Studies.

Application Procedure

An applicant for admission must submit complete credentials to the proposed department or program at least 30 days before the first day of classes for the semester admission is requested. (Allow at least 60 days when applying from outside the United States.) An applicant for admission and concurrent financial aid consideration must have the completed application forms on file generally by March 1 for fall semester or by November 1 for spring semester. Most departments award financial aid for the academic year, which begins in the fall semester. The credentials must include the following items:

1. Completed application forms, part A and B, with the nonrefundable application fee.
2. Official transcripts of all previous undergraduate and graduate courses taken for credit.
3. Graduate and/or undergraduate degree verification, which can be posted on the academic transcript or certified by the academic institution where the degree(s) has been awarded.
4. Three letters of recommendation from former professors or other persons familiar with the applicant’s ability and probable performance as a graduate student.
5. For departments and programs which require standardized tests, the results of the Graduate Record Examination, the Miller Analogies Test, or the Graduate Management Admission Test. (Contact the department for the tests that are required for the degree programs in that department.)
6. Certain programs require submission of writing samples, portfolios, scheduling of auditions and personal interviews. (Refer to departmental materials for details.)

Admission of International Students

The admissions criteria for international students are the same as U.S. residents except for the following:

1. International students whose first language is not English must demonstrate English proficiency by taking the Test of English as a Foreign Language (TOEFL) exam and earn a minimum score of 550. Some departments require higher scores.
2. To obtain a student visa, international students must demonstrate financial sufficiency by submitting bank statements and other financial documents indicating sufficient funds to support the tuition and living expenses for one academic year.
3. For those students who are to receive financial aid from the department, the amount of funds required will depend on the amount of the aid award. In some cases it will be living expenses, and in others more funds will be required.

When a letter of acceptance for an international student has been issued, a copy is sent to the International Student’s Office where the I-20 is processed and sent to the student who must then obtain a student visa in order to begin study in the U.S. More detailed information can be obtained from the International Students’ Office and from the “Student Affairs” section of the Bulletin.

Admission Status

Full Standing

To be admitted to full standing the applicant must meet all the admissions criteria without conditions or academic provisions. Applicants must have a good academic record, e.g., a B average or rank in the upper third of his or her graduating class at an
institution whose status and programs are readily assessed. The applicant will be expected to meet essentially all of the undergraduate prerequisites for the proposed field of graduate study. In addition to evidence of admissibility from transcripts, grade records, letters of recommendation and TOEFL test (English proficiency test for international students only), certain departments require that the applicant submit satisfactory scores on the Graduate Record Examination, the Miller Analogies Test, or the Graduate Management Admission Test.

Ordinarily a bachelor’s degree is required for unconditional admission to the graduate school. Under some circumstances, an admissions committee may recommend admission to the School of Graduate Studies on the basis of an equivalent experience. In this case, final approval for admission by the Dean of Graduate Studies is required.

Provisional Standing

Applicants who have academic deficiencies and do not qualify for admission with full standing are occasionally admitted provisionally. A student may give evidence of ability in his or her chosen field that is sufficiently convincing to warrant provisional admission, but the quantity or quality of the student’s preparation may be difficult to determine with sufficient certainty for admission in full standing. The provisions will be specified by the department to which the student is admitted, and stated in the official letter of admission from the Dean of Graduate Studies. A provisional graduate student is expected to complete appropriate course work and to meet the performance standards of the School of Graduate Studies within the first academic year of study. Although the provisional student’s records will be reviewed each semester, the student’s status will be reconsidered by the department no later than at the end of two semesters of study. At that time, if the student has satisfied the provisions associated with his or her admission in the judgment of the department and the Dean of Graduate Studies, the student will be given full standing; otherwise, he or she will be separated from further graduate study in that department.

Conditional Standing

Applicants who have missing documentation in their admissions file (such as an official academic transcript with degree posted or official copies of test scores), or who are required to attain higher achievement levels on standard tests such as the GRE or TOEFL, as specified by either the department or the School of Graduate Studies may be admitted conditionally. The condition(s) specified in the letter of acceptance must be satisfied prior to matriculation in the School of Graduate Studies.

Postponement of Matriculation

Applicants are guaranteed admission only for the term specified in the letter of admission. An applicant who is unable to enroll in the semester for which he or she was initially admitted may request to postpone matriculation up to two regular academic semesters. In such cases, the department to which the applicant has applied may accept or reject the applicant’s request, and the terms of readmission may differ from the original offer. If a delay of more than two semesters is requested, the applicant’s file must be reviewed and reevaluated by the department. If more than two years elapse since acceptance, the applicant must reapply in the same manner as a new applicant. Because applicant files are only kept for a maximum of two years, all documentation will have to be resubmitted.

Non-Degree Students

Individuals with earned bachelor’s degrees that want to enroll in classes for personal enrichment or to satisfy prerequisite course requirements for later admission to graduate programs may enroll as non-degree students in the office of the University Registrar. A student who wishes to register as a non-degree student should request the appropriate application form from the Registrar’s office and submit evidence that a bachelor’s degree has been earned. Students may enroll in undergraduate and graduate level courses. However, for graduate (400 level and above) courses, written consent from the instructor must be obtained. Continuation in non-degree status is at the discretion of the Dean of Graduate Studies.

Applicants who are interested in transferring course work into graduate degree programs are encouraged to seek early advice from the departments to which they intend to apply to ensure that courses taken as non-degree students will satisfy departmental requirements. Non-degree students cannot assume that they will be admitted to any graduate degree program, or that all course work taken will transfer into the program. Only 400 level and higher course work will be considered for graduate transfer. The term of the earliest approved, transferred course will establish the date of entrance into the degree program. Courses transferred from non-degree status must have been taken within five years of the first term of matriculation as a degree seeking student and passed with a grade of B or better. Students considering transfer into a degree program will need to meet a minimum matriculation requirement of two semesters and six semester hours of course work.

Planning the Study Program

Graduate study presupposes a considerable maturity on the part of the student in planning and reaching his or her educational objectives. The effectiveness of the graduate program lies jointly with the individual student and the faculty advisor or advisory committee through early, substantive planning discussions. The formal requirements set forth in these regulations are intended to aid in the maintenance of uniform minimum standards of performance, to form a basis for planning programs of graduate study, and to provide for efficient management and coordination.

For each graduate student, an official planned program of study consisting of the courses and other requirements for the M.A., M.F.A., M.S., M.P.H., D.M.A., or Ph.D. degrees should be established in consultation with the faculty advisor or advisory committee. After the major faculty advisor and department chair have approved the program of study, it should be submitted to the Dean of Graduate Studies to be placed in the student’s file. At the latest, students enrolled in Master’s programs must submit an approved program of study along with an application to graduate. For doctoral students, it must be submitted when the student advances to candidacy. A revised program of study must be submitted when any change in the original plan occurs. For graduate engineering students, additional details regarding degree program requirements are given in the Engineering section of the Bulletin. The various departments and schools may make such additional regulations concerning programs of study as may be necessary to reach particular academic goals. These regulations must be in writing, with a copy filed in the School of Graduate Studies.

The Academic Advisor

Each graduate student will have a faculty advisor or advisory committee assigned by the department or professional school to assist the student in planning the program of study best designed to enable the student to reach appropriate educational objectives.
Academic Requirements for Master’s Degrees

In recognition that the objectives of master’s degrees differ for various departments and for individual students, especially in the importance given to research, two general plans for master’s degrees may be followed:

Plan A

M.A. or M.S. with a thesis based on individual research and a final oral examination.

Plan B

M.A., M.F.A., M.P.H., or M.S. without a thesis but requiring a comprehensive examination and/or a major project to be administered by the academic unit.

The Master’s Thesis (Plan A)

The minimum requirements for the master’s degree under Plan A are 18 semester hours of course work plus a thesis equivalent to at least 9 semester hours of registration, or 21 semester hours of course work plus a thesis equivalent to at least 6 semester hours of registration. Once registered for thesis credit (Course 651), a student must continue 651 registration each succeeding regular semester until graduation. However, if a student is registered for course work or research toward the doctorate in the semester in which the thesis examination is expected to occur, concurrent registration for 651 is not required. At least 18 semester hours of course work, including thesis, must be at the 400 level or higher.

Each student must prepare an individual thesis. Joint theses are not permitted. The written thesis must conform to regulations concerning format, quality, and time of submission as established by the Dean of Graduate Studies. Detailed instructions can be obtained from the School of Graduate Studies.

For completion of master’s degrees under Plan A, an oral examination (defense) of the master’s thesis is required. This examination is conducted by a committee of at least three members of the University faculty, and the candidate’s thesis Advisor customarily serves as the chair of the examining committee. The other members of the committee are appointed by the chair of the department or curricular program faculty supervising the candidate’s course of study. The examining committee must agree unanimously that the candidate has passed the thesis examination. Because theses are made public immediately upon acceptance, they should not contain proprietary or classified material. When the research relates to proprietary material, the student and Advisor are responsible for making preliminary disclosures to the sponsor sufficiently in advance to permit timely release of the thesis, and these plans should be disclosed when the thesis is submitted to the School of Graduate Studies.

The Master’s Comprehensive (Plan B)

The minimum requirements for the master’s degree under Plan B are 27 semester hours of course work, a comprehensive examination, and in some fields, an approved project. At least 18 semester hours of course work must be at the 400 level or higher.

Each candidate for the master’s degree under Plan B must pass satisfactorily a comprehensive examination to be administered by the department or curricular program committee. The examination may be written or oral or both. A student must be registered during the semester in which any part of the comprehensive examination is taken. If not registered for other courses, the student will be required to register for one semester hour of EXAM 600, Comprehensive Examination, before taking the examination.

Academic Requirements for Doctoral Degrees

The degree of Doctor of Philosophy is awarded in recognition of in-depth knowledge in a major field and comprehensive understanding of related subjects together with a demonstration of ability to perform independent investigation and to communicate the results of such investigation in an acceptable dissertation.

Curricular Requirements

Within the framework of these general regulations, it is expected that a relevant program of study will be planned for each candidate for the doctorate by the student and the faculty Advisor or advisory committee. Such a program should include appropriate courses, together with work on the doctoral dissertation, and may also include, where relevant, such experiences as field work or practicum.

Although specific requirements vary among departments, students entering with a bachelor’s degree will satisfactorily complete a minimum of 36 semester hours of courses (which may include independent study/research, course 601), tutorials, and seminars. For students entering with an approved master’s degree, completion of at least 18 semester hours of course work is required. A minimum of 18 semester hours of dissertation research (Course 701) is required for all doctoral students.

Examination Requirements

In order to meet the requirements for the doctorate, a student must pass satisfactorily a general examination (or a series of examinations covering different fields) specified and administered by the student’s department or supervising committee. The examination generally precedes advancement to candidacy. A student must be registered during the semester in which any part of the general or qualifying examination is taken. If not registered for other courses, the student will be required to register for one semester hour of EXAM 700, General/Qualifying Examination, before taking the examination. A student who fails the examination on the first attempt may be permitted to take the examination a second time within one year at the discretion of the department. Except in unusual circumstances, a student who fails the examination a second time will be separated from further graduate study within the same department or program.

Advancement to Candidacy

The formal acceptance of a student as a candidate for the doctoral degree is the responsibility of the student’s department or the committee supervising the doctoral program in accordance with the written procedures of the academic unit. At its discretion the supervising unit may require a student to pass qualifying examinations before candidacy is granted. Generally, advancement to candidacy allows the student to enter the dissertation research
phase of the degree program, and occurs after all course work and exam requirements are satisfied. Students are expected to make regular and continuous progress toward the degree. Advancement to candidacy in a Ph.D. program should occur within a maximum of 6 years post-matriculation with a bachelor’s degree (no later than at the completion of 36 semester hours of graduate study) and 4 years post-matriculation with a master’s degree (no later than at the completion of 18 semester hours of graduate study). Students may continue in pre-candidacy status beyond this time by means of a petition to the School of Graduate Studies by a program director, based on evidence of student progress toward the degree. Individual programs can require advancement to candidacy before the time limit set in this policy.

The Dean of Graduate Studies must promptly be notified in writing of the decision concerning a student’s advancement to candidacy, and a copy of the notification must be sent to the student concerned. A student who is refused candidacy status may not undertake further study for credit toward the doctoral degree within the same department or supervising unit. With the approval of both the department concerned and the Dean of Graduate Studies, such a student may:
1. Take additional courses, if required, in order to complete a master’s degree in that department.
2. Seek admission to the graduate program of another department.

Course 701 Requirements

Pre- and Post-Candidacy Dissertation Research

When a student has been advanced to candidacy, he or she may begin dissertation research by formally registering for course 701 credits. At the point at which students begin registering for course 701, the department must identify a university faculty member who will serve as the doctoral student’s principal research advisor, and formally notify the Dean of Graduate Studies. Students who have been advanced to candidacy may register for 1-9 credits of course 701 each fall and spring semester (or up to 6 credits for the summer when needed). In certain cases, students who have not advanced to candidacy may begin registering for up to 6 credit hours of course 701 at the discretion of the department and upon written notification to the Dean of Graduate Studies. Pre-Candidacy 701 hour(s) can only be taken concurrently with course work. Once a student begins registration of 701 hours, he or she must register for at least one credit hour of 701 each semester until graduation. Once 701 registration begins doctoral students have five consecutive calendar years from the semester of the first credited 701 registration, including leaves of absence, to complete all requirements for the doctorate.

Course 703 Requirements

Dissertation Fellowship and Post-Candidacy Research

Students who have been advanced to candidacy and are within the five-year time limit for completion of the degree, but have not completed the dissertation, can register for 703 upon departmental recommendation and the approval of the School of Graduate Studies. Students will register for 8 credit hours of dissertation fellowship (703), but must also co-register for a least 1 credit hour of 701 or one credit hour of 701 and a course, with the total registration hours equaling 9 credit hours. No tuition is charged for 703 when accompanied by a paid credit hour(s) of tuition. This Dissertation Fellowship is available for a maximum of 6 consecutive semesters and cannot exceed a total of 36 credit hours. If the dissertation is not completed and defended in the last semester of the fellowship, the fellow must resume registration for course 701 at a minimum of one credit hour each semester through the allowed five-year limit. Registration for 703 cannot be used to postpone the normal timetable for completion of the 18 credit hour 701 requirement.

Foreign Language Requirements

Although there is no general foreign language requirement for the doctorate, each department or supervising committee may set such requirements as are appropriate to the student’s program of study. It is the student’s responsibility to ascertain the foreign language requirements approved by the supervising unit. Each department must notify the Dean of Graduate Studies in writing of the specific language(s) required and the date of examination determining the student’s proficiency in the required language(s).

Dissertation Requirements

All candidates for the Ph.D. degree must submit a written dissertation as evidence of their ability to conduct independent research at an advanced level. The dissertation must represent a significant contribution to existing knowledge in the student’s field, and at least a portion of the content must be suitable for publication in a reputable professional journal or as a book or monograph. Students must prepare their own dissertations. Joint dissertations are not permitted. The written dissertation must conform to regulations concerning format, quality, and time of submission as established by the Dean of Graduate Studies. Detailed instructions can be obtained from the School of Graduate Studies.

Research work connected with a dissertation is to be carried out under the direct supervision of a member of the university faculty selected by the student in consultation with departmental faculty and approved by the chair of the department.

Two copies of each completed and acceptable dissertation will be deposited in the University library by the School of Graduate Studies. In addition, the student must guarantee the reproduction of the dissertation through University Microfilms, Ann Arbor, Michigan, before certification for the doctorate. Because dissertations are made public immediately upon acceptance, they should not contain proprietary or classified material. When the research relates to proprietary material, the student and Advisor are responsible for making preliminary disclosures to the sponsor in advance to permit timely release of the dissertation. These arrangements must be disclosed when the thesis is submitted to the School of Graduate Studies.

Dissertation Advisory Committee

Each doctoral student is responsible for become sufficiently familiar with the research interests of the department or program faculty to choose in a timely manner a faculty member who will serve as the student’s research Advisor. The research Advisor is expected to provide mentorship in research conception, methods, performance and ethics, as well as focus on development of the student’s professional communication skills, building professional contacts in the field, and fostering the professional behavior standard of the field and research in general.

The research Advisor also assists with the selection of at least two other faculty to serve as members of the dissertation advisory committee. At a minimum, the dissertation defense committee must consist of four members of the University faculty, including at least one whose primary appointment is outside the student’s program, department or school. The committee is appointed by the Dean of Graduate Studies upon recommendation of the Chair of the department, division, or curricular program committee.

The student’s dissertation Advisor must be a member of the dissertation advisory committee and may serve as chair. The chair
of the committee must be a regular Case Western Reserve University faculty member in the student’s program. Under special conditions, a former faculty member whose time of leaving the university has not exceeded 18 months may be approved as a voting university member by the Dean of Graduate Studies. Throughout the development and completion of the dissertation, members of the dissertation defense committee are expected to provide constructive criticism and helpful ideas generated by the research problem from the viewpoint of their particular expertise. Each member will make an assessment of the originality of the dissertation, its value, the contribution it makes, and the clarity, with which concepts are communicated, especially to a person outside the field. The doctoral student is expected to arrange meetings and maintain periodic contact with each committee member. A meeting of the full committee for the purpose of assessing the student’s progress should occur at least once a year until the completion of the dissertation.

Final Oral Examination (Defense of Dissertation)

Each doctoral candidate is required to pass a final oral examination in defense of the dissertation. The examination may also include an inquiry into the candidate’s competence in the major and related fields.

The defense must be scheduled with the School of Graduate Studies no later than three weeks before the date of the examination. The chair of the examining committee should give approval to schedule the defense when the written dissertation is ready for public scrutiny. The candidate must provide to each member of the committee a copy of the completed dissertation at least 10 days before the examination so that the committee members have an opportunity to read and discuss it in advance.

Scheduled defenses are made known through on-campus publication, and any member of the university may be present at that portion of the examination pre-designated as public by the chair of the dissertation advisory committee. Others may be present at the formal defense only by invitation of that chair.

It is expected that all members of the dissertation defense committee be present at the defense. Exceptions to this rule: a) must be approved by petition to the Dean of Graduate Studies and only under extraordinary circumstances, b) no more than one voting member can ever be absent, c) the absent member must participate through real-time video conferencing at departmental expense and d) the student must always be physically present.

The dissertation advisory committee is responsible for certifying that the quality and suitability of the material presented in the dissertation meet acceptable scholarly standards. A student will be certified as passing the final oral examination if no more than one of the voting members of the committee dissents.

Institutional Review Board (IRB)

The promotion of scholarship and the discovery of new knowledge through research are among the major functions of Case Western Reserve University. If this research is to be meaningful and beneficial to humanity, involvement of human subjects as experimental participants is necessary. It is imperative that investigators in all disciplines strive to protect human subjects. University policy and federal regulations demand compliance. Per federal regulations (45 CFR 46), all research involving human subjects requires submission of an IRB application prior to initiation of research to the Case Western Reserve IRB. THIS INCLUDES ALL RESEARCH CONDUCTED FOR THESSES AND DISSERTATIONS THAT INVOLVE HUMAN SUBJECTS.

Each IRB application must have a faculty member noted as the Responsible Investigator. Applications that are not fully completed as instructed will not be accepted. See University Policy on the involvement of Human Participants in Research for guidelines under which investigations involving human subjects may be pursued.

Course Designations

Courses numbered 100 to 399 are undergraduate-level courses. Courses numbered 400 and higher are graduate-level courses.

Grading System

See the “University” section of this Bulletin for a list of valid grades for the School of Graduate Studies and their appropriate use in assigning to graduate students. The only grades that can be changed after they have been assigned by the instructor are Incompletes (I). All others will remain permanently on the student’s academic record. Additional work cannot be done to change an existing grade to a higher grade.

There are some grading schemes in the School of Graduate Studies that have important policy implications. They are:

Incomplete (I)

Grades of I should only be assigned for letter graded and Pass/No Pass courses for extenuating circumstances, and only when a student fails to complete a small segment of the course. Students may not sit in the same course in a later semester to complete the work required for the original course. All work for the incomplete grade must be made up, and the change of grade recorded in the Office of the University Registrar, by the date specified by the Instructor, but no later than the last day of class in the session following the one in which the I was received. Unresolved Incomplete grades will remain permanently on the student’s academic record, if the work is not made up by the designated deadline. A student who has a permanent Incomplete for a required course must retake the course in a later term. When an I grade is assigned by the instructor, he or she must also submit to the School of Graduate Studies the completed “Arrangement to Resolve a Grade of Incomplete” form indicating the date that the I grade will be resolved. If the student cannot complete the work for the Incomplete by the specified deadline, he or she must petition for an extension which must be endorsed by the instructor, and explain the reasons why the work has not been completed, and include a new date for completion. Students will be allowed only one extension of no more than one additional semester to complete the work for an I grade.

Pass/No Pass (P/NP)

Some graduate courses are graded on a pass or no pass basis, and students need to be aware of the regulations governing letter graded and pass/no pass credits. Of the minimum credit hours required beyond the bachelor’s degree to complete course work requirements, at least 12 credits must be letter graded for the Master’s degree, and at least 24 credits must be letter graded for the Ph.D. degree. For students with approved master’s degrees who are admitted to Ph.D. programs, at least 12 credits of the required minimum of 18 credits of course work must be letter graded. Letter graded courses should be the courses most central to the student’s plan of study. Additional credit hours of letter graded course work may be specified by departmental policy. Performance evaluation for course 601 (Independent study/Research) is limited to P/NP grading.
Satisfactory/Unsatisfactory (S/U)

Grades of Satisfactory (S) and Unsatisfactory (U) are to be used exclusively for three courses: 651 thesis research; 701, dissertation research; and 703, dissertation fellowship. Satisfactory indicates an acceptable level of progress towards completion of the research required for the degree, and Unsatisfactory indicates an unacceptable level of progress towards completion of the research for the degree. Any student who receives a grade of U will automatically be put on academic probation, and if a second U is received, the student will be separated from further study in his or her degree program.

Academic Policies

Graduate Student Rights and Responsibilities

It is the responsibility of the student to become familiar with the general rules and regulations of the University not just those of the School of Graduate Studies. A member of the University community who is accused of violating any of these rules and regulations is subject to University disciplinary action. Due process procedures of adequate notice of all charges and a fair hearing will apply. Case Western Reserve University has established a mechanism whereby students of the University may express a grievance against the actions of other students or members of the faculty and staff. A statement of the policies and procedures to be followed in the case of academic infractions by graduate students may be obtained through the School of Graduate Studies. The policies and procedures governing all other infractions are detailed in the university’s annual Student Services Guide and in the “Student Affairs” section of this Bulletin. The University Office of Student Affairs should be consulted for non-academic infractions.

It is also the responsibility of the student to become acquainted with the general regulations and administrative procedures governing graduate study, together with the departmental or school regulations which apply to the student’s course of study, and, in consultation with the faculty Advisor or advisory committee of the supervising unit, to plan the program and carry out the work in accordance with these regulations and procedures.

Departmental Responsibility for Requirements

Requirements for master’s and doctoral degrees beyond those set forth in these regulations may be established by departments or curricular program committees with the approval of the Dean of Graduate Studies. Individual students may be required to take courses beyond the published requirements in order to successfully complete their degree programs. In such instances the student must be notified in writing upon matriculation by the chair of the department or curricular program, with a copy to be filed in the School of Graduate Studies.

Maintenance of Good Standing

A student maintains standing in the School of Graduate Studies by registering each fall and spring semester unless on an official leave of absence which has been approved by the School of Graduate Studies. A student is in good standing who meets the standards set by the academic department and the School of Graduate Studies to ensure normal progress toward the fulfillment of the stated requirements at levels of quality without warning or probation or extension of the allowable time limit for degree completion. Students whose quality point averages fall below minimum standards (3.00 for doctoral students; 2.75 for master’s) will automatically be placed on probation until the minimum standards are achieved. In addition, a student will be subject to separation from the university for any of the following reasons:

1. Failure to achieve a quality-point average of 2.50 or higher at the completion of 12 semester hours or 2 semesters of graduate study.
2. Failure to achieve a quality-point average of 2.75 or higher at the completion of 21 semester hours or 4 semesters of graduate study.
3. Failure to receive a grade of S in thesis research 651 or dissertation research 701/703. A student who receives a grade of U in thesis (Course 651) or dissertation research (Courses 701/703) will be placed on probation and be subject to separation. The probationary status will be recorded on the student’s transcript.
4. Failure of a conditionally or provisionally admitted student to satisfy the conditions or provisions stated in the letter of acceptance by the end of the first academic year (2 semesters) or after 18 credits of course work.
5. Failure to make progress towards degree completion. If the student is not making progress towards degree completion, and it has been judged that the student is unlikely to be successful in working independently and productively toward the completion of the thesis or dissertation research, the department and/or the Dean of Graduate Studies (in consultation with the department) can recommend academic separation.
6. In addition to disciplinary actions based on academic standards, on recommendation of the student’s department or school, the Dean of Graduate Studies can suspend or separate a student from the university for failure to maintain appropriate standards of conduct and integrity. Such a suspension or separation will be implemented only for serious breaches of conduct that threaten to compromise the standards of a department or create concern for the safety and welfare of others. In the event of such suspension or separation, the student will be entitled to an appeal through the grievance procedure of the Graduate School.

Maintenance of Quality-Point Average

In calculating the quality-point average, courses taken as a student in the School of Graduate Studies at the 400 level or above, as well as any courses accepted toward fulfillment of degree requirements for which quality points are given, will be counted, including courses which may need to be repeated. Unless otherwise stated by the department a minimum cumulative quality-point average of 2.75 is required for the award of the Master’s degree, and a minimum cumulative quality-point average of 3.00 is required for award of the doctoral degree. Any department, school, or curricular program committee may choose to establish quality standards higher than those stated above if such additional requirements are made known in writing to the students upon matriculation, and are recorded with the Dean of Graduate Studies. In that case, the departmental standards supersede the minimum standards. Students who do not maintain
the minimum quality point average will be placed on academic probation until the minimum standard has been achieved.

Residency Requirement

The doctoral residency requirement is intended to insure a period of intensive academic interaction with faculty and peers and of sustained independent research. Graduate students are considered to be in residence when they are fully engaged in academic work. As resident students they may teach at the university, take graduate courses, assist in course development, and engage in research or in other scholarly activities at the university. Regardless of the nature of the work, the student’s regular presence at the university is expected during fulfillment of the residency requirement.

The formal fulfillment of residency requires continuous registration in at least six consecutive academic terms (fall, spring and/or summer) from matriculation to a period not exceeding five years after the first credited hour(s) of dissertation research (701). The period while students are on a leave of absence do not count towards fulfilling the residency requirement. Within the context of continuity of registration, departments may enact other restrictions. In such instances, the departmental requirements take precedence and must formally be disclosed to the student at matriculation. This is meant to be a reflection of the appropriate reality that departments and fields have different norms and traditions of graduate study. For example, to fulfill the residency requirement, some departments may require the doctoral student to be registered for 9 or more semester hours of graduate credit in each of two consecutive semesters. Fulfillment of residency by all engineering Ph.D. candidates will be certified by their research Advisors and department chairs based on an assessment of active, concentrated involvement for a period of two consecutive semesters during their pursuit of the doctorate.

Time Limitation

All the requirements for the master’s degree must be completed within five consecutive calendar years after matriculation as a graduate student, including any leaves of absence. Doctoral students have five consecutive calendar years from the semester of the first credited 701 registration, including leaves of absence, to complete all requirements for the doctorate. Any graduate student who fails to complete the requirements within the five-year limit for his or her degree program will be subject to separation from further study unless granted an extension by the Dean of Graduate Studies with the recommendation of the faculty Advisor or advisory committee and approval by the department chair. An extension may be granted if the student and his or her advisor work out a plan of action for degree completion within a specified time frame which must be endorsed by the department chair. Students will be expected to meet all the specified deadlines outlined in the plan of action. The minimum acceptable registration during this extended period for each semester until graduation is three credit hours of 651 or 701, or, for Plan B Master’s students, an appropriate course.

Leave of Absence from Graduate Study

Students undertaking graduate work are expected to pursue their studies according to a systematic plan each year whether registered for full or part-time study. Occasionally a student finds it necessary to interrupt his or her studies before completion of the graduate program. A leave of absence is not to be requested unless the circumstances are such that the student cannot continue graduate study. Under such circumstances the student must request in writing a leave of absence for a period not to exceed two consecutive regular academic semesters. In exceptional circumstances, the leave can be extended for another two semesters. However, the maximum amount of leave permitted per graduate program is four semesters. The reason for the leave must be stated clearly, and the request must be submitted to the Dean of Graduate Studies with the written endorsement of the student’s academic department. During a leave of absence the student must not seek aid from faculty members or use of the facilities of the university. This means that students may not take exams or defend theses and dissertations while on a leave. A leave of absence does not extend the maximum time permitted for the completion of degree requirements, and a leave cannot be taken while students are on extension of the five-year limit. At the expiration of the leave the student must resume registration unless formally granted an extension of the leave. Retroactive leaves are not permitted. A student who fails to obtain a leave of absence, or who fails to register following an official leave, must petition the Dean of Graduate Studies for reinstatement in order to resume work as a student in good standing at the university.

A student who is granted a maternity or paternity leave of absence related to infant care, as well as those who must fulfill military duty obligations can petition to extend the five-year time limit associated with completion of the degree. The length of the extension may not exceed two years. International students must check with the Office of International Student Services before petitioning for a leave of absence, as such a leave can affect their visa status.

Withdrawal and Resignation

Students must maintain continuous registration throughout their degree programs unless granted an official leave of absence. Students who fail to register for any academic term will be automatically withdrawn from their programs. Students who are withdrawn from their programs must petition for reinstatement in order to continue graduate study. The petition must be approved by both the student’s department and the Dean of Graduate Studies before the student may register for further course work as a student in full standing. In each case of readmission with full standing, the official letter will state the terms of readmission, including future time limits for the degree program, and the past course work that will be credited toward the degree. If more than 24 months have elapsed since the last registration, students may have to resubmit file materials if requested by the School of Graduate Studies.

Transfer of Credit

Transfer of credit from another university toward master’s and doctoral degree requirements is awarded for appropriate course work (not applied to another degree program) taken prior to admission. Transfer of credit must be requested in the student’s first academic year, and must be appropriate for the student’s planned program of study. For master’s candidates, transferred credit is limited to six semester hours of graduate-level courses, and no credit for master’s thesis may be transferred from another university. No transfer of credit will be awarded towards the Ph.D. degree except by petition, and no credit for the doctoral dissertation may be transferred from another university.

Students who wish to receive credit for courses taken outside the university once they are enrolled must petition for approval. All transfer of credit requires approval from the student’s advisor, the departmental chair or graduate committee, and the Dean of Graduate Studies. Such courses must have been taken within five years of first matriculation at Case Western Reserve University and passed with grades of B or better. Seniors of exceptional ability in
the undergraduate programs of Case Western Reserve University who have the approval of the Dean of Undergraduate Studies and the Dean of Graduate Studies may apply to receive credit for graduate courses completed in excess of the undergraduate degree requirements.

Changes in Registration
To add or withdraw from courses or to change registration from credit to audit or the reverse, a student must obtain the appropriate official form to submit to the University Registrar in accordance with the dates published each academic term for such actions to be taken. Students must make appropriate changes to their schedules by the end of the first week of classes in order to avoid paying full tuition for courses withdrawn after the final drop/add date. Only complete withdrawal for the semester entitles a student to a percentage refund of the withdrawn courses after the final week of classes. (See the "Financial Information" section of the Bulletin under Refunds). Failure to attend class or merely giving notice to the instructor will not be regarded as official notice of withdrawal or change. When making changes in registration, the international student must be aware of maintaining full-time status. Full-time status requires registration for a minimum of 9 semester hours per semester. Students financed by federal loans must remain registered for at least 6 semester hours (defined as half-time) each semester to maintain continued eligibility for that funding or to initiate such a loan.

Graduation
A candidate for a degree awarded by the School of Graduate Studies must make application for the degree to the School of Graduate Studies by the deadline established for that semester, which is approximately twelve weeks before the commencement date for which the degree is expected to be awarded. Students are encouraged to contact the School of Graduate Studies at the beginning of the semester in which they intend to graduate to obtain a packet of graduation materials. The candidate must meet all the deadlines for completion of degree requirements set forth in the calendar. All candidates must be registered for credit and in good standing during the semester in which the degree is awarded. Payment of tuition, fees, and fines is a prerequisite to the award of a degree.

Delayed Graduation
It is a requirement of the School of Graduate Studies that a student be registered for credit in the semester in which he or she completes all the requirements to graduate in accordance with established deadlines for that semester. For a student engaged in thesis or dissertation research the completion of all requirements to graduate is not easily predicted, making it difficult to adhere to scheduled deadlines. If a student will not be able to meet the degree requirements to graduate in one semester, but will finish before the next semester begins, he or she can petition for a waiver of the requirement to be registered in the semester of graduation. To be granted a waiver of registration students must be registered for the appropriate thesis or dissertation credit hours in the semester (or summer session) immediately preceding the semester of graduation, complete all degree requirements, including a current application to graduate, and submit all required materials to the School of Graduate Studies by the last day scheduled for the Drop/Add period of the next semester.

A student who qualifies for the waiver will be awarded the degree at the next graduation without the need to be registered or to pay a special fee. If a student fails to meet the waiver deadline, he or she will be required to register for the appropriate thesis or dissertation credit hours in the next semester, and to reapply for graduation in that semester.

Exceptions to Regulations
Students have the right to petition for exceptions to these regulations. Such a petition should be addressed to the Dean of Graduate Studies. In most cases the student’s department or program committee must endorse the petition.

Graduate Student Grievance Procedure
It is the responsibility of the School of Graduate Studies to assure that all students enrolled for graduate credit at Case Western Reserve University have adequate access to faculty and administrative consideration of their grievances concerning academic issues. A three-step procedure has been established for graduate students to present complaints about academic actions they feel are unfair.

1. Students with complaints should first discuss their grievances with the person against whom the complaint is directed.
2. In those instances in which this discussion does not resolve a grievance to the student’s satisfaction, a complaint should be presented in writing to the Department Chairperson.
3. In the event that a decision still appears to the student, the student may bring the matter to the attention of the Dean of Graduate Studies. The Dean may ask the student to put the complaint in writing. The Dean will then discuss the case with the student and the Department Chairperson to evaluate the particulars and to make a ruling on it.

The Dean of Graduate Studies has the responsibility for the final decision, and the ruling from the Dean’s Office will be considered final and binding on the persons involved in the grievance. Additional information about the grievance procedure can be obtained from the School of Graduate Studies.

It should be understood that this grievance procedure relates solely to graduate student complaints concerning academic issues. The procedure for handling complaints about other matters is detailed in the University’s Students Services Guide.

Procedures and sanctions for graduate student academic infractions
Graduate students accused of violating the University’s standards of conduct, which are detailed in this Bulletin (See Student Affairs section), are entitled to adequate notice of all charges and to a fair hearing and may subsequently be subject to disciplinary action. The process that is outlined in the Bulletin apply to academic infractions, e.g., cheating on examinations, plagiarism, and other forms of dishonesty in academic activities. Additional information is available from the School of Graduate Studies.
Undergraduate Studies
programs offered by the faculties of the Case School of Engineering, the College of Arts and Sciences, the Frances Payne Bolton School of Nursing, the School of Medicine, and the Weatherhead School of Management. In addition, the University offers several baccalaureate programs jointly with the Cleveland Institute of Art, and the Cleveland Institute of Music.

The faculties and administration are dedicated to offering educational programs that enable undergraduates to achieve disciplinary literacy in one or more major fields, to acquire educational breadth through study across the natural sciences, humanities and arts, and social sciences, and to learn to think critically and to communicate effectively. Furthering the University mission, the educational programs aim to foster the development of qualities of integrity, creativity, leadership, and societal engagement.

The bachelor’s degree programs engage students in in-depth study in one field (the major), as well as general education or core requirements. Overlap among the general education and core curricula for the various bachelor’s degree programs allows students flexibility and choice in the choice of majors and degree program. Foundational courses and seminars introduce students to modes of inquiry, thought, and communication in the natural sciences, humanities and arts, and social sciences.

Freshman advisors, departmental advisors, other faculty, and deans assist students in selecting from approximately 60 alternative curricula and major concentrations a field of study suited to the students’ interests and qualifications. Highly motivated and responsible students whose educational and career goals are better served through an individualized course of study may pursue academic programs of their own design through a Dean’s Approved Major.

Students with broad educational interests and goals may pursue concurrently two or more majors for the Bachelor of Arts degree, or may earn two bachelor’s degrees, completing both a Bachelor of Arts degree and a Bachelor of Science degree, or fulfilling the requirements for two Bachelor of Science degrees. The Bachelor of Music degree may be combined with either a Bachelor of Arts or a Bachelor of Science degree. Qualified students who wish to accelerate their undergraduate and graduate or professional studies may earn the opportunity to begin in the senior year advanced study toward a graduate or professional degree.

Programs that allow for full-time work or off-campus study include the Cooperative Education Program, the Practicum Program, Junior Year Abroad, Washington Semester, and the Senior Year in Absentia privilege. In addition, the University participates with other colleges and universities in the Cleveland area in a Cross Registration Program that permits undergraduate students to take at other colleges and universities in the area courses that are not offered at their own institution.

Students are encouraged to engage in independent study, practica, and research. Individual departments offer independent study opportunities to motivated and qualified students; some departments offer courses which incorporate practical field experience or community service. The location of the University in University Circle, with its outstanding array of cultural, educational, and health care institutions, and the proximity and accessibility of the University’s various professional schools and their facilities enable undergraduates to draw upon diverse and distinctive resources to enrich their education.

Degree Programs
Case Western Reserve University offers a broad range of programs in the liberal arts and sciences, engineering, management, accountancy, and nursing leading to the Bachelor of Arts (B.A.), and the Bachelor of Science (B.S.) degrees. These programs provide depth through concentrated study in a major field and breadth through the fulfillment of general education or core curriculum requirements, and free electives.

The B.A. is available in more than 40 fields in the humanities and arts, the social and behavioral sciences, and the natural sciences and mathematics. In addition, B.S. programs are offered in accounting, computer science, the natural sciences, mathematics, statistics, art education, music education, management, nursing, and nutrition. The B.S. in Engineering is available in 13 major fields.

The Bachelor of Music (B.M.) degree is offered through the Joint Program in Music of Case Western Reserve University and the Cleveland Institute of Music. Students who are candidates for the B.M. enroll in the Cleveland Institute of Music.

Listed below are all the undergraduate degrees offered by the University.

Bachelor of Arts
Bachelor of Science in:
Accounting
Applied Mathematics
Art Education
Astronomy
Biochemistry
Biology
Chemistry
Computer Science
Geological Sciences
Management
Mathematics
Mathematics and Physics
Music Education
Nursing
Nutrition
Nutritional Biochemistry and Metabolism
Physics
Statistics

**Bachelor of Science in Engineering**

Major fields:
- Aerospace Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Engineering Physics
- Fluid and Thermal Engineering Sciences
- Materials Science and Engineering
- Mechanical Engineering
- Polymer Science and Engineering
- Systems and Control Engineering
- Engineering (undesignated)

With the exceptions of engineering physics and the undesignated major in engineering, all of the engineering programs listed above are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

**General Requirements for All Bachelor’s Degrees**

Every candidate for a baccalaureate degree from the University must:
1. Complete the English Composition Requirement, as described below. This is normally done in the first year.
2. As specified for the degree sought, complete a core curriculum or general education requirements which include courses to develop quantitative, analytical, and communication skills, and a heightened awareness of human values, cultures, and institutions.
3. Complete a course of studies with a cumulative grade point average of no less than 2.00 for work taken at Case Western Reserve University
4. Earn in residence at Case Western Reserve University a minimum of 60 semester hours, including at least 30 hours after achieving senior status.
5. Complete two semesters of physical education. This is normally done in the first year through a combination of half and/or full semester offerings in Lifetime Sports Activities.

**English Composition Requirement**

The English Composition Requirement, incorporated into the general education and core curricula for all baccalaureate degree programs, is normally completed in the first year of enrollment and must be met in one of the following ways:
1. Completion of ENGL 150, Expository Writing, with a grade of C or higher.
2. Achievement of a score of 4 or 5 on a the College Board Advanced Placement Examination in English Language/Composition.
3. For transfer students, acceptance of transfer credit for ENGL 150 and then, either passing the English placement examination, or completing ENGL 180, Writing Tutorial, with a grade of C or higher.
4. For students participating in the Seminar Approach to General Education and Scholarship (SAGES) pilot program, compilation of a portfolio of graded writing from the First Seminar and the University Seminars that meets the “C” competence level described below.

Students who fail ENGL 150 will be required to repeat the course. Students who pass ENGL 150 with a grade of D or SAGES students whose writing portfolios are below the “C” competence level will be required to complete ENGL 180. Writing Tutorial (1 credit) with a grade of C or higher. ENGL 180 may be taken up to three times to achieve a C performance in English composition. On the basis of admission records or on the basis of the English placement examination for transfer students, students may be placed in ENGL 148, Introduction to Composition. Students placed in ENGL 148 must complete ENGL 148 with a grade of C or better in order to enroll in ENGL 150. A maximum of three hours of credit for ENGL 148 will count toward the requirements for a bachelor’s degree.

**Definition of “C” Competence in English 150/English Composition.**

“C” competence means that the student has demonstrated in the course of writing 7,000 words (an equivalent of 28 typed, double-spaced pages) that he or she can consistently produce an original paper which has, prior to revisions suggested by the instructor, the following characteristics: (1) Mechanics-The “C” paper is neat and free of repeated errors in spelling, verb, and pronoun form, agreement, sentence completion, punctuation, and capitalization. (2) Organization-The “C” paper clearly states a reasonably limited thesis on a subject appropriate to the assignment and continues to focus on the idea with some supporting detail (footnoted where necessary) and with transitions between sections that are clear, though not necessarily smooth. (3) Style-The “C” paper is generally clear and moderately concise, even though the word choice may be narrow and the emphasis awkward.

**Physical Education Requirement**

Two semesters of non-credit courses in physical education are required as part of all undergraduate curricula. Normally this requirement will be satisfied in the freshman year and must be met by all undergraduate students unless waived by the chair of the Department of Physical Education or the Dean of Undergraduate Studies.

**SAGES Pilot Program**

A pilot program, the Seminar Approach to General Education and Scholarship (SAGES), beginning in fall 2002, enables some students to fulfill General Education or Core Curriculum Requirements with a sequence of specially developed seminars and a selection of courses. Students begin the program in the fall of the freshman year with the First Seminar: The Life of the Mind, that focuses on critical thinking and communication. In each subsequent semester of the first two years at the University, students participating in the pilot program enroll in two or three University Seminars in which specific topics selected by faculty become the focus for thinking about the natural world, or the symbolic world, or the social world. The First Seminar and each of the University Seminars incorporate the consideration of diversity, ethics, and information literacy. To fulfill the University’s English Composition Requirement, students in the SAGES pilot program submit portfolios of writing from the First Seminar and subsequent University Seminars. SAGES seminars and courses provide an alternate way to fulfill traditional general education and core requirements, as noted within the descriptions of the requirements for specific degrees. Additional components of the SAGES program for students pursuing degree programs in the College of Arts and Sciences include courses for educational breadth (two courses in each of three general areas - humanities and arts, natural sciences and mathematics, and social sciences) and a “senior capstone experience” culminating in a paper and presentation that incorporate acquired knowledge and demonstrate critical thinking and writing skills.
Major—program of ten or more courses (required)  
Minor—program of five or six courses (optional)  
Sequence—program of three, four, or five courses (required for degrees based on Engineering Core)

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<th>SUBJECT (DEGREE PROGRAM)</th>
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### Requirements for Specific Degrees

#### Bachelor of Arts Degree

**College of Arts and Sciences**

Candidates for the Bachelor of Arts degree, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:

1. A minimum of 120 semester hours earned.
   - a) No more than 42 hours beyond the 100 level in any one department may be applied to the 120 hour total.
   - b) The 120 semester hours must include at least 90 semester hours in arts and sciences. These credits may be drawn from those offered by the College of Arts and Sciences as well as those in economics, biochemistry, nutrition or computer science. (Students completing both a B.A. and B.S. degree are exempted from 6 hours of the 90 hour arts and sciences requirement for the B.A.)

2. The General Education Requirements of the College of Arts and Sciences or the SAGES pilot program.

3. A minimum of 30 semester hours of courses at the 300-400 level.

4. The requirements for a major as specified in this bulletin for each department or program. A major concentration requires a minimum of 30 semester hours, at least 24 of which are taken in the major department or program. For all courses taken in the major department and for which grades are averaged, and for all courses taken to satisfy major requirements and for which grades are averaged, a B.A. candidate must earn a minimum cumulative average of 2.00. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields. Transfer students must complete at Case Western Reserve University at least half the hours required for the major.

#### Major Concentrations Available for the B.A.

- American Studies*
- Anthropology
- Art History
- Asian Studies (including Asian language)
- Asian Studies (without Asian language)*
- Astronomy
- Biochemistry
- Biology
- Chemistry
- Classics (Greek/Latin)
- Communication Sciences
- Comparative Literature
- Computer Science
- Economics
- English
- Environmental Geology
- Environmental Studies*
- Evolutionary Biology
- French
- French Studies
- Geological Sciences
- German
- German Studies
- Gerontological Studies*
- History

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* = available only as 2nd major for B.A.

HA = Humanities and Arts

SS = Social Sciences

Foundation = for each degree/major a student must complete the foundation curriculum required for that degree/major

A&S = based on Arts & Sciences General Education Requirements

EC = based on Engineering Core (new in 1998)

WSOM = based on Weatherhead General Education Requirements

FPB = based on Nursing General Education Requirements
Bachelor of Science Degree

(College of Arts and Sciences)

Candidates for the Bachelor of Science degrees, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:

1. A minimum of 120-134 hours as specified by the requirements for each B.S. program.
2. A minimum of 30 semester hours of courses at the 300-400 level.
3. The Arts and Sciences General Education Requirements or the SAGES pilot program. For some B.S. programs, the Arts and Sciences General Education Requirements have been modified and incorporated into the degree requirements as presented in this bulletin in the section devoted to each department or program.
4. The requirements for a major field as presented in this bulletin in the section devoted to each department or program. For all courses taken in the major department and for which grades are averaged, and for all courses taken to satisfy major requirements and for which grades are averaged, a candidate for a B.S. from the College of Arts and Sciences must earn a minimum cumulative average of 2.00. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields. Transfer students must complete at Case Western Reserve University at least half the hours required for the major.

Bachelor of Science degrees conferred by the College of Arts and Sciences are offered in the following fields:

History and Philosophy of Science and Technology
International Studies
Japanese Studies
Mathematics
Music
Natural Sciences*
Nutrition
Nutritional Biochemistry and Metabolism
Philosophy
Physics
Political Science
Pre-Architecture*
Psychology
Religion
Sociology
Spanish
Statistics
Theater Arts
Women’s Studies*

*indicates may be taken only as a second major

Any student interested in developing for the B.A. a major of his or her own design may submit, before the end of the sophomore year, a program proposal to the Office of Undergraduate Studies for approval by the Deans’ Committee.

Arts and Sciences General Education Requirements

General Education Requirements of the College of Arts and Sciences provide a broad educational foundation for programs in humanities and arts, social and behavioral sciences, and mathematics and natural sciences, leading to the Bachelor of Arts or the Bachelor of Science degree. The areas in which courses are required are indicated below. In some areas students must complete an approved two-course sequence. Courses that are approved to serve as the first course in a sequence or to meet the requirement for a single course in a specific area are shown in boldface. This information is subject to addition. An updated list that includes such courses as well as the approved two-course sequences is published annually in the Handbook for Undergraduate Students, and is available from the Office of Undergraduate Studies.

1. The English Composition Requirement as described above.
2. Natural and Mathematical Sciences (12 semester hours total)

Students must complete at least three semester hours in area a) Mathematical Reasoning and Analysis, three semester hours in area b) Natural Sciences, and an additional course making an approved sequence in area a) or area b). The courses listed below fulfill the minimum three-hour requirement in each area, and also serve as first courses for two-course sequences. An updated list of approved two-course sequences is published annually in the Handbook for Undergraduate Students, and is available from the Office of Undergraduate Studies and on-line at http://www.cwru.edu/provost/ugstudies/undstud.htm.

An additional course taken to fulfill the 12 hour requirement may come from area a), b), or c) Science and Society.

a) Mathematical Reasoning and Analysis (3 semester hours minimum): courses in which students engage in step-by-step reasoning and computation using mathematical methods for discovery and for solving problems
MATH 121* or 123* or 125* or 150
STAT 201* or ANTH 319* or PSCL 282*
PHIL 201

* a student completing successfully any one of these three courses is not eligible to enroll in or receive degree credit for either of the other two

b) Natural Sciences (3 semester hours minimum) courses that survey the identification, description, experimental investigation, and theoretical examination of physical or biological phenomena
ANTH 105
ASTR 201 or 202 or 204 or 205 or 221
BIOL 114 or 214 or 216
CHEM 105 or CHEM 111
GEOL 101 or 110 or 115 or 117
PHYS 100 or 115* or 121* or 123*

* a student completing successfully any one of these three courses is not eligible to enroll in or receive degree credit for either of the other two

c) Science and Society (0-3 semester hours): courses that broadly examine the social/cultural aspects or implications of science and/or technology
ANTH 215, 317, 337, 363; PHIL/RLGN/BETH 271; BIOL 103; ENSC 340; ESTD 387; GEOL 105, 202; HIST 151, 152, 201, 202, 395; PHIL 225, 309; PHYS/POSC 196; RLGN 206, 240

Nutritional Biochemistry and Metabolism
Statistics

History and Philosophy of Science and Technology
International Studies
Japanese Studies
Mathematics
Music
Natural Sciences*
Nutrition
Nutritional Biochemistry and Metabolism
Philosophy
Physics
Political Science
Pre-Architecture*
Psychology
Religion
Sociology
Spanish
Statistics
Theater Arts
Women’s Studies*
3. Arts and Humanities (12 semester hours total) Students must complete at least three semester hours in each of the areas below, and an additional three-hour course making an approved sequence in one of the areas. The courses listed below fulfill the minimum three-hour requirement in each area, and also serve as first courses for two-course sequences. An updated list of approved two-course sequences is published annually in the Handbook for Undergraduate Students, and is available from the Office of Undergraduate Studies and on-line at http://www.cwru.edu/provost/ugstudies/undstud.htm.

a) The Arts (3 semester hours minimum): courses which serve as an introduction to art, music, and theater
- ARTH any 100 or 200 level course
- MUSC 221
- THTR 123 or 124; THTR 121 or 122

b) History, Philosophy, and Religion (3 semester hours minimum): courses that cover historical change, philosophical or religious ideas and works, and the methods and concepts of these disciplines
- AMST 117
- CLSC 111 or 112 or 201
- HSTY 112 or 113
- PHIL 101 or 205
- RLGN 102 or 115 or 201 or 202 or 203 or 204 or 207 or 208 or 223 or 254

c) Literature and Language (3 semester hours minimum): language courses beyond the first year level, and courses that serve as an introduction to important literary works and to the methods and concepts of literary study:
- CLSC 203 or 204
- CMPL 211 or 212
- or 290 or 291
- ENGL 200 or 255 or 256
- French Language—any 200 or higher level course in a foreign language
- GREK 201 or above except 395
- LATN 201 or above except 395

4. Social Sciences (9 semester hours) Students must complete three semester hours in each area listed below, and an additional three-hour course making an approved sequence in one of the areas. The courses listed below fulfill the minimum three-hour requirement in each area, and also serve as first courses for two-course sequences. An updated list of approved two-course sequences is published annually in the Handbook for Undergraduate Students, and is available from the Office of Undergraduate Studies and on-line at http://www.cwru.edu/provost/ugstudies/undstud.htm. Of the 9 hours, no more than 6 may be from a single department.

a) Social Institutions (3 semester hours minimum): courses that introduce students to the methods and concepts in the social sciences relevant to the understanding of organizational or societal functioning
- ANTH 102 or 103 or 107
- COSI 228
- ECON 102 or 103 or 205
- MUSC 241 (for Music Education majors only)
- POSC 109 or 260
- SOCI 113

b) Human Behavior and Development (3 semester hours minimum): courses that introduce students to the methods and concepts in the social sciences relevant to understanding individual or family functioning
- ANTH 102
- COSI 100
- or COSI 109

PSCL 101
SOCI 112B or 310

5. Global and Cultural Diversity (3 semester hours) From approved courses designed to develop students' awareness of their cultural assumptions and to expand their understanding of cultural issues, students must complete a three-hour course which focuses on a culture outside the United States and Europe or on ethnic or cultural differences and/or interactions within or outside the United States. ANTH 314, 322, 352, 353, 356, 357; ARTH 203; CMPL 215, 250, 275, 361; COSI 260; ECON 335, 375; ENGL 363H, 365E, 365N, 365Q, 366G; FRCH 375; HSTY 113, 135, 232, 258, 260, 261, 262, 268, 281, 282, 285, 321; MUSC 337, 338; PHIL 356; POSC 360D, 366, 370K, 374, 379; RLGN 204, 215, 217, 223, 254, 280, 303, 314; SOCI 302, 326; SPAN 303, 339, 342, 343; any 200 or 300 level course in Chinese, Japanese, or Russian

Restrictions/Exceptions
No more than three courses from any one department may be used for the satisfaction of the Arts and Sciences General Education Requirements, and no single course may fulfill more than one requirement.

Students completing more than one major, or completing a major and one or more minors, classified under different general headings (natural sciences and mathematics, arts and humanities, social sciences) are exempt from a maximum of six semester hours of arts and sciences general education requirements. Specifically, students who complete two majors are exempt from six hours of general education requirements in the area of one of the majors or from three hours of general education requirements in each of the areas of the two majors. Students completing a minor are exempted from six hours of general education requirements in the area of the minor.

Note: Students in the SAGES pilot program fulfill Arts and Sciences General Education Requirements by completing the following:
1. First semester: The Life of the Mind
2. Three University Seminars, one in each of the following categories: Thinking about the Natural World, Thinking about the Symbolic World, Thinking about the Social World
3. A writing portfolio of graded papers from the above seminars that demonstrates writing competency at the level established for the English Composition
4. Courses for disciplinary distribution (educational breadth), with two courses selected from each of the following general areas: Natural Sciences and Mathematics, Humanities and Arts, Social Sciences
5. A Senior Capstone project

Bachelor of Science in Engineering Degree
(Case School of Engineering)
Candidates for the Bachelor of Science in Engineering (B.S.E.) degree, in addition to meeting the general requirements for bachelor's degrees as described above, must also complete the following requirements:
1. A minimum of 129-135 hours as specified by the requirements for each B.S.E. program.
2. The Engineering Core Curriculum.
3. The requirements for the specific engineering major as presented in this bulletin in the section devoted to each department or program.
Major Fields Available for the B.S.E.
Bachelor of Science in Engineering degrees conferred by the Case School of Engineering are offered in the following fields:
- Aerospace Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Engineering Physics
- Fluid and Thermal Engineering
- Sciences
- Materials Science and Engineering
- Mechanical Engineering
- Polymer Science and Engineering
- Systems and Control Engineering
- Engineering (undesignated)

With the exceptions of engineering physics and the undesignated major in engineering, all of the engineering programs listed above are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Bachelor of Science in Computer Science Degree
(Case School of Engineering)
Candidates for the Bachelor of Science in Computer Science degree, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:
1. A minimum of 127 hours.
2. The Engineering Core Curriculum, with the exception of ENGR 200, ENGR 210 and ENGR 225
3. The requirements for the computer science major as presented in this bulletin.

Engineering Core Curriculum
The Engineering Core curriculum of the Case School of Engineering provides a foundation in mathematics and sciences for programs in engineering and in computer science leading to the Bachelor of Science degree. The Engineering Core Curriculum is also designed to develop communication skills and to provide a body of work in the humanities and social sciences.
1. The English Composition Requirement (3 semester hours) as described above.
2. Mathematics (14 semester hours):
   - MATH 121, 122, 223, Calculus for Science and Engineering I, II, III, or equivalent;
   - MATH 224, Elementary Differential Equations or equivalent or an approved course in Introduction to Dynamic Systems.
3. Chemistry (4 semester hours):
   - CHEM 111, Principles of Chemistry for Engineers
4. Physics (8 semester hours): PHYS 121, 122 General Physics I, II, or equivalent.
5. Engineering (18 semester hours):
   - ENGR 131, Elementary Computer Programming;
   - ENGR 145, Chemistry of Materials;
   - ENGR 200, Statics and Strength of Materials;
   - ENGR 210, Introduction to Circuits and Instrumentation;
   - ENGR 225, Thermodynamics, Fluid Mechanics, and Heat and Mass Transfer.

Note: the chemistry-materials course sequences CHEM 105-106-ENGR 145, CHEM 105-106-EMSE 201, or CHEM 105-106-EMAC 276 may substitute for the sequence CHEM 111-ENGR 145

6. Natural Science, Mathematics, or Statistics Requirement (3 semester hours) as designated by the major department
7. Humanities and Social Sciences: 21 semester hours (usually 7 courses) in the humanities and social sciences, including:
   a) ENGL 398N, Professional Communication for Engineers (3 hours)
   b) An approved sequence of 9 hours (three courses) in a single department or program in the humanities or social sciences
   c) A minimum of 6 hours (two courses) in the social sciences and 6 hours (two courses) in the humanities, not including the Professional Communications course.

For students who choose to complete a minor, up to 12 hours of these 21 hours, excluding ENGL 398N, may be used towards fulfillment of the minor requirements.

Two semesters of beginning work in a foreign language may be counted toward satisfaction of the requirement for a three-course sequence only when the sequence consists of three courses taken in a single foreign language. Credit for the first semester of beginning study (101 level) in a foreign language will not serve toward satisfaction of any degree requirement unless credit is earned for the second semester (level 102) as well.

Note: Studio courses in art and music cannot serve toward the satisfaction of the humanities and social science requirement unless they are part of a sequence. A sequence including such work will normally require more than the three courses that ordinarily serve for this purpose and will require the approval of the sequence advisor in advance.

Sequences have been classified as follows:
- Social and Behavioral Sciences: Anthropology, Communication Sciences, Economics, Gerontological Studies, Political Science, Psychology, and Sociology

For those humanities/social science sequences that are interdisciplinary (Artificial Intelligence, Environmental Studies, and Women’s Studies), the program advisor shall assign a program to one category or the other on the basis of its content.

Note: The seminars and writing portfolio of the SAGES pilot program provide an alternate way for students pursuing the Bachelor of Science in Computer Science or the Bachelor of Science in Engineering degree to fulfill the English Composition Requirement and to earn credit for two courses for the Humanities/Social Science Requirement of the Engineering Core.

Bachelor of Science in Nursing Degree
(Frances Payne Bolton School of Nursing)
Candidates for the Bachelor of Science in Nursing (B.S.N.) degree, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:
1. A minimum of 124 hours.
2. The School of Nursing General Education Requirements.
3. A minimum of 50 semester hours of courses at the 300-400 level.
4. For all courses taken in nursing and science, a minimum grade of C.
School of Nursing General Education Requirements

The General Education Requirements of the Frances Payne Bolton School of Nursing are based upon the Arts and Sciences General Education Requirements, and provide a broad educational foundation for the Bachelor of Science in Nursing program.

1. The English Composition Requirement (3 semester hours) as described above.

2. Natural and Mathematical Sciences (17 semester hours total)
   a) Mathematical Reasoning and Analysis: STAT 201*, Basic Statistics I or ANTH 319* or PSCL 282*.
      * a student completing successfully any one of these three courses is not eligible to enroll in or receive degree credit for either of the other two
   b) Natural Sciences: BIOL 114-Principles of Biology, BIOL 119-Molecular View of Biology and BIOL 121 Chemical Biology, BIOL 346-Human Anatomy

3. Arts and Humanities (12 semester hours total) The requirement is the same as the Arts and Humanities requirement of the Arts and Sciences General Education Requirements (above), except that the courses need not form a sequence; the courses should all be selected from courses designated as first courses for a sequence if a sequence cannot be completed.

4. Social Sciences -Human Behavior and Development (6 semester hours total)
   a) PSCL 101-General Psychology or ANTH 102-Being Human: An Introduction to Social and Cultural Anthropology or SOCI 112B-Introduction to Sociology: Human Interaction
   b) SOCI 203 or an approved course in human growth and development

1. Global and Cultural Diversity (3 semester hours) The requirement is the same as the Global and Cultural Diversity requirement of the Arts and Sciences General Education Requirements

Note: The SAGES pilot program provides an alternate way for B.S.N. students to fulfill certain School of Nursing General Education Requirements, including the English Composition Requirement and requirements in humanities and arts. For further information, consult the Handbook for Undergraduate Students.

Bachelor of Science Degree
(Weatherhead School of Management)

Candidates for the Bachelor of Science in Accounting and the Bachelor of Science in Management degrees, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:

1. A minimum of 122 hours.
2. The Weatherhead School of Management General Education Requirements.
3. A minimum of 30 semester hours of courses at the 300-400 level.
4. The requirements for a major field as presented in this bulletin in the section devoted to each department or program. For all courses taken in the major department and for which grades are averaged, and for all courses taken to satisfy major requirements and for which grades are averaged, a candidate for a B.S. from the Weatherhead School of Management must earn a minimum cumulative average of 2.00. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields. Transfer students must complete at Case Western Reserve University at least half the hours required for the major. Bachelor of Science degrees conferred by the Weatherhead School of Management are offered in the following fields:

Accounting
Management

Weatherhead School of Management General Education Requirements

The Weatherhead School of Management General Education Requirements are based upon the Arts and Science General Education Requirements, and provide a broad educational foundation for programs in accounting and management, leading to the Bachelor of Science degree.

1. The English Composition Requirement (3 semester hours) as described above.

2. Natural and Mathematical Sciences (for accounting, 17 semester hours total; for management, 20 semester hours total)
   In addition to the specified mathematics and statistics courses, students must complete at least one course in area b) Natural Science and an additional course from area b) or from area c) Science and Society.
   a) Mathematical Reasoning and Analysis: (11-14 semester hours) MATH 125-MATH 126 or equivalent courses in introductory calculus, and STAT 207-Statistics for Business and Management Science; management majors must also complete STAT 208
   b) Natural Sciences: (minimum 3 semester hours) See Arts and Sciences General Education Requirements
   c) Science and Society: (0-3 semester hours) See Arts and Sciences General Education Requirements
3. Arts and Humanities (for accounting, 9 semester hours total; for management, 12 semester hours total) The requirement is the same as the Arts and Humanities requirement of the Arts and Sciences General Education Requirements (above), except that accounting majors are exempt from the 3-hour arts requirement.
4. Social Sciences (for accounting, 12 semester hours total; for management, 9 semester hours total)
   a) Social Institutions: (6 semester hours): ECON 102-Principles of Microeconomics and ECON 103-Principles of Macroeconomics;
   b) Human Behavior and Development: (3-6 semester hours)
      For management majors, the requirement is the same as that of the Arts and Sciences General Education Requirements. Accounting majors must complete two courses in this area: 1) COSI 100 or COSI 236, and 2) PSCL 101 or SOCI 112
5. Global and Cultural Diversity (3 semester hours) The requirement is the same as the Global and Cultural Diversity requirement of the Arts and Sciences General Education Requirements

Note: The SAGES pilot program provides an alternate way for students pursuing the B.S. in management or in accounting to fulfill certain Weatherhead School of Management General Education Requirements, including the English Composition Requirement and requirements in sciences, humanities and arts. For further information, consult the Handbook for Undergraduate Students and/or the Undergraduate Services Office of the Weatherhead School of Management.

Dual Undergraduate Degree Programs

Undergraduates who wish to pursue study in two disciplines may combine degree programs. Possible combinations include:

1. Two different Bachelor of Science degrees. Examples of combinations are: computer engineering/electrical engineering, physics/music education, management/accounting
2. A Bachelor of Science degree and a Bachelor of Arts degree. Examples of combinations of majors are: computer science/English, chemical engineering/music, management/psychology
3. Either the B.A. or a B.S. and a Bachelor of Music (B.M.) degree offered in conjunction with the Cleveland Institute of Music.
To qualify for two degrees, students must meet the requirements of each degree, and complete a minimum of 30 semester hours of study beyond the requirement for one of the degrees. Such programs usually require a minimum of five years, but may be completed in four years by an unusually industrious and capable student.

Students completing both a B.A. and a B.S. degree are exempted from 6 hours of the 90 hour arts and sciences requirement for the B.A.

Students interested in pursuing any of the degree combinations listed above should consult the Office of Undergraduate Studies. Students who seek a dual degree program that involves the B.M. must meet admission requirements of the Cleveland Institute of Music.

**Minors**

For the degrees described above, minors are not required. However, students have the option of completing a minor in a discipline other than the major, in addition to the major. A minor concentration normally requires 15-18 semester hours, and will be indicated on a student’s transcript if the requirements, as outlined below, are fulfilled.

**Minors for Students Majoring in Fields other than Engineering**

1. A minor program shall consist of no fewer than 15 and no more than 18 semester hours of specified course work in a discipline other than the student’s major.
2. The responsibility for designating the requirements for a minor shall lie with the department offering the minor.
3. For all courses taken to satisfy minor requirements and for which grades are averaged, students pursuing degrees based on the General Education Requirements of the College of Arts and Sciences, the Weatherhead General Education Requirements, or the School of Nursing General Education Requirements must earn a minimum cumulative average of 2.00. Transfer students who wish to complete a minor must complete at Case Western Reserve University at least half the requirements for the minor.

**Minors for Engineering Majors**

An engineering student’s academic work in a discipline other than the student’s major may be recognized as a minor. A student will be entitled to have the minor designation recorded on his/her transcript upon successful completion of a basic academic program in a discipline not within the student’s major. The completion of a minor academic program does not relieve the student of any requirements for his/her major degree. The following rules govern the minor program for an engineering student:

1. A minor program shall consist of no fewer than 15 and no more than 18 semester hours of course work.
2. The responsibility for designating the requirements for a minor shall lie with the department offering the minor.
3. With the exception of the humanities and social science requirement stated in section 4 below, no more than two courses taken for the minor may be used simultaneously to satisfy the requirements of the student’s major field, including department requirements, technical electives, and the Engineering Core.
4. An engineering student who chooses to do so may, by taking work that goes beyond the requirement for a three-course sequence in the humanities or social sciences, complete a minor concentration in either of these areas, and count towards the minor up to 12 hours of humanities/social science courses that are also being counted towards the 21 hour humanities/social sciences requirement of the Engineering Core.

**Minor Concentrations**

Accounting
American Studies
Anthropology
Art History
Artificial Intelligence
Art Studio
Asian Studies
Astronomy
Biochemistry
Biology
Biomedical Engineering*
Chemical Engineering*
Chemistry
Childhood Studies
Chinese
Civil Engineering*
Classics (Greek/Latin)
Communication Sciences
Comparative Literature
Computer Engineering*
Computer Science (for B.A.)
Computer Science (for B.S.)*
Dance
Economics
Electrical Engineering*
Electronics (for B.A.)
English
Entrepreneurial Studies
Environmental Geology
Environmental Studies
French
French Studies
Geological Sciences
German
German Studies
Gerontological Studies
History
History of Technology and Science
International Studies
Japanese
Management Information and Decision Systems
Materials Science and Engineering*
Mathematics
Music
Natural Sciences
Nutrition
Philosophy
Photography
Physical Education
Physics
Political Science
Pre-Architecture
Psychology
Public Policy
Religion
Russian
Sociology
Spanish
Statistics
Systems and Control Engineering*
Theater Arts
Women’s Studies
* minor based on Engineering Core
Academic Advising

Academic advising is an important component of the educational program at Case Western Reserve University. Academic advisors assist students in the exploration of academic opportunities at the University, and in the selection of courses. Advisors may refer students to other sources of information and assistance at the University. Students are expected to initiate and maintain regular contact with their advisors to address the student’s curricular and career concerns, and to review progress towards graduation. Students are responsible for obtaining required permissions and approvals relating to registration, major and minor declaration, and graduation.

Freshman Advisors

All freshmen are assigned a faculty member or administrator who will assist them as they plan a course of study. Freshmen are encouraged to consult with their advisors about academic options, university rules and regulations, meeting effectively the challenges of college work, and study in graduate or professional school.

Departmental Advisors

Students are encouraged to select a major at the end of their freshman year. When formally declaring a major(and/or minor), a student will visit with the department chairperson or academic representative who will assign the student a faculty department advisor. Students with declared majors and minors should meet regularly with their department advisors to ensure that they are making satisfactory progress toward graduation and are being made aware of academic and professional opportunities in their field of study.

Advising in the Office of Undergraduate Studies

The deans in the Office of Undergraduate Studies are available to answer student and faculty questions about University rules, practices, programs, and resources and to meet with students who are interested in study abroad, accelerated undergraduate to graduate and professional school programs, academic awards, and fellowship and scholarship opportunities. All students who have not declared a major after the freshman year should consult with one of the deans for advising and schedule approval.

Pre-Professional and Special Program Advisors

Students planning to study at the graduate or professional school level or who are interested in special undergraduate programs at the University are urged to consult the appropriate advisor. Please refer to the Handbook for Undergraduate Students for the listing of pre-professional and special program advisors.

Academic Regulations

All academic regulations governing undergraduates are administered by the Office of Undergraduate Studies. Academic regulations are subject to change by action of the University Undergraduate Faculty and the various committees responsible for the oversight of curriculum and academic standing. For the latest information consult the student handbook.

When circumstances so warrant, a student may submit to the Office of Undergraduate Studies a petition to waive a specific regulation or requirement.

Academic Integrity

Students, faculty, and administrators share responsibility for the determination and preservation of standards of academic integrity. Not only must they adhere to their own personal codes of integrity but they must also be prepared to educate others about the importance of academic integrity, to take reasonable precaution to discourage violations of academic integrity, and to adjudicate violations.

For students, education about the importance of academic integrity begins during the admissions process. The centrality of integrity to the academic enterprise is reinforced during new student orientation when students engage in discussion about academic integrity. Specific mention of academic integrity and course-specific guidelines should be presented in all classes.

Programs and instruction about academic integrity guidelines also should be offered throughout the students’ undergraduate career.

Faculty and students are expected to uphold standards of academic integrity by taking reasonable precaution in the academic arena. Reasonable precaution involves implementing measures that reduce the opportunities for academic misconduct but do not inhibit inquiry, create disruption or distraction in the testing environment, or create an atmosphere of mistrust.

The vitality of academic integrity is dependent upon the willingness of community members to confront instances of suspected wrongdoing. Faculty have specific responsibility to address suspected or reported violations as indicated below. All other members of the academic community are expected to report directly and confidentially their suspicion of violation to a faculty member or a dean or to approach suspected violators and to remind them of their obligation to uphold standards of academic integrity.

Academic Integrity Violations

All forms of academic dishonesty including cheating, plagiarism, misrepresentation, and obstruction are violations of academic integrity standards. Cheating includes copying from another’s work, falsifying problem solutions or laboratory reports, or using unauthorized sources, notes or computer programs. Plagiarism includes the presentation, without proper attribution, of another’s words or ideas from printed or electronic sources. It is also plagiarism to submit, without the instructor’s consent, an assignment in one class previously submitted in another. Misrepresentation includes forgery of official academic documents, the presentation of altered or falsified documents or testimony to a university office or official, taking an exam for another student, or lying about personal circumstances to postpone tests or assignments.

Obstruction occurs when a student engages in unreasonable conduct that interferes with another’s ability to conduct scholarly activity. Destroying a student’s computer file, stealing a student’s notebook, and stealing a book on reserve in the library are examples of obstruction.

If a faculty member suspects that an undergraduate student has violated academic integrity standards, the faculty member shall advise the student and the departmental chair and consult with the Dean of Undergraduate Studies about the appropriate course of action. Before speaking with the student, the faculty member also may choose to consult with the chair or dean about academic integrity standards. If the faculty member, in consultation with the dean, determines that the evidence is not adequate to charge the student with a violation, the matter will be dropped. Otherwise, the following procedures will be followed:

First Violations. If the faculty member, the dean, and the student agree that a violation has occurred, and the violation is
determined to be a first violation (the university has no record of previous violations by the student of the university’s Standards of Conduct), the faculty member may choose to sanction the student with either failure in the work in question or failure in the course. In such cases, the faculty member will be provided with a standard reporting form to be signed by both the student and faculty member.

Alternately, the faculty and the dean will refer the case to the assistant vice president for student affairs for integrity board action if:

1. The student claims not to have violated academic integrity standards or the student disagrees with the sanction imposed by the professor.
2. The faculty member and the dean agree that the seriousness of the first offense warrants presentation to the academic integrity board.
3. The faculty member, after consultation with the dean, prefers to have the academic integrity board investigate or adjudicate the alleged violation, or prefers that the board sanction the student.

The signed report form from a faculty member or the finding of responsibility by the academic integrity board will become part of the student’s university judicial file. Students found responsible for a first violation will be required, in addition to any other sanctions imposed, to attend an ethics education program or to complete an ethics exercise as assigned by the dean of undergraduate studies or the assistant vice president for student affairs.

Subsequent violations. If the university judicial file indicates that the student suspected of a violation has been responsible for one or more previous violations of the university’s Standards of Conduct, the case will be referred to the assistant vice president for student affairs for academic integrity board action.

Misrepresentation and obstruction. Reports of suspected academic misrepresentation or obstruction occurring in settings other than the classroom will be referred to the assistant vice president for student affairs for academic integrity board action.

Academic Integrity Board/Adjudication

If a suspected or known violation of academic integrity standards warrants consideration by the academic integrity board, the assistant vice president for student affairs (or his or her designee) will convene the board. The board will be comprised of three students (voting members) appointed by the Undergraduate Student Government, two faculty (voting members) appointed by the Executive Committee of the Faculty Senate and two administrators (non-voting members). One administrator will be a dean from the office of undergraduate studies. The other administrator, the assistant vice president for student affairs or his or her designee, will chair the board. All members of the board may question witnesses. Academic integrity board procedure, the vote required for the determination of responsibility, and the evidence standard will be the same as those for the university judicial board.

Should the board find the student not responsible for a suspected violation, the faculty member and the student will be so notified. The faculty member will be asked to evaluate the student’s performance in the assignment in question and to issue a grade based on his or her normal grading practices.

If the board finds a student responsible for a violation of academic integrity standards, the board will notify the student and the faculty member. The board can sanction violations by issuing failure in the work in question, failure in the course, university disciplinary warning, university disciplinary probation, university disciplinary suspension, or expulsion.

In cases in which the academic integrity board finds a student responsible for a second or subsequent violation, the minimum sanction will be failure in the course; the maximum penalty will be expulsion.

If the academic integrity board finds a student responsible for misrepresentation or obstruction, the minimum sanction will be university disciplinary probation; the maximum penalty will be expulsion.

Suspected violations of academic integrity standards reported after a student voluntarily withdraws or is academically separated will be investigated and adjudicated. A student who withdraws or is academically separated during the investigation and adjudication of a suspected violation may be asked to appear at a hearing or, if the student fails to appear, have his or her case heard in absentia.

If the student is found responsible for a violation, sanctions can be imposed.

In the event that a suspected violation of academic integrity standards is reported after graduation, the assistant vice president for student affairs will make a determination as to the feasibility of investigation and adjudication. Graduation will not preempt investigation or adjudication of a suspected violation when those processes are feasible. If a student is found responsible for a violation and the sanction imposed makes the student ineligible to earn his or her degree, the degree may be revoked.

Violations of academic integrity standards are considered violations of the university’s Standards of Conduct and will be recorded in the student’s judicial record. University judicial files are maintained by the assistant vice president for student affairs in the office of student affairs.

In addition, the University is required to report to the funding agency the identity and misconduct of anyone, including a student, found guilty of falsification, fabrication or plagiarism in the performance of research that is receiving support from federal sources.

Application for Graduation

A student who has completed all graduation requirements in fewer than four years has the choice of graduating early or deferring graduation in order to graduate with his or her class. A student who completes all graduation requirements in four years or more must graduate at that time.

In addition, the student must have filed a formal application for the degree in the Office of Undergraduate Studies by October 10 for January graduation, by December 2 for May graduation, and by July 15 for August graduation; and the student must have discharged all financial obligations to the University.

Attendance

Students are expected to attend classes regularly. Each instructor keeps his or her own record of student absences and is free to determine the extent to which absences affect the final grades of students.

An instructor who feels a student is jeopardizing his or her class work by absences reports this to the Dean of Undergraduate Studies for such action as the dean considers appropriate. An instructor who judges a student’s absences from his or her class to be excessive may exclude the student from class and assign a grade of F. Instructors taking such action must notify the dean in writing.

Absences from hour examinations must be explained satisfactorily to the instructor of the course.

Audit

A student may audit a course with the dean’s or advisor’s approval and the consent of the instructor of the course. An auditor receives no credit for the course.
Registration in a course cannot be changed from audit to credit or the reverse after the end of the drop/add period. However, a student may take credit for a course he or she audited in an earlier semester. At the beginning of the course, the student and instructor should reach agreement regarding the requirements to be met for a grade of AD. The grade of AD is entered on the student’s transcript if approved by the instructor of the course. If the instructor does not approve the grade AD, the enrollment is not posted on the transcript.

Course Repetition

Any student who has received an F or W in a course specifically required for his or her curriculum must retake that course at the next regular opportunity unless the student has since passed the course by proficiency examination.

A student desiring the opportunity to repeat a course because of dissatisfaction with the quality of an earlier performance is eligible to do so, but must advise the Office of Undergraduate Studies of his/her intention by completing a Course Repetition Form. Upon completion of the repeated course for an evaluative grade A, B, C, D, or F, the grade received for the earlier enrollment will be replaced by the designation RPT and will no longer be computed in either the semester or cumulative grade point averages. The only grade posted and averaged for a course on the student record will be that resulting from the most recently completed enrollment in that course. This option may be exercised subject to the following conditions:

1. The repetition must occur within one calendar year of the previous enrollment or, for courses that are not offered annually, in the next semester in which the course is offered.
2. A student may not use the Pass/No Pass Option when repeating a course.
3. An academic action that occurred under the earlier grade is neither reversed nor removed from the record as a result of a change in the semester or cumulative averages that results from the repetition of one or more courses.
4. A student using the option must enroll for a minimum of 12 semester hours for which credit had not previously been earned. Students repeating courses previously passed may lose their eligibility to receive all forms of federal financial aid if they are not also enrolled in courses comprising 12 additional credit hours.

Credit by Examination

Advanced Placement/International Baccalaureate Examinations

Students may earn degree credit on the basis of advanced examinations taken while in secondary school; examinations eligible for credit and/or advanced placement include, but are not limited to: College Board Advanced Placement Examinations and International Baccalaureate Higher Level Examinations. Determination of the criteria for granting credit and/or placement is made by the appropriate department. In assigning credit or granting advanced placement for credentials from outside the United States, the University is guided by the placement recommendations and grade equivalencies approved by the National Council on the Evaluation of Foreign Educational Credentials.

Proficiency Examinations

Departments within each academic unit offering undergraduate programs may choose to offer students the opportunity to earn course credit in specific courses by proficiency examination. To qualify for proficiency examination credit for a course, the student’s examination performance must demonstrate knowledge and skills at a level no lower than that of an average student who successfully completes the course. Upon notification from the academic department, the Office of Undergraduate Studies will direct the Office of the Registrar to post credit for the course on the transcript. The grade will be recorded as PR, and will not be included in a student’s grade point average.

Any student who receives proficiency credit for a course through a proficiency examination administered during a semester when the student is not registered for a full-time schedule (12 or more semester hours) at Case Western Reserve University is charged a fee equal to one-third of the present tuition charge for the course. No fee is charged if the student does not receive credit from the examination.

Cross Registration

If approved by the Office of Undergraduate Studies, full-time undergraduates in good academic standing may cross-register through the Northeast Ohio Council on Higher Education (NEO CHE) program at Baldwin-Wallace College, the Cleveland Institute of Art, the Cleveland Institute of Music, Cleveland State University, Cuyahoga Community College, David Myers College, Hiram College, John Carroll University, Lake Erie College, Lakeland Community College, Lorain County Community College, Notre Dame College of Ohio, and Ursuline College for one course per semester. Approval is normally limited to courses that are not offered at Case Western Reserve University. Cross-registration is not available to seniors in the final semester before graduation. To cross-register at the Cleveland Institute of Art, a student must have permission from the University’s Director of Art Studios.

Final Examinations

Final examinations are normally required in all courses and must be given during the final examination period at the time assigned by the Registrar. Any exception must be approved by the Dean of Undergraduate Studies. No student will be required to take more than two final examinations on a single day. A student who has three final examinations scheduled for a single day will be assisted by the dean in arranging to take one of those examinations on an alternative day during the final examination period. Similarly, a student with conflicting examinations should seek the assistance of the Dean of Undergraduate Studies in arranging to have the time of one examination changed.

A student must explain immediately and in writing to the dean an absence from a final examination. If the explanation is acceptable, the dean will authorize the assignment of the grade Incomplete and the administration of a make-up examination by the instructor.

In the event of an unexcused absence from a final examination, a student should be assigned a final grade that assumes a grade of zero on the final examination and is otherwise consistent with the grading policy for the course.
Foreign Language and Mathematics Credit

Credit earned for the first semester of a beginning work (101 level) in a foreign language will not serve for satisfaction of any degree requirement until a student successfully completes the second semester (102 level) of such work.

No credit will be allowed to count towards degree requirements for foreign language or mathematics courses which duplicate work taken earlier in high school or in another institution.

Grading System
See section on Registration.
For freshman grading policy, see section on Academic Standing.

Incomplete Grade
Assignment of the Incomplete Grade
The Incomplete grade (I) is assigned by and at the discretion of the instructor when: a) there are extenuating circumstances, explained to the instructor before the assignment of the grade, which clearly justify an extension of time beyond the requirements established for and met by other students in the class, and b) the student has been passing the course and only a small segment of the course, such as a term paper, remains to be completed. It is the student's responsibility to notify the instructor of the circumstances preventing completion of all assigned work. In the absence of notification or adequate justification the instructor has the authority to assign the student a final grade that assumes a failing grade for the missing work. An Incomplete grade should not be assigned when: a) a student has been absent for much of the semester and/or has done little of the work required for a course, or b) because a student is absent from a final examination, unless the Dean of Undergraduate Studies has authorized the grade.

Changing the Incomplete Grade
The instructor shall submit to the Office of Undergraduate Studies for transmission to the Registrar a final evaluative grade to replace the Incomplete upon completion of the work outstanding by a date established for the student by the instructor. When a student fails to submit the work required for removing the Incomplete by the date established, the instructor shall submit to the Office of Undergraduate Studies for transmission to the Registrar a final grade that assumes a failing performance for the missing work. In the absence of the assignment of a grade by the instructor the Registrar will convert the I to F when the deadline for making up Incomplete grades from a previous semester has passed.

The amount of additional time allowed a student to make up incomplete work should serve to accommodate the student while being fair to other students in the course. It should be proportional to the duration of a student's illness or absence and might be no more than a few days or weeks. At the extreme, it should not extend past the eleventh week of the session following the one in which the Incomplete grade was received. In certain cases (such as students on probation) the dean may establish a date for completion of courses with Incomplete grades.

Pass/No Pass Option
Courses elected on a Pass/No Pass basis and completed with a grade of D or higher will be entered with a grade of P on a student's transcript. Courses taken Pass/No Pass and for which a grade of P is earned will be entered on the transcript with the letter grade NP. Courses completed with letter grade P under this option will be counted for credit toward the baccalaureate. Courses completed with the grade NP do not earn credit. Courses completed with grades P and NP are not included in computing the grade point average.

The Pass/No Pass option is subject to the following regulations:
1. The Pass/No Pass option is exercised during the last three days on which classes are scheduled.
2. It is available only during regular fall and spring semesters to full-time students who are in good standing.
3. It can be exercised for only one course during any semester.
4. It cannot be used for courses taken for satisfaction of core requirements.
5. It cannot be used for courses taken for the satisfaction of requirements of a major or minor concentration.
6. Courses offered only on a Pass/No Pass basis with the approval of the curriculum committee do not affect the student's use of the Pass/No Pass option.
7. Instructors are not notified of a student's use of this option.

They are required to submit evaluative grades for all students and these are converted to Pass/No Pass in the Registrar's Office. The meaning of the grades P and NP will be noted on the transcript.

Petitions
Petitions for exceptions to undergraduate academic rules must be submitted to the Office of Undergraduate Studies for consideration by the deans committee, the curriculum committee, or the committee on academic standing, as appropriate to the subject of the petition.

Promotion
The standards for promotion are:
• To the sophomore class, 27 hours completed
• To the junior class, 60 hours completed
• To the senior class, 90 hours completed

Reading Days
The last two weekdays preceding the start of the final examination period are set aside as Reading Days to be used by students for completing assignments and preparing for final examinations. These days are not to be used by faculty for scheduling examinations or other course activities that require the attendance of students. They can be used by faculty to schedule review sessions for which attendance is optional.

Readmission after Separation
See section on Academic Standing

Re-enrollment after Voluntary Withdrawal
Students who have voluntarily withdrawn from the University and have not taken courses elsewhere following their withdrawal may reenroll in any semester. Students who have taken courses elsewhere following withdrawal must provide official transcripts of their work with their request for re-enrollment. Upon re-enrollment following a voluntary withdrawal, students retain the hours earned and quality points for courses completed prior to withdrawal. In the first semester of re-enrollment, their academic status is the status in effect at the time of withdrawal, unless that status is changed by action of the Committee on Academic Standing.
Withdrawal from Courses

After consultation with a dean in the Office of Undergraduate Studies, a student may withdraw from a course no later than the end of the 11th week of the semester and receive a grade of W. After this date, a student who withdraws from a course normally will receive a grade of F. In unusual circumstances, the dean may permit a student to withdraw from a course after the final date and receive a W. A freshman who is subject to the freshman grading policy is not permitted to earn more than 15 semester hours as transient credit for work done at institutions outside the United States. Credit earned elsewhere after matriculation is not applied toward the 60 hour minimum required in residence. Work taken through the cross registration program (see below) is treated as transfer credit. Credit is not awarded for work done at an unaccredited institution in the United States except by proficiency examination in those departments offering that opportunity. The award of transfer credit for work done at institutions outside the United States is subject to departmental evaluation and to the recommendations of the National Council on the Evaluation of Foreign Credentials. A student dismissed for poor scholarship from any institution cannot receive credit by transfer for courses taken in the first two sessions after that dismissal without prior permission of the Dean of Undergraduate Studies. Grades for courses taken at other institutions will not be entered on the student’s record nor will they be computed in the student’s grade point average.

Academic Standing

Good Standing

The Freshman Year: For the first two semesters of full-time enrollment students who are beginning their college studies will earn credit and grades only for those courses completed with a grade of D or higher. Any courses for which a grade of F, W or NP is assigned will not be included in the computation of the grade point average and will not be posted on the official transcript. This grading policy is not available to part-time or transfer students and does not apply to the summer session. In order to maintain good standing a freshman must earn at Case Western Reserve a minimum of 9 hours and an average of 1.70 or higher in the first semester and a total of 21 hours with a cumulative average of 1.75 or higher by the end of the second semester of full-time enrollment. Thereafter: Following the freshman year grades of F will be posted on the transcript and will be used in the computation of the grade point average. Following the freshman year, the requirements for good standing are:

1. A semester grade point average of 1.75 or higher and
2. a cumulative grade point average as follows:
   a) for students with 22-40 hours earned, a cumulative grade point average of 1.80
   b) for students with 41-59 hours earned, a cumulative grade point average of 1.90
   c) for students with 60-89 hours earned, a cumulative grade point average of 1.95
   d) for students with 90 or more hours earned, a cumulative grade point average of 2.00

Students with incomplete grades may be placed on “probation (incomplete)” as described below. Part-time and transfer students will be subject to the cumulative average requirements that are consistent with their hours earned.

Probation

Students who, at the end of any semester, fail to maintain the standard of performance required for good standing as specified above will be placed on probation. Students placed on probation are ineligible to represent the University in intercollegiate activities and may not hold an elective or appointed office or committee chairship in any campus organization. There are two categories of probation:

1. Academic Probation: Students will be placed on academic probation for failure to achieve the standards of performance specified above. When placed on academic probation students will be required to meet a standard of improvement established for individual students by the colleges. They are normally eligible for a maximum of two consecutive semesters of probation for the purpose of restoring themselves to good standing. However, the second semester of probation will be granted only in those cases where during a first semester of
probation progress has been made toward achieving good standing.

2. Probation (Incomplete): A student will be placed on Probation (Incomplete) if he/she has incomplete grades which if converted to F’s would result in the student’s being placed on academic probation. Once the incompletes are converted to grades, the student shall be restored to good standing or placed on academic probation as determined by the semester and/or cumulative grade point average that results.

Separation
Students on academic probation who fail to meet the standard of improvement established by the colleges will be eligible to be separated from the colleges for at least two academic sessions, including the summer session.

A student is eligible for separation without a semester of probation for either of the following reasons:
1. the student’s semester grade point average is less than 1.00
2. the student has not earned more than a total of 18 credit hours in two consecutive semesters of enrollment for full-time study.

Ineligible to Register
Students on probation will be declared “ineligible to register” when they have Incomplete grades which if averaged as F make them eligible for separation. Such students will be required to finish the incomplete courses with grades that justify their retention before they will be allowed to continue in the colleges.

Restoration to Good Standing
Students will be restored to Good Standing at the end of their semester of academic probation if they have earned at least 12 hours of credit with a semester grade point average of 1.75 or higher and have attained the cumulative grade point average required for good standing (see above).

Readmission after Separation
Students separated for reasons of scholarship may petition the Office of Undergraduate Studies for readmission after two regular sessions have elapsed. In determining the period of separation, the summer session is considered a regular session.

Students readmitted after being separated for reasons of academic performance will retain earned credit only for those courses passed with a grade of C or better.

Readmitted students do not retain quality points earned before separation, and the cumulative grade point average will be computed solely on the basis of work completed following readmission.

Students readmitted after being separated must thereafter maintain good academic standing. A readmitted student who performs below the level required for good academic standing will be eligible for permanent separation from the University.

Students separated for reasons of academic performance may not offer for transfer credit work taken elsewhere during the two sessions after their dismissal unless such work has been specifically approved in advance by the Office of Undergraduate Studies.

Eligibility
Eligibility rules apply to all activities in which students represent the University in any way, official or otherwise. These include intercollegiate athletics, musical or dramatic clubs and performances, oratorical or debating teams, class offices, student government, committee memberships, and publication staffs. Students who are on probation for any reason are ineligible to participate in these activities.

Eligibility is based on full-time status (enrollment for 12 hours or more), and students carrying fewer than 12 semester hours are ineligible to participate in intercollegiate competitions. Eligibility is determined at the end of each session as of the last official date of that session.

Students must complete the work of the previous session with a 2.0 grade point average to be eligible for initiation into a social fraternity or sorority.

The dean or the appropriate committee may at any time declare as ineligible those students whose conduct, attendance, or academic standing is unsatisfactory, or whose participation in student activities is detrimental to their academic work.

Special Programs
Teacher Licensure
The undergraduate/graduate programs in art education and music education, and the graduate program in speech-language pathology meet the requirements for teacher licensure. For further information, see departmental information in this bulletin for art history and art, music, and communication sciences.

Ohio teacher licensure may be attained by those undergraduate students who complete the approved curriculum of the Case Western Reserve University/John Carroll University Joint Program in Teacher Licensure. Adolescence/Young Adult Teacher Licensure is available in Integrated Language Arts (English major), Integrated Social Studies (history major), Integrated Mathematics (mathematics major), Life Sciences (biology major), and Physical Sciences (chemistry or physics major). Multi-age licensure is available in French. The program requires 36 credit hours in professional education: 12 taken at Case Western Reserve University and 24 taken at John Carroll University. For program details, see section on Education in this bulletin.

Independent Study
Most departments offer courses in independent study to their qualified majors. These are at an advanced level and require departmental approval.

Departmental Honors Programs
A number of departments offer outstanding upperclassmen the opportunity to follow an honors program by pursuing independent research and special study in seminars. Those who qualify receive the bachelor’s degree “with departmental honors.”

Minority Engineers Industrial Opportunity Program (MEIOP)
The Case Minority Engineers Industrial Opportunity Program (MEIOP) is part of a national effort to increase the number of minority engineers. The program provides supplementary academic preparation, laboratory experience, and career exploration for talented minority students enrolled in secondary school (grades 9 -12) or at the University. For this program, minority students are defined as Native Americans (American Indians), African Americans, and Hispanics-those minority groups underrepresented in engineering. Minority students enrolled in the 8th through the 11th grades who have strong academic records and a genuine interest in engineering are eligible for participation in the MEIOP early exposure and pre-college programs. Any minority student pursuing an engineering degree may apply for admission to the undergraduate phase of MEIOP. Selected undergraduate participants may qualify for summer employment with industrial firms which sponsor MEIOP. For further informa-
tion, see the Student Affairs section of this bulletin, or write or call the Office of Multicultural Affairs, 116 Baker Building, (216) 368-2904.

The Binary (3-2) Program

Superior students who begin their academic careers at liberal arts colleges and fulfill the required mathematics and science courses may apply for admission to the Binary (3-2) Program. The Binary (3-2) Program assures liberal arts students a smooth transition into engineering programs and selected science programs (astronomy and biochemistry) at Case Western Reserve University. The combination of a liberal arts education—mathematics, science, humanities, and social science—followed by a professional orientation in engineering gives the binary student a unique preparation for a career.

Binary applications should be submitted during the junior year. Binary students enter Case Western Reserve University at the end of their junior year as third-year engineering students. After completing the engineering degree requirements, the students are awarded a baccalaureate degree from their liberal arts college and a Bachelor of Science in Engineering from Case Western Reserve University. This dual-degree program normally requires three years of study at the liberal arts college and two years at Case Western Reserve University.

Academic Guidelines

Binary students normally complete 90 semester hours or 135 quarter credit hours in the first three years at a liberal arts institution.

Specifically, these courses should include the following:

1. Mathematics: Courses equivalent to two years of mathematics, i.e., MATH 121, 122, Calculus for Science and Engineering I, II; MATH 223, Calculus for Science and Engineering III; and MATH 224, Elementary Differential Equations.

2. Physics: Courses equivalent to one and one half years of physics, i.e., PHYS 121, Mechanics, with laboratory; and PHYS 122, Electricity and Magnetism, with laboratory.

3. Chemistry: Courses equivalent to one year of chemistry, i.e., CHEM 105, 106 States of Matter, Atomic and Molecular Structure, Thermodynamic Equilibrium and Kinetics.

4. Computer Programming: Courses covering subjects of elementary programming with a laboratory for the development of programming skills in C++ (ENGR 131).

5. Natural Science, Mathematics, or Statistics course, as designated by major department for major student intends to pursue at Case Western Reserve University.

6. Humanities and Social Sciences: Binary students are required to fulfill the humanities/social science requirements of their liberal arts college, which must total at least 21 semester hours.

7. English Composition: Binary students who have met the English composition requirement of their college are exempt from the ENGL 150 competency requirement.

8. Physical Education: Binary students who have met the physical education requirement of their college are exempt from the Case Western Reserve physical education requirement.

Students may complete courses in one of the basic engineering science areas that will provide background to their studies at Case Western Reserve University. These courses should have the approval of the liaison officer and the director of the Binary Program.

Students who satisfactorily complete three years at the liberal arts institution with an overall 3.00/4.00 average, a 3.00/4.00 in mathematics and science courses, and who are recommended by their liaison officer will be admitted to the third year of the appropriate curriculum and can expect to complete their degree work in approximately two years.

Participating Colleges

Colleges and universities participating in the Binary Program in Engineering with Case Western Reserve University are:

- Albion College, Albion, Michigan
- Allegheny College, Meadville, Pennsylvania
- Baldwin-Wallace College, Berea, Ohio
- Bates College, Lewiston, Maine
- Bethany College, Bethany, West Virginia
- Bethel College, St. Paul, Minnesota
- Capital University, Columbus, Ohio
- Carthage College, Kenosha, Wisconsin
- Centenary College of Louisiana, Shreveport, Louisiana
- Clarion University, Clarion, Pennsylvania
- Colby College, Waterville, Maine
- College of Charleston, Charleston, South Carolina
- College of William and Mary, Williamsburg, Virginia
- College of Wooster, Wooster, Ohio
- Denison University, Granville, Ohio
- DePauw University, Greencastle, Indiana
- Dickinson College, Carlisle, Pennsylvania
- Duquesne University, Pittsburgh, Pennsylvania
- Earlham College, Richmond, Indiana
- Edinboro University, Edinboro, Pennsylvania
- Fordham University, Bronx, New York
- Franklin and Marshall College, Lancaster, Pennsylvania
- Goshen College, Goshen, Indiana
- Heidelberg College, Tiffin, Ohio
- Hiram College, Hiram, Ohio
- Hope College, Holland, Michigan
- Illinois Wesleyan University, Bloomington, Illinois
- John Carroll University, University Heights, Ohio
- Kenyon College, Gambier, Ohio
- Lebanon Valley College, Annville, Pennsylvania
- Marietta College, Marietta, Ohio
- Miami University, Oxford, Ohio
- Monmouth College, Monmouth, Illinois
- Muskingum College, New Concord, Ohio
- North Park College, Chicago, Illinois
- Notre Dame College, South Euclid, Ohio
- Oberlin College, Oberlin, Ohio
- Ohio Wesleyan University, Delaware, Ohio
- Otterbein College, Westerville, Ohio
- Rollins College, Winter Park, Florida
- State University of New York, Brockport, New York
- State University of New York, Cortland, New York
- State University of New York, Fredonia, New York
- State University of New York, Geneseo, New York
- Suffolk University, Boston, Massachusetts
- Texas Wesleyan College, Fort Worth, Texas
- Thiel College, Greenville, Pennsylvania
- Universidad Catolica De Puerto Rico, Ponce, Puerto Rico
- Washington and Jefferson College, Washington, Pennsylvania
- Waynesburg College, Waynesburg, Pennsylvania
- Western Illinois University, Macomb, Illinois
- Westminster College, New Wilmington, Pennsylvania
- Wheaton College, Wheaton, Illinois
- Wheeling College, Wheeling, West Virginia
- Whittier College, Whittier, California
- Wittenberg University, Springfield, Ohio
Programs Allowing Acceleration toward Professional Degrees

Senior Year in Professional Studies at Case Western Reserve University

B.A. candidates of superior ability and attainment who are admitted to professional studies in Case Western Reserve University by the end of the junior year are able to shorten their entire course of studies by one year through the senior year in professional studies privilege. Application should be made during the second semester of the junior year through the student’s undergraduate dean. The senior year in professional studies privilege is extended to students who attend the School of Dentistry, the School of Medicine, the Frances Payne Bolton School of Nursing, or the Mandel School of Applied Social Sciences of Case Western Reserve University.

A student granted the senior year in professional studies privilege is permitted to substitute the work of the first year in a professional school for that required during the last year in the undergraduate college. Upon the satisfactory completion of the first year’s work in the professional school, the student will be granted the B.A. To be eligible for the senior year in professional studies privilege, a student must:

1. Be accepted for admission to professional studies in Case Western Reserve University.
2. Meet the following degree requirements:
   a. Completion of the Arts and Sciences General Education Requirements and two semesters of physical education, unless excused from the latter.
   b. Completion of three-fourths of the requirements for the major, including three-fourths of the courses required in the major department.
   c. Completion of 84 hours of arts and sciences courses. These credits may be drawn from those offered by the College of Arts and Sciences as well as those in economics, biochemistry, nutrition or computer science.

In addition to meeting all requirements listed above, students qualifying for the senior year in professional studies privilege must have completed at least 90 semester hours of academic credit, of which the final 60 hours must have been in residence. A student may include in that final 60 hours no more than six semester hours earned in courses completed in other institutions, either by cross registration in regular sessions or by approved transient registration in summer sessions.

Senior Year in absentia Privilege for Students of Medicine and Dentistry

B.A. candidates of superior ability and attainment who are admitted to a medical or dental school other than Case Western Reserve University’s at the end of the junior year of studies are offered an opportunity to shorten the entire course by one year through the senior year in absentia privilege. Applications should be made during the second semester of the junior year through the student’s undergraduate dean. The senior year in absentia privilege is extended to students who attend medical schools in the United States and Canada approved by the American Association of Medical Schools or dental schools in the United States approved by the American Dental Association. (Students desiring such acceleration through enrollment at Case Western Reserve University’s Schools of Dentistry or Medicine should see the regulations pertaining to the Senior Year in Professional Studies).

A student granted the senior year in absentia privilege is permitted to substitute the work of the first year of the professional school for that required during the last year in the undergraduate college. Upon the satisfactory completion of the first year’s work in the professional school, the student will be granted the B.A. To be eligible for the senior year in absentia privilege, a student must:

1. Attain a cumulative grade point average of at least 3.20 in all courses attempted from the date of admission as an undergraduate.
2. Meet the following degree requirements:
   a. Completion of the Arts and Sciences General Education Requirements and two semesters of physical education, unless excused from the latter.
   b. Completion of three-fourths of the courses required for the major, including three-fourths of the courses required in the major department.
   c. Completion of 84 hours of arts and sciences courses. These credits may be drawn from those offered by the College of Arts and Sciences as well as those in economics, biochemistry, nutrition or computer science.

In addition to meeting all requirements listed above, students qualifying for the senior year in absentia privilege must have completed at least 90 semester hours of academic credit, of which the final 60 hours must have been in residence. A student may include in that final 60 hours no more than six semester hours earned in courses completed in other institutions, either by cross registration in regular sessions or by approved transient registration in summer sessions.

For Candidates for the B.S. in Accounting

There are two programs which integrate graduate and undergraduate work in accountancy. These programs are strongly recommended for those individuals planning to become certified accounting professionals, particularly as CPAs (Certified Public Accountants).

Joint B.S. in Accounting/Master of Accountancy (M.Acc.)

This program allows students to begin graduate course work while studying for the award of their undergraduate accounting degree. Undergraduate accounting majors accepted for this opportunity will be permitted to enroll for 6 credit hours of Weatherhead School graduate courses during the senior year. These hours will also be part of the undergraduate business elective requirements. These hours of credit will count toward the satisfaction of the M.Acc. degree program requirements, reducing the graduate program requirements from 36 to 30 hours. Before taking graduate course work, the student must have completed all prerequisites for the course on the undergraduate level and have a “B” average in those prerequisites. Students will complete and be awarded their Bachelor of Science in Accounting degree prior to enrolling in the Master of Accountancy program.

Accelerated B.S. in Accounting/Master of Accountancy (M.Acc.) Program

This program allows motivated students to accelerate their pursuit of both the B.S. and M.Acc. degrees. In addition to applying six credit hours of Weatherhead graduate course work towards their undergraduate degree program, students in this program may begin taking more graduate course work before completing all of their undergraduate degree requirements. To enroll in this program, students must have:

1. Completed 90 hours of undergraduate course work
2. Completed all of the undergraduate Weatherhead General Education Requirements
3. Completed 36 hours of the Weatherhead Management requirements (including 18 hours of the required Accountancy course work)
4. Achieved at least a 3.0 overall GPA

Students in this program will receive both the B.S and the Master’s degree at the end of the program. For the first eight semesters of study, the student will register as undergraduates in Case Western Reserve University; thereafter, students will register in the graduate professional degree program in the Weatherhead School of Management.

Programs Allowing Acceleration toward Graduate Study

Integrated Graduate Studies Program
The Integrated Graduate Studies (IGS) Program is intended for highly-motivated candidates for the B.A. whose objective is a degree at the master’s or doctor’s level. By closely integrating undergraduate and graduate studies, qualified students begin a program of graduate study in their senior year leading to the simultaneous completion of requirements for both the master’s and bachelor’s degrees, each within its specified framework.

Any department, division, or interdepartmental committee that offers a graduate program may, with the approval of the Dean of Graduate Studies, participate in the IGS Program.

A student desiring this opportunity will normally apply for admission to PHASE I of the program in the sophomore year.

PHASE I: Admission to the program is chiefly determined by the estimate of a student’s talents, motivation, and potential for graduate study and independent work. Students may apply for admission to Phase I of the IGS Program through their major department during the second semester of the sophomore year. Contingent upon their completion of 54 semester hours of study, students are admitted to Phase I at the beginning of the junior year on recommendation of the department, division, or interdepartmental committee to which they have applied. During the junior year, IGS students will take between four and six courses in the major field, as advised by their department, to prepare them for the work of Phase II. Students seeking admission to Phase I will be informed by their departments if their admission requirements differ from those specified here.

PHASE II: Admission to graduate study is facilitated by, but not dependent upon, participation in Phase I. On completion of no fewer than 90 semester hours (ordinarily at the end of the junior year), students may be accepted for admission to the School of Graduate Studies. Transfer students are subject to the College of Arts and Sciences residence regulations and must have completed at least 60 semester hours, including the last 30, in residence.

Admission to the graduate school will be approved if the student has met the criteria above, has completed all requirements for the bachelor’s degree except total number of hours, has completed three-fourths of the hours required for the major, and has completed the Arts and Sciences General Education Requirements, and two semesters of physical education, unless excused from the latter. In addition, the student must be recommended by the department, division, or interdepartmental committee to which he or she seeks admission.

Upon admission to the School of Graduate Studies, a student will begin a program of study leading to the master’s or doctor’s degree as approved by his or her department or committee and by the Dean of Graduate Studies.

The bachelor’s degree normally will be awarded at the commencement immediately following satisfactory completion of the year of graduate study and attainment of a total of 120 semester hours of credit. Participants in Integrated Graduate Studies are exempt from the Bachelor of Arts degree limit of 42 hours above 100 level in a single department. The master’s or doctor’s degree will be awarded upon satisfactory completion of the requirements for these degrees. In some instances, the bachelor’s and master’s degrees may be awarded simultaneously. The completion of the master’s degree, however, may require an additional semester or summer of course work.

For Candidates for the B.S. in Nutrition
Integrated B.S./M.S. in Nutrition
Admission to the Integrated B.S./M.S. in Nutrition program is subject to the same process and requirements as admission to the Integrated Graduate Studies Program described above. Upon successful completion of the program, students earn the B.S. degree in Nutrition and the M.S. in Nutrition.

For Candidates for the B.S. in Engineering, Computer Science, Mathematics, Natural Sciences, and Statistics
B.S./M.S. Program
The Integrated B.S./M.S. Program is intended for highly-motivated candidates for the B.S. whose objective is a degree at the master’s or doctor’s level. Application to the B.S./M.S. program must be made after completion of 75 semester hours of course work and prior to attaining senior status (completion of 90 semester hours). Generally, this means that a student will submit the application during his/her sixth semester of undergraduate course enrollment and will have no more than two semesters of remaining B.S. requirements to complete. Applicants in engineering or computer science should consult the Associate Dean in the College of Engineering. Applicants in mathematics, natural sciences, or statistics should consult the Dean of Undergraduate Studies.

A student admitted to the program may, in the senior year, take up to nine hours of graduate courses that will count towards both B.S. and M.S. requirements. The courses to be double-counted must be specified on the student’s M.S. Program of Study. Students for whom the master’s project or thesis is a continuation and development of the senior project should register for Exxx 651 Thesis (or the appropriate project course) during the senior year and are expected to complete all other courses for the B.S. before enrolling in further M.S. course work and thesis (continuing the senior project). Students for whom the master’s thesis or project is distinct from the senior project will be expected to complete the B.S. degree before taking further graduate courses for the master’s degree.

Programs Allowing Entering Students Conditionally Guaranteed Admission to the University’s Professional Schools
The Pre-Professional Scholars Programs in medicine, dentistry, law, and social work grant to a few outstanding entering freshmen conditional commitments of admission to the appropriate professional school at Case Western Reserve University. These commitments are honored upon successful completion of the requirements established by each professional school. Students admitted to these programs are relieved of much of the anxiety and uncertainty associated with pre-professional studies. Consequently, they feel free to undertake challenging courses of study and pursue a variety of interests as they prepare for professional studies. Pre-Professional Scholars are free to choose any of the bachelor’s degrees available in the University. Participants who wish to change their career goals or apply for admission to other professional schools are free to do so. Students enrolled in the Engineering Core curriculum may have less flexibility in arranging........
to take some undergraduate courses identified as desirable by the professional schools.

The Six-Year Dental Program gives exceptionally able and committed entering freshmen the opportunity to accelerate their undergraduate and professional studies.

The Early Admission Decision Program in Law gives outstanding students who have completed two years of undergraduate study a conditional commitment of admission to the School of Law. The commitment is honored upon successful completion of the requirements established by the School of Law.

**Dentistry**

**Pre-Professional Scholars Program in Dentistry**

Each year, as many as 10 exceptionally well-qualified high school seniors who plan to pursue careers in dentistry are offered places in the Pre-Professional Scholars Program in Dentistry. This program requires eight years: four years of successful study in the University and four years at the School of Dentistry.

Pre-Professional Scholars in Dentistry are free to choose a major in an area of interest in the humanities, social sciences, or natural sciences, but must take the following courses to fulfill admission requirements of the School of Dentistry:

2. Biology: BIOL 214, Genes and Evolution; BIOL 215, Cells and Proteins; and BIOL 216, Organisms and Ecosystems.
3. Mathematics: MATH 125, Mathematics I.

They are required to take the Dental Admission Test in the junior year and achieve an acceptable level of performance on the test. Successful progress through the program and admission to dental studies will be based on the pre-professional student’s continuing to fulfill expectations for outstanding personal and academic development and on the student’s achievement of cumulative grade point average of 3.0 or higher for his or her work overall, as well as for his or her work in the required sciences. Successful progress in the program will be determined individually and reviewed at regular intervals during the student’s undergraduate career.

Pre-Professional Scholars in Dentistry who wish to accelerate their program may apply for the senior year in professional studies privilege.

**Six-Year Dental Program**

Each year a few exceptionally well qualified high school seniors who plan to pursue careers in dentistry are offered places in the Six-Year Dental Program.

The first two years of the program are spent in undergraduate studies. Students are required to earn a minimum of 60 semester hours. They are required to take all of the science and mathematics courses listed above for the Pre-Professional Scholars Program in Dentistry. If Advanced Placement credit is used to satisfy some of these science requirements, a minimum of 30 semester hours in biology, chemistry, physics, and mathematics must be taken during the two years of undergraduate study. Additionally, students must take one year of physical education, ENGL 150, and, from the Arts and Sciences General Education Requirements, two courses in the area of Arts and Humanities, two courses in the area of Social Sciences, and one further course in either of the latter areas or in Global and Cultural Diversity.

To qualify for the place reserved in the School of Dentistry, a student in the program must achieve the following:

1. A cumulative grade point average of 3.00 or higher for all course work completed.
2. Grades of B or higher in the required courses in biology, chemistry, physics, and mathematics.
3. An average score of 16 or higher on both the academic and PAT portions of the Dental Admission Test of the American Dental Association. The test must be taken no later than April of the second year.

**Law**

**Pre-Professional Scholars Program in Law**

Each year, as many as 12 exceptionally well-qualified high school seniors who plan to pursue careers in law will be offered places in the Pre-Professional Scholars Program in Law at Case Western Reserve University. Pre-Professional Scholars receive a conditional commitment of admission to the Case Western Reserve University School of Law, to be honored upon completion of the bachelor’s degree at the University. The Pre-Professional Scholars in Law are encouraged to gain a wide cultural experience in college, to major in the area that most interests them and to choose courses in which they will learn habits of rigor and logical analysis. The School of Law recommends that Pre-Professional Scholars in Law take courses in accounting, economics, history, and philosophy and that they gain as much writing experience as possible, because the ability to write effectively is critical to success in law school and legal practice.

Students admitted to the Pre-Professional Scholars Program in Law will be guaranteed a seat in the School of Law upon graduation from Case Western Reserve University if they satisfy the following requirements:

1. Graduation from Case Western Reserve University with rank in the top quarter of the class.
2. Demonstration of good moral character sufficient for admission to the bar of the State of Ohio.
3. Participation in the Law School Data Assembly Service and an LSAT score at or above the 65th percentile.

**Medicine**

**Pre-Professional Scholars Program in Medicine**

Each year, as many as 25 exceptionally well-qualified high school seniors who plan to pursue careers in medicine are offered places in the Pre-Professional Scholars Program in Medicine. Pre-Professional Scholars receive a conditional commitment of admission to the Case Western Reserve University School of Medicine to be honored upon successful progress toward and completion of the bachelor’s degree. The Pre-Professional Scholars Program in Medicine requires eight years: four years of successful undergraduate study leading to the bachelor’s degree followed by four years at the School of Medicine.

Pre-Professional Scholars in Medicine are free to choose from among all of the degree and major programs offered in the University, but must take the following courses to fulfill admission requirements of the School of Medicine:

2. Biology: BIOL 214, Genes and Evolution; BIOL 215, Cells and Proteins; and BIOL 216, Organisms and Ecosystems.
3. Mathematics: MATH 125, Mathematics I.

Pre-Professional Scholars in Medicine are not required to take the Medical College Admission Test (MCAT) for the program.
However, if they do take the MCAT, they are expected to earn 32 or higher on the exam. Program participants who have an interest in applying to any other medical schools, or who wish to be considered for a dean’s merit scholarship at the Case Western Reserve School of Medicine, should plan on taking this test.

Pre-Professional Scholars are expected to demonstrate successful progress by meeting the following levels of performance:

1. By the end of the fourth semester, Pre-Professional Scholars in Medicine are expected to attain a cumulative overall grade point average of 3.60, and to maintain that average for the rest of their undergraduate studies.

2. Pre-Professional Scholars in Medicine are expected to earn grades of B or higher in all required courses in chemistry, biology, physics, and mathematics. By the end of the fourth semester, they should attain a cumulative grade point average of 3.60 for these courses, and should maintain this average for the rest of their undergraduate studies.

3. Pre-Professional Scholars in Medicine are expected to continue to fulfill expectations for outstanding personal development. Progress is reviewed with each student at regular intervals in the program. At the end of the third year, Pre-Professional Scholars in Medicine who have met the required levels of performance go through the normal admission procedures for the School of Medicine, including an application and an interview. Participants who do not meet the required levels of performance may still be admitted into the School of Medicine, but such admission will be subject to review and approval by the School of Medicine’s Admissions Committee.

Social Work

Pre-Professional Scholars Program in Social Work

Each year, as many as 10 high school seniors who plan to pursue careers in social work are offered places in the Pre-Professional Scholars Program in Social Work. The program gives a conditional commitment of admission to the Case Western Reserve University Mandel School of Applied Social Sciences to be honored upon successful completion of the bachelor's degree.

Admission to the master’s degree program in social work at MSASS is dependent upon the following requirements:

1. Graduation from the University with a cumulative grade point average of 3.0 in the junior and senior years.

2. Completion of a minimum of 24 semester hours in the social and behavioral sciences.

3. Continued evidence of a combination of personal qualities which are considered essential for the professional practice of social work.

Pre-Professional Scholars in Social Work who wish to accelerate their program may apply for the senior year in professional studies privilege.

Application Procedures for Pre-Professional Scholars and Six-Year Dental Programs

Prospective students who wish to apply to any of the Pre-Professional Scholars Programs or to the Six-Year Dental Program should apply for admission through the Office of Undergraduate Admission of Case Western Reserve University. All forms are included in the application booklet.

The application for admission, supporting test scores and high school transcript, must be submitted to the Office of Undergraduate Admission as early as possible, but no later than January 1. Students who are admitted to the University and are also deemed eligible for consideration for one of the Pre-Professional Scholars Programs or the Six-Year Dental Program will be notified by March 1 and will be invited for interviews at the appropriate professional schools. The basis for selection for these programs will be dedication to the pursuit of the particular profession, a distinguished high school record, high scores on the college entrance examinations (ACT or SAT and three College Board Achievement Tests), a record of personal accomplishments that attests to a student’s maturity, leadership, and interpersonal skills, and an interview with an admissions officer from the appropriate professional school. Decisions on admission to the programs will be communicated on or about April 15.

Students who are not admitted to these special programs are encouraged to pursue their undergraduate studies and to apply in the normal course to the professional school of their choice, including the professional schools of Case Western Reserve University.

Off-Campus Programs

Cooperative Education Program

Cooperative Education (Co-op) enables students to integrate classroom theory into practice in a paid employment position coordinated with their major field of study. Students participating in the Co-op Program gain a better understanding of their career objectives through practical work experience in conjunction with academic course work.

The Cooperative Education Program is accredited by the Accreditation Board for Engineering and Technology (ABET) and maintains a strong academic focus. Co-op is available to full-time undergraduate students in good academic standing in all engineering and science departments (except astronomy) and accounting and management majors. Through the Cooperative Education Program, students can acquire positions in industry and government while completing their undergraduate degrees. Co-op assignments are full-time; typically for two seven-month periods consisting of a summer and the contiguous spring or fall semester. Employers prefer the duration of the seven month assignments since it allows students to become involved with longer term, challenging projects.

Students are eligible to co-op after the sophomore year, although schedules vary among the departments. The Co-op Program does not add additional course work, but merely rearranges the academic course load. One faculty member in each participating department serves as the co-op advisor, assisting students in scheduling courses and co-op assignments.

While the co-op experience is voluntary and non-credit, it can lead to credit for engineering senior projects with approval of the student’s major department.

Binary and transfer students must complete at least one semester of course work at the University before admission to the Co-op Program. Binary students participating in the program are obligated to work only one seven-month co-op assignment.

Over 500 employers throughout the United States have expressed interest in participating in the Co-op Program, offering challenging academic assignments that often lead to offers of permanent employment after graduation. The salary for co-op experiences assists students in meeting financial obligations. Generally, companies pay co-ops about two-thirds of the starting salary of a new graduate.

In addition to financial compensation earned during the industrial co-op period, students often benefit from higher starting salaries and greater lifetime earnings that can result from the experience acquired in co-op assignments.
**Typical Co-op Schedule**

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<thead>
<tr>
<th>Year</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
<th>Summer Semester</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Classes</td>
<td>Classes</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td>Co-op</td>
<td>Co-op</td>
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<tr>
<td>3</td>
<td>Co-op</td>
<td>Co-op</td>
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</tr>
<tr>
<td>4</td>
<td>Classes</td>
<td>Co-op</td>
<td>Co-op</td>
</tr>
<tr>
<td>5</td>
<td>Classes</td>
<td>Classes</td>
<td>-</td>
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</table>

Once a position is secured, students register for the Cooperative Education course (Co-op 001, 002, or 003) which is reflected on the transcript. Registration for Co-op maintains full-time student status as it is an academic program and considered an extension of the classroom. In addition, enrollment in Co-op defers repayment of student loans.

The Co-op Office is housed in the Office of the Dean, Case School of Engineering. Prior to obtaining a co-op assignment, students are assisted in identifying companies of interest, designing a professional resume, refining interviewing skills, and focusing on career direction. The Co-op staff will arrange interviews for the students with a variety of companies. Assistance with pre-registration, financial aid, housing and health services are additional services provided by the staff while students are on assignment.

**International Exchange Programs**

Qualified students may participate in international exchange programs which send Case Western Reserve students overseas and bring to the University visiting international students. Up to 36 semester hours of credit may be granted for study as an exchange student at an established foreign university with which Case Western Reserve has an exchange program. University students participating in exchange programs pay tuition to Case Western Reserve and maintain their student status during the period of the exchange.

**Global Engineering Exchange Program (GE3)**

Case Western Reserve University participates in the Global Engineering Education Exchange (GE3), an international exchange program administered by the Institute for International Education. The GE3 program provides opportunities for engineering students at member institutions to receive academic credit for courses taken at overseas member institutions, and to have an internship experience in a foreign setting. Information about the GE3 program is available from the study abroad advisor in the Office of Undergraduate Studies.

**Bilateral Exchange Programs**

Case Western Reserve University has bilateral exchange agreements enabling students from overseas institutions to attend Case Western Reserve as visiting students and permitting University students to receive academic credit for study at the following institutions:

- University of Lancaster, UK (all majors)
- ESC de Montpellier, France (management, accounting)
- University of Frankfurt, Germany (management, accounting)
- National University of Singapore (engineering, computer science)

Information about bilateral exchange programs with other overseas universities is available from the study abroad advisor in the Office of Undergraduate Studies.

**Internships**

A number of departments offer courses which allow undergraduates to participate in internships and practica in conjunction with a course. Such courses are listed among departmental course offerings in the degree program section of this bulletin. Information about how students can obtain summer and part-time internships is available by contacting Career Center.

**Junior Year Abroad**

Full-time undergraduate students who have earned a 3.0 grade point average at the University are eligible to apply for the Junior Year Abroad. Up to 36 semester hours of credit may be granted for study at an established foreign university or for approved foreign study programs offered through accredited American universities. The selection of location and institution for study abroad is made in consultation with a study abroad advisor in the Office of Undergraduate Studies, and must be approved by the Office of Undergraduate Studies and the student’s major advisor. A fee is charged for participation in the Junior Year Abroad program (see schedule of fees). Financial aid may be applied to the Junior Year Abroad.

In recent years, Case Western Reserve University undergraduates have studied in Australia, Austria, Denmark, England, France, Germany, Israel, Italy, Japan, Kenya, New Zealand, Scotland, and Spain. Through a special arrangement, up to 20 students from the University may be accepted at the University of Lancaster, England, for the Junior Year Abroad.

**Practicum Program**

The Practicum Program allows students pursuing majors in the College of Arts and Sciences or in the Weatherhead School of Management to include a workplace experience in their undergraduate program. The primary goal of the practicum is the intellectual, personal and professional growth of the student in an area related to their academic goals. The practicum provides the student with new skills, insights and experiences that are transferable to the academic setting and/or a future position in the workplace. A practicum is a planned, structured, supervised workplace experience at an approved “site” and is generally a paid opportunity.

The Practicum Program is an experiential learning arrangement between the student, the employer and the practicum advisor in conjunction with the Career Center. Employers provide appropriate supervision and work related learning. The practicum advisor guides and evaluates the student’s experience. All Practica developed through the Career Center must be taken for transcript notation and have a faculty member serve as a Practicum Advisor. If a student elects to work in an internship / practicum without enrolling in the course for academic notation, they will not have the benefits of a full-time student status nor will they be supported by the Practicum Program in any official capacity.

Students are eligible to participate in the practicum program when they have successfully completed 60 credit hours at Case Western Reserve—or 30 credit hours for students who entered as transfer students (typically, at the end of the sophomore year). Applicants should have a minimum GPA of 2.0 and be a full-time student. To participate in the program students apply to the Career Center in the semester preceding the work assignment. A student who has completed all graduation requirements is not eligible for a practicum.

Academic year practica consist of a full time工作 assignments for a minimum of four weeks (or equivalent), which falls within an academic semester. Normally, no more than two semester-long practica may be completed by a student. A student doing two practica must spend at least one intervening semester in residence at the University. Students are required to complete pre-practicum assignments as well as develop a Learning Agreement with the student’s practicum advisor. All requirements must
be met no later than the last day of final exams during the practicum course.

Students who are engaged in a practicum during the academic year will register for a non-credit practicum course (PRAC 001, PRAC 002 or MGMT 001, MGMT 002). In general, this course will be the primary academic activity of the student. Registration in these courses will maintain student status for purposes such as student loan repayment, maintenance of health insurance, on campus residence and visa status.

The Practicum Program is managed by the Career Center in coordination with academic departments. The practicum of each student will be guided by a faculty member and Career Center career counselor. At the completion of the practicum, the practicum advisor will determine whether the student has satisfactorily completed the experience and will submit a grade of Pass or No Pass. Satisfactory completion is based on an assessment of the completion of all pre- and post-practicum requirements, fulfillment of the requirements set forth in the individualized Learning Agreement and adequate performance in the workplace.

**Reserve Officer Training Corps (ROTC)**

Reserve Officer Training Corps (ROTC) programs are available to Case Western Reserve University students through cooperative arrangements with the University of Akron, for Air Force ROTC, and with John Carroll University, for Army ROTC. Each of these universities offers military studies, leadership and training courses. Participating students do not receive academic credit at Case Western Reserve for these courses, but may be exempted from the undergraduate physical education requirement. Students who are not recipients of ROTC scholarships may enroll in the first and second year ROTC courses without incurring any military obligation. University students enrolling in ROTC programs are eligible to compete for ROTC scholarships awarded by the Air Force or the Army. See section on Financial Aid for scholarship information.

**Air Force ROTC**

The Air Force Reserve Officer Training Corps (AFROTC) program provided by the University of Akron prepares students for service as officers in the United States Air Force. Through courses in history, management, and leadership, and through practical training, students acquire leadership and management skills, and learn about Air Force career opportunities, the role of the military in American society, the history of air power, and national defense policy.

An agreement between Case Western Reserve University and the University of Akron allows full-time Case Western Reserve students to complete aerospace studies courses. The courses are held at the University of Akron, which is approximately 30 miles from CWRU, and are usually scheduled on one or two afternoons during the week. This arrangement allows Case Western Reserve students to participate in either the four-year or two-year AFROTC program. Students wanting to enter the two-year program in the junior year must contact the professor of aerospace studies before March of the year before their planned entry.

Air Force ROTC scholarships are available on a competitive basis. Information about courses, registration, and scholarships may be obtained from the Department of Aerospace Studies, 9 Schrank Hall South, the University of Akron, Akron, Ohio 44325-0009; telephone: (330) 972-7653.

**Army ROTC**

The Army ROTC program is designed to prepare young college men and women for service as a commissioned Army officer in either the active duty U.S. Army or the reserve components of the Army Reserve or National Guard. Classes and practical training focus on military skills, officer professionalism, leadership training, and the development of military-related officer and management techniques and procedures.

Students may enroll in Army ROTC classes through cross-registration in the Department of Military Science at John Carroll University, which is approximately five miles from Case Western Reserve. Military science classes are taught at John Carroll University, with some activities also taking place at Cleveland State University or at Case Western Reserve.

Army ROTC scholarships are available on a competitive basis. Information about courses, registration, and scholarships may be obtained from the Department of Military Science (ARMY-ROTC), John Carroll University, University Heights, OH 44118-4851; telephone: (216) 397-4421.

**The Washington Study Programs**

Qualified students may participate in either of two programs which provide the opportunity to spend a term of study in Washington, D.C.

**The Washington Semester Program (WASH 001)**

A full semester’s credit can be earned for the satisfactory completion of specialized work with source materials and at governmental institutions. All work is conducted at American University, and includes two seminars, a half-time internship, and directed research in an area of the student’s interest.

**The Washington Center Program (WASH 002)**

Students receive up to 15 hours of credit for work supervised by the Washington Center. The emphasis is on practical experience in the form of a full-time internship (WASH 002A) which provides the opportunity for intensive research and the development of a portfolio (WASH 002B) in the student’s area of major interest. In addition, students participate in a seminar and attend a weekly lecture/discussion group (WASH 002C). The credits earned can be counted as general electives or applied to a student’s major or minor, with the prior consent of the individual department(s).

The Washington Center also offers a variety of academic seminars and symposia during the summer for which credit can be earned.

**General Requirements**

Students make application through the Department of Political Science. Applications also must have the approval of the Dean of Undergraduate Studies and the student’s major advisor. To be eligible for participation in either program a student must:

1. Be ranked as a junior or first-semester senior in the semester of enrollment in the program.
2. Have completed the Arts and Sciences General Education Requirements before enrollment. (Some exceptions may be made for a student enrolling in the program in the first semester of the junior year.)
3. Have earned a cumulative grade point average of 3.0 or better.

**Non-Degree Students**

**Transient (Visiting) Students**

A transient student is one who has begun his or her education at another college or university and intends to return there. The University permits full or part-time study as a transient student in the summer as well as during the fall and spring semesters. Enrollment must be for credit-bearing courses. Before enrollment, the transient student must present a statement of good standing from the registrar of his or her home college.
Enrollment is limited to 30 semester hours and is subject to the regulations of the student’s college. Transient students must meet all requirements for prerequisites before being admitted to specific courses. Transient students are not eligible to receive financial aid from Case Western Reserve University. If the student’s home institution has entered into a consortium agreement with Case Western Reserve University, the student should inquire of the home institution regarding eligibility to receive aid through the home institution.

Applications for enrollment as a transient student may be obtained from the Office of Undergraduate Studies, 102 Baker Building.

Pre-College Scholars
Students enrolled in high school who wish to take courses at Case Western Reserve University will be considered for admission upon application to the Pre-College Scholars program and only with the endorsement of their high school principal or guidance counselor. This program is designed for those who have demonstrated a high degree of academic competence for study in all areas by doing consistent A and B work in an accredited high school curriculum.

Further information concerning the Pre-College Scholars program and the Post-Secondary Enrollment Option Program of the State of Ohio may be obtained by writing the Office of Undergraduate Studies or by calling (216) 368-2928.

Non-Degree Students
Adults may apply through the Office of Undergraduate Studies to enroll for credit in courses for which their education or experience has qualified them, even though they are not pursuing a baccalaureate degree. These non-degree students may study full or part time and enroll in the same classes as degree students; they are required to perform up to the same academic standards as degree students.

Non-degree students may be eligible for admission to candidacy for a degree program if they meet the requirements for admission to the University. Courses taken for credit as a non-degree student may be applied toward the degree upon acceptance as a degree candidate. A non-degree student who wishes to become a degree candidate must apply through the Office of Undergraduate Admission.

All non-degree students who do not already hold a bachelor’s degree register through the Office of Undergraduate Studies, 102 Baker Building. 368-2928.

Persons who already hold degrees and wish to continue their studies without actively pursuing an additional degree are welcome to apply to the School of Graduate Studies.

Continuing Education
The University provides academic, non-credit courses for those who seek self-enrichment and professional advancement. Courses are presented both on and off campus. Special workshops and seminars are designed and presented by faculty and in cooperation with various community groups throughout the academic year. Illustrations of two such programs follow.

Senior Scholars
This program is designed for men and women 50 years of age and older who seek non-credit, university-level courses and the intellectual stimulation provided by being on a college campus.

Two seminars are presented each semester. They are taught by University faculty and meet once a week for 10 consecutive weeks. In addition, Thursday Forums (lectures followed by a question-and-answer period), are offered on the second and fourth Thursdays of each month. These forums cover a cross section of the academic disciplines at the University.

Senior Scholars pay a single fee at the beginning of the academic year which entitles them to two semesters of specially designed seminars and forums. They may participate in all or any parts of the program they choose.

Registration for this program is handled by the Office of Continuing Education, 103 Guilford House, 368-2090.

Special Audit
The Special Audit Program provides the adult student with the opportunity to attend a regular University course as a serious but informal observer at half the regular tuition. This program is available only to those not enrolled in a degree program at Case Western Reserve University. Special audit students receive no grades and no academic credit for the courses attended. No transcripts will be issued, but a certificate of attendance will be provided if requested.

Registration for this program is handled by the Office of Undergraduate Studies. No transcripts are necessary to register.

Participants in the Senior Scholars or Special Audit programs are considered students at the University and may obtain student ID cards which entitle them to use the University Libraries, receive a student discount at the bookstore, and take advantage of student rates at campus events. Part-time parking privileges in University assigned parking lots are also available.

Honors, Prizes, and Awards

Dean’s Honor Lists
The Dean’s Honor Lists consist of the names of those undergraduate students who have distinguished themselves by achieving during the previous semester the grade point averages required with a minimum of 12 hours earned and who have no Fs, NPs, or Incompletes during the same period. Students with a grade point average of 3.75 or higher will be placed on the Dean’s High Honors List. Students with a grade point average of at least 3.50 but less than 3.75 will be placed on the Dean’s Honors List.

Commencement Honors
[To take effect with the class graduating in 2003] Commencement Honors are awarded to the top 55 per cent of the graduating class.

Top 10 per cent ......................................................... summa cum laude
Next 10 per cent ....................................................... magna cum laude
Next 15 per cent ............................................................ cum laude

To be eligible for commencement honors, candidates must have:
1. Earned a minimum of 54 hours for evaluative grades (A, B, C, D) in residence at the University.
2. Attained the required cumulative average in all work for which grades are averaged at the University.

Departmental Honors
Students who participate in departmental honors programs and satisfy the requirements for such a distinction, as specified by the department, may qualify to receive the degree “with departmental honors.”

Phi Beta Kappa
Phi Beta Kappa, a national honor society, recognizes outstanding scholarship in the arts and sciences. The Alpha Chapter of Ohio, one of the first ten established nationally, was established in Western Reserve College in 1847. Students may qualify for election to membership in the second semester of the senior year.
A few outstanding students may be elected to membership as juniors.

**Tau Beta Pi**

Tau Beta Pi is a national honor society which recognizes full-time engineering students for outstanding scholarship, leadership, and service.

**Mortar Board**

Mortar Board is a national honor society which recognizes full-time senior students for outstanding scholarship, leadership, and service.

**Prizes, Awards, and Scholarships**

Students are selected by departments or by the deans as recipients of the following awards, which are presented at the Honors Assemblies each spring. Awards made to graduating seniors are listed in the commencement program.

**Departmental Awards**

**Accountancy**

- The Beta Alpha Psi Award for excellence in Accounting
- The Ernst and Young Accounting Achievement Award
- The Deloitte and Touche Award to an outstanding junior majoring in Accounting
- The Becker Conviser Professional Review Scholarship
- The Beta Alpha Psi Scholars Recognition Award for outstanding scholarship among members of the Pi Chapter
- The Louis Levy Meritorious Service Recognition Award for outstanding service to chapter, school and community
- The Alcoa Financial Award
- The Alcoa Foundation Award
- The Andersen Award
- The Skoda, Minotti & Company Award for an outstanding underclassman
- The Price Waterhouse Coopers Scholarship Award
- The KPMG Peat Marwick Scholarship Award
- The Cohen & Co./Beta Alpha Psi Leadership Award
- The Plante and Moran Award

**Anthropology**

- The Ruth and Newbell Niles Puckett Award to a graduating senior for outstanding achievement in anthropology
- The James Dysart Magee Award for the senior year to an outstanding student in social and behavioral sciences who is also enrolled in the Integrated Graduate Studies Program
- The Callender Memorial Award for outstanding achievement in anthropology

**Art History/Art Studio**

- The Hazel Gibbs Herbruck Prize for excellence in art education
- The Doris Young Hartsock Prize for excellence in art education
- The Kennedy Prize for creative work in art
- The William Grauer Award for excellence in art studio courses
- The Arnold Philip Award for excellence in art
- The Charles E. Clemens Prize for outstanding talent and accomplishment in art
- The Muriel S. Butkin Art History Prize for overall best performance and highest grade point average by an undergraduate Art History major
- The Noah L. Butkin Award for the best term paper on an art history topic written by an undergraduate

**Astronomy**

The Jason J. Nassau Prize was established by the Cleveland Astronomical Society in 1965 in memory of Professor Emeritus Nassau, former head of the Department of Astronomy, who was a member of the faculty for 41 years. It is awarded annually to a senior student in astronomy selected by the faculty of the department.

**Biochemistry**

- The Harland G. Wood Prize for outstanding performance by a graduating senior majoring in biochemistry who is a candidate for the B.S. in Biochemistry
- The Merton F. Utter Prize to a candidate for the B.A. majoring in biochemistry for outstanding achievement

**Biology**

- The Russell M. Lawall Prize in Biological Sciences for excellence in both academics and research in biology
- The Francis Hohart Herrick Prize for outstanding biological research and academic excellence in biology
- The Ralph A. Spengler, Jr. Award for excellence in plant science
- The Michelson-Morley Undergraduate Research Prize in the Biological Sciences for outstanding research presentation, funded by the Howard Hughes Medical Institute
- The J. Paul Visscher Memorial Award of the Cleveland Audubon Society to the senior or graduate student who demonstrates outstanding ability and promise in the field of ecology or environmental science
- The Mather Alumnae Award in Biology for outstanding academic performance in biology
- The Daniel Burke Prize for excellence in both biology and chemistry

**Biomedical Engineering**

- The Mark Bernstein Memorial Award to a senior biomedical engineering major for outstanding achievement in academics and leadership, contributions to research, and service to the university, department or community
- The Biomedical Engineering Chair’s Award for outstanding academic achievement and service to the biomedical engineering community
- The Biomedical Engineering Faculty Award for outstanding academic achievement, achievement in sports, and service to the biomedical engineering community
- The Biomedical Engineering Research Award for outstanding performance in biomedical engineering research combined with outstanding academic achievement and outstanding achievement in sports
- The J. Thomas Mortimer Cooperative Education Award
- The Jose Ricardo Alcala Memorial Award for biomedical engineering research
- Cristina A. Camardo Award to a biomedical engineering student in recognition of his or her leadership and service within the university community

**Chemical Engineering**

- The Monroe J. Bahnsen Award was established by contributions of friends and associates in memory of Dr. M. J. Bahnsen, Case ’29. It is awarded annually to a senior for achievement in chemical engineering whose work in design and research projects has been outstanding.
- The Carl F. Prutton Chemical Engineering Award was established by Kent H. Smith, ’17, Kelvin Smith, ’22, and Vincent K. Smith in honor of Carl F. Prutton, ’20, for many years head of the Department of Chemistry and Chemical Engineering and a...
consultant to the Lubrizol Corporation. The prize is awarded to the senior whose academic performance merits his or her selection as outstanding.

The William H. Schuette Memorial Award is given to a senior whose major field is chemical engineering and whose academic performance, character, and qualities of leadership merit election as outstanding. The award was established by friends and co-workers in memory of Mr. Schuette, '33, vice president and general manager of Dow Chemical Company.

The A. W. Smith Prize is presented to the senior in engineering whose major field is chemical engineering, and who has earned the highest record in the junior and senior years in chemical engineering courses. The prize was established by Dr. Carl F. Prutton, '20, former head of the Department of Chemistry and Chemical Engineering, in memory of Dr. Albert W. Smith, Case 1887, a member of the Case faculty for 40 years.

The Connie Ilcin Award to the student who exhibits outstanding performance in chemical engineering

Chemistry
The W. R. Veazey Prize is awarded to a junior achieving the highest academic record in physical chemistry courses. This prize was established by Dr. Carl F. Prutton, Case '20, honoring W. R. Veazey, for 29 years a member of the Case faculty.

The Olin Freeman Tower Prize for excellence in physical chemistry

The Carl F. Prutton Prize for scholarship in chemistry to a student in the general field of chemical engineering

The Emma Maud Perkins Prize for excellence in classical studies

The Crawford Summer Scholarship to the American School of Classical Studies in Athens

Communication Sciences
The National Student Speech-Language-Hearing Association Award for outstanding leadership and achievement in communication sciences

The Outstanding Undergraduate in Communication Studies Award

Economics
The Robert N. Baird Award for academic excellence and leadership in extracurricular activities

The Marvin J. Barloon Book Award for outstanding performance in economics

The James Dysart Magee Award to an outstanding student in economics for the senior year

The Howard T. McMyler Award to an outstanding student majoring in economics

The W. H. Kniesner Prize to an outstanding senior in economics

The Gardiner Scholarship to a student majoring in economics and is also interested in finance

Electrical Engineering and Computer Science
The Chair's Award to a student in the Department of Electrical Engineering and Computer Science who shows exceptional academic or leadership potential

The Carolyn J. and John A. Massie '66 Prize for Computer Engineering and Science awarded to the outstanding graduating senior in computer engineering and science based on performance in the Cooperative Education Program

The Andrew R. Jennings Award to a senior for excellence in computer engineering and science

The ACM Award to the senior judged by the student chapter of the Association for Computing Machinery most likely to have an outstanding professional career

The National Electrical Engineering Consortium William L. Everitt Award to a student who has excelled academically in communications or computers

The Phillips Award for the best senior project in computer engineering and computer science

The Eta Kappa Nu-I.E.E.E. Award was established by I.E.E.E. and Eta Kappa Nu honorary fraternity. This award is given to the senior student judged by his or her fellow students to possess the qualities necessary for an outstanding professional career in a general field of electrical engineering

The W. Bruce Johnson Award was established in 1969 in memory of Dr. W. Bruce Johnson, professor of engineering and head of the Division of Electrical Sciences and Applied Physics. This award is given to the senior who has demonstrated outstanding ability and shows unusual potential for future contributions in the area of electrical sciences and applied physics

The Electrical Engineering Service Award is given to the senior performing outstanding service to his class

The National Electrical Engineering Consortium William L. Everitt Award to a student who has excelled in electrical engineering studies

The Phillips Award for the best senior project in electrical engineering or systems and control engineering

The Donald P. Eckman Award was established by the American Automatic Control Council in memory of Dr. Donald P. Eckman, professor of mechanical engineering and first director of the
The Kevin J. Semelsberger Prize for excellence in management
The Nellie Chittenden Carlton Prize is awarded to a senior
The Financial Executive's Institute Award
The Wall Street Journal Award to the outstanding senior in management
The Roulston Performance Award for outstanding performance in management
The Samuel Maron Memorial Award is given to an undergraduate for excellence in polymer research.

**English**
The Charles E. Clemens Award for talent and accomplishment in writing
The Finley Foster/Emily M. Hills Poetry Prize for the best poem or group of poems
The Emily M. Hills Award for the best poem or essay written by a woman in the College of Arts and Sciences
The Holden Prize for the best English paper written by an upperclass student
The Kennedy Prize for creative work in English
The Edith Garber Krotinger Prize for excellence in creative writing
The Karl Lemmerman Prize for the best paper by a freshman
The Eleanor Leuser Award for outstanding writing for or about children by a student enrolled in a creative writing course at the university
The Nemet Scholarships for the demonstration of excellence in creative writing
The Harriet Pelton Perkins Prize to an outstanding student majoring in English
The Helen B. Sharnoff Award for formal poetry submitted by undergraduate students
The Emily M. Hills Award for the best poem or essay written by a student enrolled in a creative writing course at the university

**Geological Sciences**
The Charles S. Bacon Award for outstanding academic achievement in geological sciences
The Carol W. Walker Award for outstanding contributions to the Department of Geological Sciences

**History**
The Donald Grove Barnes Award to a senior for excellence in history
The Clarence H. Cramer Award for excellence in research and writing of history
The Annie Spencer Cutter Prize to a senior for outstanding achievement in history
The Sigma Psi Prize for excellence in history
The John Hall Steward Prize for excellence in historical studies
The History Department Award for outstanding achievement in history

**Macromolecular Science and Engineering**
The Hal Loranger Award for Polymer Science was established in 1974 by friends as a memorial to Hal Loranger. This award is given to the outstanding senior in polymer science.
The Samuel Maron Memorial Award is given to an undergraduate for excellence in polymer research.

**Management**
The Roulston Performance Award for outstanding performance in management
The Wall Street Journal Award to the outstanding senior in management
The Financial Executive’s Institute Award
The Nellie Chittenden Carlton Prize is awarded to a senior majoring in management science whose outstanding work in the general field of economics shows the greater promise of leadership. This prize was established by Professor Frank Tracy Carlton, Case ’95, and his wife, Mrs. Nellie Chittenden Carlton. The Kevin J. Semelsberger Prize for excellence in management

**Materials Science and Engineering**
The Robert O. Berger, Jr. Award to a junior who demonstrates overall achievement in scholarship, as well as notable community participation and leadership

**Mathematics**
The Max Morris Prize was established in 1964 by family, friends, and former students in memory of Professor Max Morris to honor his contribution to the teaching of mathematics. This prize is presented to an outstanding undergraduate student in mathematics who is pursuing the B.S. degree.
The Webster Godman Simon Mathematics Award to a sophomore or junior pursuing a B.A. degree, for excellence in mathematics

**Mechanical and Aerospace Engineering**
The Fred Hale Vose Prize was established by Elmer L. Lindseth, Case ’25, to honor Professor Emeritus Fred Hale Vose, former head of the Department of Mechanical Engineering. It is presented to the senior in mechanical engineering who has demonstrated the greatest promise for professional leadership.
The Gustav Kuerti Award is given to the senior in mechanical and aerospace engineering who has demonstrated the highest level of scholarship.
The Robert and Leona Garwin Prize was established in 1977 by Richard L. Garwin, Case ’47. It is given to a student who had demonstrated theoretical scientific ability with experimental competence and inventive talent.
The Robert and Leona Garwin Prize was established in 1977 by Richard L. Garwin, Case ’47. It is given to a student who had demonstrated theoretical scientific ability with experimental competence and inventive talent.
The Anish Shah ’91 Award to an outstanding senior in mechanical and aerospace engineering based on academic achievement, extra-curricular activities, and community service

**Modern Languages**
The Emile B. deSauze Award for attaining the highest honors in modern languages and literatures
The French Undergraduate Book Prize for high achievement in French
The Susie Scott Christopher Prize for excellent contributions to the French program
The German Undergraduate Book Prize for high achievement in German
The Folberth German Prize for excellence in German language and literature
The Italian Undergraduate Book Prize for high achievement in Italian
The Spanish Undergraduate Book Prize for high achievement in Spanish
The Chinese Undergraduate Book Prize for high achievement in Chinese
The Japanese Undergraduate Book Prize high achievement in Japanese
The Russian Undergraduate Book Prize for high achievement in Russian
The Florence Keuerleber Prize to an undergraduate student who has seriously pursued and excelled in the study of a modern language while majoring in another area
The B.S. Chandrasekhar Prize awarded upon completion of the
Physics University through the athletic program
The Arthur P. Leary Award to the senior man who demonstrates leadership, good sportsmanship, maintains good academic standing and made contributions to the department and university
The Dorothy L. Hoza Award to the outstanding freshman, sophomore or junior who has demonstrated leadership, good sportsmanship, maintained good academic standing and made contributions to the department and university
The B.S. Chandrasekhar Prize awarded upon completion of the junior year to a physics major who has demonstrated superior performance

Music
The Charles E. Clemens Prize for talent and accomplishment in music
The Doris Young Hartsock Prize for outstanding performance in music education
The Kennedy Prize for creative work in music
The Arthur H. Benade Prize to a senior with a major other than music who has made a notable contribution to music on campus during his or her undergraduate years
The Joan Terr Ronis Recital Prize to an outstanding undergraduate majoring in music who has made an exceptional contribution to the musical life of the University
The Lyman Piano Award

Nursing
The Bolton Scholar Award for Excellence in Psychiatric/Mental Health Nursing
The Bolton Scholar Award for Excellence in Critical Care Nursing
The Bolton Scholar Award for Excellence in Pediatric Nursing
The Bolton Scholar Award for Excellence in Maternal-Child Nursing
The Bolton Scholar Award for Excellence in Nursing Informatics
The Bolton Scholar Award for Excellence in Nursing Research
The Bolton Scholar Award for Excellence in Acute Care Nursing
The Bolton Scholar Award for Excellence in Community Health Nursing
The Bolton Scholar Award for Excellence in Gerontology
The Director's Award for Outstanding B.S.N. Graduate

Nutrition
The Mary Eliza Parker Award for excellence in nutrition and dietetics

Philosophy
The Truman P. Handy Philosophical Prizes to outstanding juniors or seniors for excellence in philosophy

Physical Education
The Emily Russell Andrews Award to the senior woman who makes the greatest contribution to the physical education department through scholarship, leadership, participation and service
The Philip K. “Nip” Heim Award to the senior man who makes the most outstanding contribution to Case Western Reserve University through the athletic program
The Patricia B. Kilpatrick Award to the four-year varsity participant with the highest grade point average
The Arthur P. Leary Award to the outstanding freshman, sophomore or junior who has demonstrated leadership, good sportsmanship, maintained good academic standing and made contributions to the department and university
The Dorothy L. Hoza Award to the outstanding freshman, sophomore or junior who has made a strong contribution to the women's intercollegiate sports program, maintained a high level of academic achievement, shown leadership in the team, and contributed service to the department and university

Physics
The B.S. Chandrasekhar Prize awarded upon completion of the junior year to a physics major who has demonstrated superior performance

The Dayton C. Miller Award was established by the late Herbert A. Erf, Case '26, honoring this internationally renowned physicist who served as professor of physics for 50 years. It is given to an outstanding senior in physics for the best thesis.
The Elmer C. Stewart Memorial Award to an outstanding senior in physics who has demonstrated achievement in the applications of physics
The Krumhansl Family Prize to an outstanding undergraduate woman for her academic accomplishments in the Department of Physics
The Leslie L. Foldy Award to the outstanding senior in physics
The Senior Award for service and scholarship in physics
The Physics and Society Essay Competition Award to the physics major who writes the best essay on the application of physics to societal problems

Political Science
The Mather Alumnae Award for outstanding academic performance in political science
The James Dysart Magee Award for the senior year, to an outstanding student in social and behavioral sciences enrolled in the Integrated Graduate Studies Program

Psychology
The Stephen Bednarik Memorial Award to an outstanding senior majoring in psychology
The James Dysart Magee Award for the senior year, to an outstanding student in social and behavioral sciences enrolled in the Integrated Graduate Studies Program
The Mather Alumnae Award for outstanding academic performance in psychology

Religion
The Ratner Family Prize to a graduating senior for the highest academic achievement in the study of religion

Sociology
The James Dysart Magee Award for the senior year, to an outstanding student in social and behavioral sciences enrolled in the Integrated Graduate Studies Program
The Schermerhorn Award for an outstanding student in sociology
The Mark Lefton Award for excellence in sociological studies
The Stella Berkeley-Friedman Award to a graduating senior for the highest academic achievement in the study of sociology
The Robert C. Davis Award for demonstrated commitment to sociological studies

Theater Arts
The Dionysus Award for an outstanding contribution to theater or dance for a student not majoring in theater arts
The Barclay Leatham/Nadine Miles Award for creativity and general excellence in theater
The Music and Drama Club Scholarship to a theater arts major for outstanding contributions to the production program with potential for professional work, given by the Music and Drama Club
The Lily Dreyfuss Memorial Award for excellence in dance
The Samuel Rosenthal Center for Judaic Studies
The Eudese and Elmer Paull Prize to one or several undergraduate or graduate students who demonstrate an interest in Jewish studies or Jewish contemporary life
Awards for Study Abroad
The Brookes Friebolin Award to an outstanding student for study in France
The Alice Seagraves Award to outstanding students for study abroad
The Eva L. Pancoast Memorial Fellowship for graduating senior women in the College of Arts and Sciences or women students in the School of Graduate Studies interested in extending their education by foreign travel or study

Collegiate Awards
The Peter Witt Scholarship to a deserving student who demonstrates a vital and active interest in the improvement of life in Cleveland
The Phi Beta Kappa Prize to sophomores with the best academic records in a liberal arts curriculum after three semesters
The Outstanding Sophomore Awards of The Case School of Engineering to the sophomores with the best academic record at the end of three semesters in The Case School of Engineering
The Harriet Levion Pullman Award to a sophomore outstanding in scholarship, leadership, and service
The Bolton Scholar Award for Excellence in Nursing for the student who has attained the highest academic record at the sophomore level
The Delta Phi Upsilon - Junior Award of the College of Arts and Sciences to juniors with the best academic records at the end of five semesters
The Outstanding Junior Awards of The Case School of Engineering to juniors with the best academic records at the end of five semesters in The Case School of Engineering
The Bolton Scholar Award for Excellence in Nursing for the student who has attained the highest academic record at the junior level
The Joseph Skigin Memorial Award to an outstanding premedical student for the senior year

The Louis K. Levy Prize for an outstanding junior in the College of Arts and Sciences
The George T. Hunt Awards to a junior and a senior outstanding in leadership, scholarship, and service
The Sylvia Green Rosenberg Award to a part-time or full-time non-traditional student
The Mather Alumnae Award for outstanding academic performance in the humanities
The George S. Traub Memorial Award to the undergraduate student completing the most outstanding paper or project contributing to understanding the past, present or future economy of Northeastern Ohio
The Carol and Edward Breznyak G’64 Cooperative Education Student of the Year Award to a student in The Case School of Engineering who has demonstrated outstanding performance in the Cooperative Education Program based on industry evaluations, written reports and student initiative
The Robert and Joyce Shaefer Prize to a student from The Case School of Engineering who has made a major contribution to campus publications
The Robert J. Adler Award to the senior student in The Case School of Engineering who, through high scholarship, technical creativity, and service to his or her peers, best exemplifies the ideals and talents of Professor Robert J. Adler
The Robert L. Shurter Prize to a senior for leadership in extracurricular activities in The Case School of Engineering

The Case Alumni Association Prize for Achievement to the senior with the best academic record in The Case School of Engineering
The Kent H. Smith Award was established in 1961 by Case students and presented by the Case Student Senate to honor Kent H. Smith, Case ’17, for his service as a member of the Board of Trustees and as acting president from 1958 to 1961. The award is presented to an outstanding senior displaying extraordinary leadership, character, and scholarship in the Case School of Engineering
The John Schoff Millis Award to the senior with the best academic record in the College of Arts and Sciences
The Russell A. Griffin Award to a senior in the College of Arts and Sciences who has made the most significant contribution to campus life
The Bolton Scholar Award for excellence in leadership and community service
The Weatherhead School of Management Award to a senior, for outstanding achievement in the Weatherhead School of Management
The Matthew Leskiewicz Award to a senior in the Weatherhead School of Management for outstanding leadership and service
The Edward J. “Ted” Corcoran Award to a senior for outstanding leadership, character and service
The Stanley E. Wertheim Prize for an outstanding junior in The Case School of Engineering who has demonstrated leadership skills through involvement in campus or co-op activities
The P. G. “Jerry” Lind Award for a graduating senior in engineering or science who has made a significant contribution to campus life
Case School of Engineering
The Case School of Engineering

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Engineering seeks to create new processes, products, methods, materials, or systems that impact and are beneficial to our society. To enable its graduates to lead the advancement of technology, The Case School of Engineering (CSE) offers fourteen degree programs at the undergraduate level (thirteen engineering degrees plus the B.S. in computer science). At the post-graduate level, the CSE offers Master of Science programs and the Doctor of Philosophy for advanced, research-based study in engineering. CSE also offers two specialized degrees at the Master's level: a Master of Engineering specifically for practicing engineers, and an integrated Master of Engineering and Management jointly administered with the Weatherhead School of Management. The faculty and students participate in a variety of research activities offered through the departments and the interdisciplinary research centers of the University.

At the core of its vision, The Case School of Engineering seeks to set the standards for excellence, innovation, and distinction in engineering education and research prominence.

Statement of Educational Philosophy

The Case School of Engineering prepares and challenges its students to take positions of leadership in the professions of engineering and computer science. Recognizing the increasing role of technology in virtually every facet of our society, it is vital that engineering students have access to progressive and cutting-edge programs stressing five areas of excellence:

- Mastery of fundamentals
- Creativity
- Societal awareness
- Leadership skills, and
- Professionalism

Emphasizing these core values helps ensure that tomorrow’s graduates are valued and contributing members of our global society and that they will carry out the tradition of engineering leadership established by our alumni.

The undergraduate program aims to create life-long learners by emphasizing engineering fundamentals based on mathematics, physical and natural sciences. Curricular programs are infused with engineering creativity, professionalism (including engineering ethics and the role of engineering in society), professional communications, and multi-disciplinary experiences to encourage and develop leadership skills. To encourage societal awareness, students are exposed to and have the opportunity for in-depth study in the humanities, social sciences, and business aspects of engineering. Undergraduate students are encouraged to develop as professionals. Opportunities include the Cooperative Education Program, on-campus research activities, and participation in the student chapters of professional societies. Graduates are prepared to enter the workforce and be strong contributors as practicing engineers, or continue for advanced study in engineering.

At the graduate level, The Case School of Engineering combines advanced classroom study with a rigorous independent research experience leading to significant results appropriate for publication in archival journals and/or presentation at leading technical conferences. Scientific integrity, engineering ethics, and communication skills are emphasized throughout the program.

Brief History

The Case School of Engineering was established on July 1, 1992, by an action of the Board of Trustees of Case Western Reserve University as a professional school dedicated to serving society and meeting the needs of industry, government and academia through programs of teaching and research.

The Case School of Engineering continues the tradition of rigorous programs based on fundamental principles of mathematics, science and engineering that have been the hallmark of its two predecessors, the Case School of Applied Science (Founded in 1880) and the Case Institute of Technology (1947). The formation of The Case School of Engineering (CSE) is a re-commitment to the obligations of the gift of Leonard Case, Jr., to serve the citizens of Northern Ohio. The CSE has been a leader in many educational programs, being the first engineering school to offer undergraduate programs in computer engineering, biomedical engineering, polymer engineering and systems and control engineering.

Administration

Robert F. Savinell, Ph.D. (University of Pittsburgh)
Dean of The Case School of Engineering and George S. Dively Professor of Engineering
James D. Cawley, Ph.D. (Case Western Reserve University)
Associate Dean of Undergraduate Programs
Joseph M. Mansour, Ph.D. (Rensselaer Polytechnic Institute)
Associate Dean of Research and Graduate Programs
Christine A. Ash, M.B.A. (Case Western Reserve University)
Associate Dean of Administration and Finance
Deborah J. Fatica, M.A. (Bowling Green State University)
Assistant Dean of Curricular Enhancements and External Assessments
Leslie A. Sabo (Bowling Green State University/Candidate for M.B.A./WSOM)
Assistant Dean of Development and External Affairs

Engineering Degrees Granted

1. Bachelor of Science in Engineering degree with major designations as follows
   - Aerospace engineering
   - Biomedical engineering
   - Chemical engineering
   - Civil engineering
   - Computer engineering
   - Electrical engineering
   - Engineering physics
   - Fluid and thermal engineering science
   - Mechanical engineering
   - Materials science and engineering
   - Polymer science and engineering
   - Systems and control engineering
2. Bachelor of Science in Engineering without designation, for programs that emphasize interdisciplinary areas or for programs that include some emphasis on non-technical fields.
3. Bachelor of Science in Computer Science
4. Master of Engineering (practice-oriented program)
5. Master of Engineering and Management
6. Master of Science with the following major field designations
   - Aerospace engineering
   - Biomedical engineering
   - Ceramics and materials science
   - Chemical engineering
Undergraduate Degree Programs

In addition to the major department requirements, each engineering undergraduate degree program includes the Engineering Core, which provides a foundation in mathematics and sciences as well as aspects of engineering fundamentals for programs in engineering. The Engineering Core also is designed to develop communication skills and to provide a body of work in the humanities and social sciences. Requirements of the Engineering Core can be found elsewhere in this bulletin.

Details of the specific curricular requirements for the undergraduate majors are described in the respective departmental descriptions.

Advanced Degree Programs

Master of Engineering Program

The practice-oriented Master of Engineering Program targets currently employed engineers. The objective of this program is to provide engineers in industry with technical as well as business, management, and teamwork skills. The program differs from a traditional Master of Science degree in engineering by concentrating on current industrial practice rather than on research.

The Master of Engineering Program prepares students to enhance their role as corporate leaders. The program provides an environment in which practicing engineering professionals can address the increasingly wide range of technical, management, financial and interpersonal skills demanded by an ever-expanding and diverse global industry base.

Participants can complete a master’s degree within a two-year (six semester), part-time, program of study. The Master of Engineering program requires 30 credit hours of course work which includes 18 credit hours of core courses and 12 credit hours of technical electives chosen from a focus area. Core courses aim at equipping participants with knowledge on how engineering is practiced in contemporary industry. Technical elective courses provide depth in a chosen specialty area. All courses are held in the late afternoon or evening hours and many are provided in a distance-learning format to minimize disruption at the workplace and home. Because the program makes extensive use of computers, participants need to have access to computer facilities.

The Program

The program consists of a set of six core courses and a four course technical elective sequence (a total of 30 credit hours are required). The core courses provide a common base of study and experience with problems, issues, and challenges in the engineering business environment. The technical course sequence provides an opportunity to update disciplinary engineering skills and to broaden interdisciplinary skills. An in-residence retreat is required of all students on the weekend prior to the summer semester. Up to six transfer credits may be approved for graduate-level courses taken at Case Western Reserve or another accredited university.

Six Core Courses

• Team Leadership, Presentation Skills and Professional Assessment and Development (EPOM 400 A,B & C)
• Applied Engineering Statistics (EPOM 405)
• Engineering Economics/Financial Analysis (EPOM 407)
• Business for Engineers (MGMT 421)
• Product/Process Design and Implementation (EPOM 403)
• Master of Engineering Capstone Project (EPOM 409)

Four Technical Electives

Four courses from the chosen technical concentration area are required. The following technical concentration areas are offered:

• Automation, Manufacturing, and Control Systems
• Chemical and Material Processing and Synthesis
• Computer Engineering
• Mechanical Engineering

Master of Engineering and Management Program

The Master of Engineering and Management program is designed to meet the needs of students seeking to excel in engineering careers in industry. The MEM degree requires only one calendar year of additional study and may be entered following a student’s Junior or Senior year. The Program prepares engineers to work in different business environments. A rigorous curriculum prepares graduates to build synergy between the technical possibilities of engineering and the profit-loss responsibilities of management. This Program evolved after years of research and interviews with over 110 professionals and 28 corporations in the U.S.

The Program

The program includes 42 credit hours of graded course work. The ten-course core sequence makes up 30 of these hours. Students choose an area of concentration, either technology entrepreneurship or biomedical entrepreneurship, for the remaining 12 credits. The Program prepares participants to function as technical leaders with a unique blend of broadened engineering and management skills, which can have a strategic impact on the organization’s bottom line. Graduates are uniquely positioned for rapid advancement in technology-based organizations.

Ten Core Courses

• Professional Development (IIME 400)
• Project Management (IIME 405)
• Accounting, Finance, and Engineering Economics (IIME 410)
• Materials and Manufacturing Processes (IIME 415)
• Product and Process Design, Development and Delivery I & II (IIME 430 A & B)
• Information Technology & Systems (IIME 420)
• Understanding People and Change in Organizations (IIME 425)
• Engineering Entrepreneurship I & II (IIME 450 A & B)

Technology Entrepreneurship Concentration

• Design for Manufacturing and Manufacturing Management I & II
• Engineering Statistics and Quality I & II

Biomedical Entrepreneurship Concentration

• Engineering Statistics for Biomedical Applications
• Models for Health Care and Regulatory Affairs
Two courses from the following areas
- Biomedical Imaging: EBME 410, EBME 431, EBME 400, EBME 461
- Biomaterials/Tissue Engineering: EBME 403, EBME 406, EBME 408, EBME 416
- Neuroprostheses: EBME 407, EBME 507, EBME 417
- Cardiac Bioelectricity: EBME 417, EBME 501, EBME 502
- Biomedical Instrumentation and Sensors: EBME 403, EBME 414, EBME 418

Master of Science Degree Programs
Recognizing the different needs and objectives of resident and non-resident graduate students pursuing the master's degree, two different plans are offered. In both plans, transfer of credit from another university is limited to six hours of graduate-level courses, taken in excess of the requirements for an undergraduate degree, approved by the student's advisor, the department chair, and the Dean of the School of Graduate Studies.

All Master of Science degree programs require the submission of a program of study which must be approved by the advisor, department chairperson and the dean of engineering and which must be submitted before registering for the last 9 course credits of the program.

Plan A - Thesis
Minimum requirements for the degree of Master of Science in a major field under this plan are
1. Completion of 18 hours of graduate course work. The courses must be approved by the department offering the degree, as well as the dean of engineering.
2. Completion of nine hours of thesis work culminating in a thesis examination given by at least three professors, plus approval by the chair of the department offering the degree. A student with research experience equivalent to a thesis may petition the Graduate Committee of The Case School of Engineering for substitution of 9 hours of course work for the thesis requirement. In this case, the thesis examination above is replaced by a similar examination covering the submitted research work and publications.
   At least 18 hours of total course work, including up to 9 hours of thesis research, must be at the 400 level or higher.

Plan B - Engineering Project
Minimum requirements for the degree of Master of Science in a major field under this plan are
1. Completion of 27 hours of graduate course work including a Special Problems course described in item 2. The program must be approved by the department offering the degree, as well as the dean of engineering.
2. Three to six hours of Special Problems course work, which must consist of an engineering project approved by the chair of the department offering the degree, which may be carried out at the student's place of employment with nominal supervision by a faculty advisor or in the division laboratories under direct supervision. The project must culminate in a written report and examination by at least three professors plus approval by the chair of the department offering the degree. The Special Problems course may be waived for students who have had industrial design or research experience and who submit sufficient evidence of this experience in the form of a publication or internal report. For these students, a minimum of 27 hours of course work and the final oral examination covering the submitted publications or reports as well as related course material will be required for the master's degree. At least 18 hours of course work including up to 6 hours of Special Problems must be at the 400 level or higher.

Undesignated Master of Science Degree
A student working toward an undesignated Master of Science degree in engineering must select a department. The student is responsible for submitting a program of study which must have the approval of the student's advisor and department head and the dean of engineering and which consist of a comprehensive course program which contains a minimum of nine semester hours of course work in the department offering the program. A minimum of 18 semester hours of course work for the degree must be at the 400 level or higher. The student must meet all the requirements of the designated Master of Science degree in engineering.

Doctor of Philosophy Degree
The student's Ph.D. program should be designed to prepare him or her for a lifetime of creative activity in research and in professional engineering practice. This may be coupled with a teaching career. The mastery of a significant field of knowledge required to accomplish this purpose is demonstrated by an original contribution to knowledge embodied in a thesis and by satisfactory completion of a comprehensive course program which is intensive in a specific area of study and includes work in other areas related to, but not identical with, the major field. The necessity for breadth as well as depth in the student's education cannot be overemphasized. To this end, any engineering department may add additional requirements or constraints to ensure depth and breadth appropriate to its field.

No student may be admitted to candidacy for the Ph.D. degree before approval of his or her program of study by the Advisory Committee, the department, and the dean of engineering. After this approval has been obtained, it is the responsibility of the student's department to notify the Dean of the School of Graduate Studies of his or her admission to candidacy after the student has fulfilled any additional department requirements. Minimal requirements in addition to the university requirements are
1. The minimum course requirement beyond the B.S. level is 36 credit hours of courses taken for credit, at least 18 hours of which must be taken at Case Western Reserve University. The following courses taken for credit will be acceptable for a Ph.D. program of study
   a. All 400-, 500-, and 600-level courses,
   b. Those 300-level courses approved by the student's department up to a maximum of three beyond the B.S. or a maximum of one beyond the M.S., and
   c. Approved graduate-level courses taken at other institutions
2. A minimum depth in basic science equivalent to six semester hours (for credit) is required. This requirement is to be satisfied by courses that have been previously approved by the faculty of the department in which the student is enrolled.
3. The requirement for breadth is normally satisfied by a minimum of 12 semester hours of courses (for credit) outside the student's major area of concentration as defined by the student's department and does not include courses taken to fulfill the basic science requirement.
4. A minimum of three teaching experiences as defined by the student's department. All programs of study must include departmental 400T, 500T, and 600T courses to reflect this requirement.
5. The minimum requirement for research is satisfied by at least eighteen hours of thesis (701) credits.
6. A cumulative quality-point average of 3.0 or above in all courses taken for credit as a graduate student at Case Western Reserve University (excluding grades in thesis research and grades of R) is required for the award of the doctor's degree.
Qualifying Examination

The student must pass a qualifying examination relevant to his or her area of study as designated by the curricular department with which he or she is affiliated. For students who obtain the M.S. degree from Case Western Reserve University, the qualifying examination should be taken preferably before the end of the student’s fourth semester of graduate study but no later than the end of the fifth semester at the University. For students entering with the masters degree the examination should be taken no later than the end of the third semester at the University.

Program of Study

Each student is required to submit a program of study, detailing his or her course work, thesis schedule, and qualifying examination schedule and indicating that all the minimum requirements of the University and the faculty of The Case School of Engineering are satisfied. This program of study must be approved by the advisory committee, the department chairperson and the dean of engineering before registering for the last 18 credits hours of the program.

If the student is pursuing the Ph.D. degree without acquiring the M.S. degree, the program of study should be accompanied by a petition to the dean of engineering to waive the requirement of the M.S. degree. All required courses taken at the University beyond the B.S. degree should be shown on the program of study with the grade if completed. If the requirements are to be fulfilled in other than the standard ways described above, a memorandum requesting approval should be attached to the program of study.

The program of study must be submitted within one semester after passing the qualifying examination.

Undergraduate Courses (ENGR)

ENGR 101. Freshman Engineering Service Project (2)
This course is intended to provide engineering freshmen with an initial exposure to engineering problem solving and engineering design in a given technical field or project-driven environment. Small groups of students will be attached to a particular service project, with the assignment of working out and implementing an engineering solution. Collaboration with the Case Engineering Service Group, as well as off-campus service organizations, will provide a source of real world problems, addressing needs within the greater community, for students to work on. Final engineering reports/presentations, as well as actual prototype solutions (possibly either hardware or software), are expected of each group.

ENGR 131. Elementary Computer Programming (3)
An introductory course in algorithmic problem solving. C++ is used to illustrate how the programming concepts can be used to solve engineering and scientific problems.

ENGR 145. Chemistry of Materials (4)
Application of fundamental chemistry principles to materials. Emphasis is on bonding and how this relates to the structure and properties in metals, ceramics, polymers and electronic materials. Application of chemistry principles to develop an understanding of how to synthesize materials. Prereq: CHEM 111 or equivalent.

ENGR 200. Statics and Strength of Materials (3)
An introduction to the analysis, behavior and design of mechanical/structural systems. Course topics include: concepts of equilibrium; geometric properties and distributed forces; stress, strain and mechanical properties of materials; and, linear elastic behavior of elements. Prereq: PHYS 121.

ENGR 210. Introduction to Circuits and Instrumentation (4)

Graduate Courses

Master of Engineering Program

EPOM 403. Product and Process Design and Implementation (3)
The course is taught through a series of lectures, class discussions, group projects and case studies. The course aims at providing a solid understanding of the many aspects of the engineering design process and management of technology. The course focuses on the engineering and management activities used to develop and bring to market new products and processes. The first part of the course focuses on the techniques used to develop new ideas, the second part focuses on the management of technology and innovation. Prereq: MGMT 421 or permission of instructor.

EPOM 405. Applied Engineering Statistics (3)
In this course a combination of lectures, demonstrations, case studies, and individual and group computer problems provides an intensive introduction to fundamental concepts, applications and the practice of contemporary engineering statistics. Each topic is introduced through realistic sample problems to be solved first by using standard spreadsheet programs and then using more sophisticated software packages. Primary attention is given to teaching the fundamental concepts underlying standard analysis methods.

In this course, money and profit as measures of ‘goodness’ in engineering design are studied. Methods for economic analysis of capital investments are developed and the financial evaluation of machinery, manufacturing processes, buildings, R&D, personnel development, and other long-lived investments is emphasized. Optimization methods and decision analysis techniques are examined to identify economically attractive alternatives. Basic concepts of cost accounting are also covered. Topics include: economics criteria for comparing projects: present worth, annual worth analysis; depreciation and taxation; retirement and replacement; effect of inflation and escalation on economic evaluations; case studies; use of optimization methods to evaluate many alternatives; decision analysis; accounting fundamentals: income and balance sheets; cost accounting. Prereq: EPOM 405.

EPOM 409. Mechanical Engineering Capstone Project (3)
This is the capstone course for the Master of Engineering Program providing students with the opportunity to integrate the Program’s topics through an intensive case study project. Interdisciplinary teams are assigned a major engineering project that covers the stages from design concept through development to final manufacture, including business and engineering decision making to maximize market penetration. Topics also include safety, environmental issues, ethics, intellectual property, product liability and societal issues. Prereq: MGMT 421, EPOM 403, EPOM 405, and EPOM 407.

Master of Engineering and Management Program

IME 400. Professional Development (3)
The goal of the course is to help students learn methods for assessing their knowledge, abilities, and values relevant to engineering and management, and for the acquiring of new professional knowledge and skills throughout their career. Prereq: Senior status in engineering.

IME 405. Project Management (3)
Project Management is concerned with the management and control of a group of interrelated tasks required to be completed in an efficient and timely manner for the successful accomplishment of the objectives of the
project. Since each project is usually unique in terms of task structure, risk characteristics and objectives, the management of projects is significantly different from the management of repetitive processes designed to produce a series of similar products or outputs. Large-scale projects are characterized by a significant commitment of organizational and economic resources coupled with a high degree of uncertainty. Thus, the objective of the course is to understand what are the main issues and problems in the management of projects and to have a thorough knowledge of the conceptual models and techniques available to deal with them. Prereq: Senior status in engineering.

IIME 410. Accounting, Finance, and Engineering Economics (3)
This class uses a combination of class lecture and discussion, in combination with problem-type and case-type assignments, to introduce you to key concepts and tools of financial economics. You are expected to use the resources at your disposal, such as the textbook or the accounting dictionary, to help you understand any unfamiliar concepts. Normally, each class will be divided into two sections. The first part of each class session will be devoted to discussions of selected problems and cases, with focus on the specific topics being covered. The second part of each class will be devoted to prepare you for the following session class assignments. Prereq: Senior status in engineering.

IIME 415. Materials and Manufacturing Processes (3)
A survey course on contemporary and modern materials and their processing, the course begins with a review of traditional materials, including metals, ceramics, plastics, and composites. The evolution of the materials will be traced from their beginnings as raw resources and precursors to finished products. Topics will emphasize modern manufacturing methods and materials. Traditional and modern tools for materials and process characterization will be an important part of the course. Special attention will be directed to examples of statistical methodology and information technology. Visits to local industries and presentations by participating companies will reinforce the information presented in the classroom. Prereq: Senior status in engineering.

IIME 420. Information Technology and Systems (3)
This course is intended to provide students with a perspective of effective use and management of information technology. The primary thrust will be to explain the enabling role of information technology, and how this insight can provide a competitive advantage for industrial organizations in many application areas. In order to accomplish this, technologies such as telecommunications and networking, distributed systems, data management systems, software development, electronic commerce, and the use of multimedia, internet, and web-based systems will be investigated. The impact of these IT technologies for improved industrial productivity and competitiveness. Prereq: Accredited Bachelors in engineering.

IIME 425. People Issues and Change in Organizations (3)
This course is intended to help students assess events occurring in organizations from a behavioral and human resources perspective and to help them develop strategies for managing these events. The course applies knowledge from the fields of organizational behavior and human resource management to provide an understanding and the skills needed to be effective in organizations. The fields of Organizational Behavior and Human Resource Management are devoted to the study of how human beings act in organized settings and how organizations can affect human behavior through a variety of policies, practices, structures, and strategies. In today’s environment, organizations are faced with high levels of international competition and an increasing pace of technological, market, and social changes. As an organizational member, you are expected to successfully operate within these increasingly complex demands as well as help create and guide change. The purpose of this course is to provide you with the framework and tools needed to analyze and operate in the changing organization. We will examine some of the features that characterize an emerging organizational form and contrast this to its traditional predecessor. The focus of the course will be on the skills you will need to operate in the “new” organization including skills for being a change agent working in entry level and early career managerial roles. Prereq: Accredited Bachelor’s in Engineering plus summer job experience.

IIME 430A. Product and Process Design, Development, and Delivery I (3)
An integrated approach to the teaching of the complex relationship of customer to designer and to manufacturer, this course will be team taught by faculty from WSOM and CSE, with participation of corporate representatives sponsoring projects for the teams. The course will be built on a series of projects, each emphasizing different aspects of the product/process design experience, selected to provide exposure to a wide variety of entrepreneurial activities. The project activities are expected to promote the development of realistic activities of cross-functional teams. Prereq: Accredited Bachelor’s in Engineering plus summer job experience.

IIME 430B. Product and Process Design, Development, and Delivery II (3)
An integrated approach to the teaching of the complex relationship of customer to designer and to manufacturer, this course will be team taught by faculty from WSOM and CSE, with participation of corporate representatives sponsoring projects for the teams. The course will be built on a series of projects, each emphasizing different aspects of the product/process design experience, selected to provide exposure to a wide variety of entrepreneurial activities. The project activities are expected to promote the development of realistic activities of cross-functional teams. Prereq: IIME 430A.

IIME 440A. Engineering Statistics and Quality I (3)
This course focuses on process optimization and control using both qualitative and quantitative techniques. At the completion of the course the student should have a thorough understanding of the importance of quality in all organizations, as well as the tools to ensure that the required levels of quality are established and maintained. Prereq: Accredited Bachelors in engineering plus experience.

IIME 440B. Engineering Statistics and Quality II (3)
This course focuses on process optimization and control using both qualitative and quantitative techniques. At the completion of the course the student should have a thorough understanding of the importance of quality in all organizations, as well as the tools to ensure that the required levels of quality are established and maintained. Prereq: IIME 440A.

IIME 450A. Engineering Entrepreneurship I (3)
The nature and importance of entrepreneurship is an area of importance to business leaders, educators, politicians, and individual members of the society. It is a driver of economic development and wealth creation in organizations units ranging in size from the individual company to entire nations. Technology-based entrepreneurship is particularly important to this economic development due to its impact on productivity and its potential for exponential growth. To create something new and of value to both the organization and the market requires a technical individual who is willing to assume the social, psychic, and financial risks involved and achieve the resulting rewards whether these be monetary, personal satisfaction, or independence. This can occur while starting an enterprise (i.e., entrepreneurship) or while driving innovation in an existing organization (intrapreneurship). This course will also take students through a variety of issues related to enhancing innovation in the context of a technology-based organization. This is sometimes termed intrapreneurship and includes innovating new products and services within an organization. This is a very complex field and relatively young. Students will learn that there are not many “absolute truths,” but there are numerous best practices and benchmarks that can assist the intrapreneur. Prereq: Accredited Bachelors in Engineering plus summer job experience.

IIME 450B. Engineering Entrepreneurship II (3)
Master of Science Degree Programs
Students in all Master of Science degree programs will prepare a program of study in conjunction with their faculty advisor. Complete listings of all graduate courses appear elsewhere in this bulletin. Graduate students interested in a cooperative education experience should register for ENGR 400C while they are on a co-op assignment.
ENGR 400C. Graduate Cooperative Education (0)
An academic opportunity designed for graduate students to enhance their classroom, laboratory, and research learning through participation and experience in various organizational/industrial environments where theory is applied to practice. Graduate Cooperative Education experiences may be integrated with the student’s thesis or research projects, or be solely for the purpose of gaining professional experience related to the student’s major field of study. Registration in this course will serve to maintain full-time student status for the period of time that the student is on a co-op assignment.

Interdisciplinary Research Centers
Interdisciplinary research centers act as intensive incubators for students and faculty doing research and studying applications in specialized areas. Thirteen research centers and research programs at The Case School of Engineering have been organized to pursue cutting-edge research in collaboration with industrial and government partners. The transfer of technology to industry is emphasized in all the centers.

The educational programs of these centers encompass the training of graduate students in advanced methods and strategies, thus preparing them to become important contributors to industry after graduation; the involvement of undergraduates in research; the presentation of seminars that are open to interested members of the community; and outreach to public schools to keep teachers abreast of scientific advances and to kindle the interest of students in seeking careers in engineering.

Advanced Liquid Crystalline Optical Materials (ALCOM)
212 Kent Hale Smith Building (7202)
http://www.lci.kent.edu/ALCOM/ALCOM.html
phone 216-368-4176; fax 216-368-4171
Jack L. Koenig, Director
e-mail jlk6@po.cwru.edu

ALCOM, a consortium between Case Western Reserve, Kent State University, University of Akron, and the State of Ohio, conducts research and educational programs in liquid crystal (LC) technology. Thirty-four scientists from diverse fields collaborate to study the properties of LC materials and the application of LC technologies to optical displays. Other uses of LC include high-contrast flat panel displays, optical imaging devices, and thermometers. Future potential applications are flat-panel TV, optical computers, and integrated optical communications.

The center conducts symposia, workshops, and short courses to train scientists from other academic institutions and industrial firms in LC technology, and to facilitate the transfer of technology for commercialization. The eye-catching properties of LC devices are also useful for demonstrating physical principles to public school teachers and students.

Applied Neural Control Laboratory (ANCL)
3480 Charles B. Bolton Building (4912)
http://www.cwru.edu/groups/ANCL/home.html
phone 216-368-3973; fax 216-368-4872
J. Thomas Mortimer, Director
e-mail jtm3@po.cwru.edu

ANCL develops technology and devices to restore missing or impaired human body functions, and participates in transferring findings to industry for commercialization. The emerging technology of applied neural control, based on the electrical stimulation of neural tissue, makes possible the external electrical control of organs or body functions normally controlled by the nervous system.

Applications focus on respiratory assists to patients with acute and chronic respiratory insufficiency; and restoration of limb control and bowel, bladder, and sexual functions in patients with spinal cord injury.

Biomedical engineers are trained at ANCL to gain a working knowledge of fundamental and design aspects of life sciences, material sciences, mechanical engineering, and electrical engineering, which have relevance to applied neural control. Through close association with the highly cross-disciplinary staff affiliated with the laboratory, students and researchers become able to work effectively with the nervous system.

The center conducts an annual research day, to which all interested persons in the community are invited.

Cardiac Bioelectricity Research And Training Center (CBRTC)
509 Wickenden Building (7207)
http://www.cwru.edu/med/CBRTC/
phone 216-368-4051; fax 216-368-4969
Yoram Rudy, Director
e-mail CBRTC@po.cwru.edu

CBRTC fosters interdisciplinary research and training in the fields of cardiac electrophysiology and electrocardiology, in order to enhance understanding of electrical activity and rhythm disorders (arrhythmias) of the heart. It is hoped that this work will lead to improved diagnostic methods and better prevention and treatment strategies. The ultimate aim is to bring about a reduction of fatalities due to arrhythmias (estimated at 400,000 per year in the U.S.) and improved quality of life for afflicted individuals.

Participants in the center include biophysicists, physiologists, biomedical engineers, cardiologists, and surgeons, working synergistically in the research and educational activities related to this field. The educational component builds on the graduate programs in the departments of Biomedical Engineering, Physiology and Biophysics, and on the Fellowship Program in Clinical Cardiac Electrophysiology. Seminars, case presentations of diagnostic and treatment procedures, clinical lectures, and demonstrations of theoretical modeling of rhythm disorders are periodically conducted. Research is supported by private and government foundations, as well as by industry.

Center for Applied Polymer Research (CAPRI)
422 Kent Hale Smith Building (7202)
http://dione.scl.cwru.edu/cse/emac/Centers/InfoOnDeptCenters.html#CAPRI
phone 216-368-4186; fax 216-368-6329
Anne Hiltner, Director
e-mail pah6@po.cwru.edu

CAPRI performs interdisciplinary applied and basic research on structure-property relationships in polymer materials of interest to industry. Recent work of the center has focused on the attributes of polymer blends and alloys and ways to improve their performance, on processing of micro- and nano-layered materials and structures, on polymers for medical applications, and on new thermoplastics and polyolefin systems.

CAPRI conducts an annual symposium to showcase the center facilities and the research of center graduate and undergraduate students and postdoctoral research associates. CAPRI co-sponsors, with the U.S. Army Research Office, the annual ASILOMAR...
Center For Automation And Intelligent Systems Research (CAISR)
517 Glennan Building (7221)
http://dora.eeap.cwru.edu/
phone 216-368-6248; fax 216-368-6039
Stephen M. Phillips, Director
e-mail smp2@po.cwru.edu
CAISR integrates technologies from several engineering disciplines for basic and applied research in manufacturing, automation and intelligent systems. Basic research in signal processing, feedback control, robotics, nonlinear system analysis, materials science, chemical sensing, neural networks and related topics has been successfully applied to practical problems such as flexible manufacturing, rapid prototyping, rapid manufacturing, machinery diagnostics, torque sensing, lubricant monitoring, intelligent process control, feedback systems with MEMS arrays of sensors and actuators. Faculty and students from six engineering departments work with more than a dozen industrial project sponsors using the computational and laboratory facilities of the center. Facilities include the Intelligent Systems Laboratory, Mechatronics Laboratory, Control Laboratory, Rotating Machinery facility, Agile Manufacturing facility and Computer Aided Manufacturing via Laminated Engineered Materials facility.

Center For Cardiovascular Biomaterials (CCB)
202 Wickenden Building (7207)
http://www.cwru.edu/affil/CCB/ccbhome.htm
phone 216-368-3005; fax 216-368-4969
Roger E. Marchant, Director
e-mail rxm4@po.cwru.edu
CCB, supported by Case Western Reserve, the University of Cincinnati, and The Cleveland Clinic Foundation, carries out research and development projects to investigate biomaterials and devices for use as cardiovascular implants in patients. The chemical and mechanical interface between the biomaterial and the host body are the focus of major study, with the goals being to improve biologic function and biocompatibility in the response of the human body to implants. Current projects include investigations of thrombosis (blood clotting) and infection mechanisms due to cardiovascular prosthesis, biomimetic design of novel biomaterials for cardiovascular and neural implants; cardiovascular and neural tissue engineering, and long-term biodegradation of elastomeric biomaterials. Atomic force microscopy is being used for molecular-level studies on the structure and interactions of blood platelets, and plasma glycoproteins and collagen with biomaterials. Studies at the cell and molecular level assist our understanding of the underlying mechanisms, so that novel biomedical interfaces may be designed, prepared, and characterized. CCB was awarded major grants from The Whitaker Foundation and the Ohio Board of Regents to establish a graduate training program in cardiovascular biomaterials. Students conduct research in this field and pursue integrated engineering and medical science courses. The center plans annual symposia at which participating students discuss their work and outside speakers present topical lectures in the field of cardiovascular biomaterials.

Center For Surface Analysis Of Materials (CSAM)
110 Glennan Building (7204)
phone 216-368-3868; fax 216-368-8932
Arthur H. Heuer, Director
e-mail ahh@po.cwru.edu
The Center for Surface Analysis of Materials and the High Resolution and Analytical Electron Microscopy Facilities provide a comprehensive solution to surface and near-surface microchemical analysis and microstructural characterization needs. The combined facility has 8 analytical instruments devoted to these purposes: 1) NEC 55DH Ion Beam Accelerator for RBS, PXE and NRA; 2) PHI 660 Scanning Auger and 3600 SIMS; 3) PHI 5600ESCA (XPS); 4) Philips CM20 STEM with EDS and PEELS; 5) JEOL 4000EX HRTEM; 6) Hitachi S-4500 FEG-SEM; 7) Philips XL30 Environmental SEM with EDS, EBSP, and tensile, heating, and cooling stages; and 8) Scintag X1 Advanced X-Ray Diffractometer with high temperature camera. These instruments are available to campus users and industrial clients for solving a variety of research, development and failure analysis problems that are often encountered in both academia and the industrial environment.

Center On Hierarchical Structures (CHS)
420 Kent Hale Smith Building (7202)
phone 216-368-4203; fax 216-368-6329
Eric Baer, Director
e-mail exb6@po.cwru.edu
The aims of this center are to understand how the unique performance of natural materials arises from precise hierarchical organization, to apply lessons from biology to the design of new hierarchical material systems, and to develop new processes for building complex hierarchical structures. Biological hierarchical paradigms will be used to satisfy societal needs and to solve existing problems.

Edison Polymer Innovation Corporation (EPIC)
Kent Hale Smith Building (7202)
http://dione.scl.cwru.edu/cse/emap/Centers/InfoOnDeptCenters.html#EPIC
phone 216-368-6366; fax 216-368-4028
Jerome B. Lando, President and CEO
e-mail jbl2@po.cwru.edu
EPIC, a partnership between Case Western Reserve, the University of Akron and Ohio State University, carries on research and development in the field of polymers and provides technical service and support, training and education, and problem solving to other academic institutions and to industry. EPIC facilitates the transfer of research results to companies for advanced development and commercialization. Current EPIC projects include studies of composites and blending, adhesion, polymer films for microware electronics, mechanisms of fatigue and abrasion in metal and elastomers, three-dimensional flow simulations, and general polymer microstructure studies. EPIC brings together faculty from the departments of macromolecular science, physics, chemistry, electrical engineering, and chemical engineering.
Electronic Design Center (EDC)

112 Bingham Building (7200)
http://www.case.cwru.edu/research/inter.html#electronic
phone 216-368-2934; fax 216-368-8738
Chung-Chiu Liu, Director
e-mail cxl9@po.cwru.edu

EDC carries research and development of advanced chemical and biological sensors for various industrial applications. The center focuses on the applications of microfabrication and micromachining technology to the production of sensor prototypes and other devices. Both silicon and non-silicon materials are used in these developments. The center is a multi-disciplinary educational and research center. Both undergraduate and graduate students use the facility in the center to carry out their research or special projects. Recent microsensor development by researchers in EDC include Schottky diode based hydrogen sensor, high temperature oxygen sensor, nano-structure tin oxide sensor and others. Applications of micromachining techniques to the fabrication of unique microdevices, such as micro-fuel cell and micro-chemical reactor, are also undertaken.

Ernest B. Yeager Center For Electrochemical Sciences (YCES)

404 White Building (7204)
http://electrochem.cwru.edu/yeager/default.htm
phone 216-368-4218; fax 216-368-3209
Joe H. Payer, Director
e-mail jhp@po.cwru.edu

The Ernest B. Yeager Center for Electrochemical Sciences (YCES) promotes and coordinates research and education in electrochemistry at Case Western Reserve University. Electrochemistry and the technologies derived from it are by their nature highly interdisciplinary. They require expertise in fields as widely divergent as surface physics, solid and liquid state physics, electronics, applied mathematics, polymer science, chemical engineering, and, of course, chemistry.

The center facilitates the undertaking of research projects in electrochemistry of a highly interdisciplinary nature, requiring resources and expertise beyond that of any one faculty research group, and usually involving faculty from several of the participating departments. Eight academic departments of the University participate in the center. Approximately 35 faculty from these departments are affiliated with the center’s regular members. The center fosters interactions and collaborations among all of the students within these departments who are involved in electrochemical research.

The center serves as an international focal point for electrochemical education. Besides the traditional educating of graduate and postdoctoral students, it offers annual workshops for educating and updating industrial and governmental scientists and engineers. Numerous seminars, special topic symposia and lectureships keep the faculty, students, and the technical community aware of the most recent advances in the field. The center attracts visiting scientists, postdoctoral research associates, and graduate students from the world’s leading academic institutions and industrial and governmental laboratories.

The center is to be viewed as a national resource to which industry and government can turn for research and education in electrochemistry.

Microelectromechanical Systems (MEMS)

Bingham Building (7200)
http://mems.cwru.edu/
phone 216-368-0755; fax 216-368-0346
Mehran Mehregany, Director
e-mail mxm31@cwru.edu

Microelectromechanical systems (MEMS) technology provides a microprocessor-compatible means for perception and control at increasingly smaller scales, higher sensitivities, higher throughputs, and lower cost. The associated fabrication technology enables the development of small, functionally sophisticated micromechanical devices (e.g., pressure sensors, inertial sensors, miniature displays, micromechanical light modulators, microvalves, micropumps, etc.) that can be mass-produced at low unit cost.

The University’s MEMS research program is interdisciplinary, and targets process and materials technology to develop devices that enable application advancements. Unique silicon carbide MEMS technology strengths are available and are being explored in addition to silicon technology. Application thrusts include: (i) healthcare; (ii) industrial control, automation and fault detection; (iii) portable power generation; and (iv) functional materials and structures.

The Microfabrication Laboratory (MFL), a state-of-the-art facility that provides the latest in micromachining processes, supports the MEMS program involving approximately 10 faculty, several postdoctoral researchers, and approximately 25 graduate students. The MFL is supporting a state-wide network, Ohio MEMSNet, for MEMS research and development.

National Center for Microgravity Research on Fluids and Combustion (NCMR)

103 Crawford Hall (7074)
http://mae1.cwru.edu/mae/
phone 216-368-0748; fax 216-368-0718
Simon Ostrach, Director
e-mail sostrach@ncmr.org

The Universities Space Research Association (USRA) and Case Western Reserve University have established a National Center for Microgravity Research on Fluids and Combustion (NCMR) under the sponsorship of the National Aeronautics and Space Administration (NASA). The National Center is located on the campus of Case Western Reserve and at Glenn Research Center where it will enjoy access to the world-class research facilities of NASA. Housed in the Zero-Gravity Facility of the Space Experiments Laboratory are laboratories for ground research, diagnostics development; a high-bay area, visitor information, flight hardware storage, shipping and receiving as well as office areas. These facilities enable NCMR and NASA to fulfill the rapidly expanding mission in microgravity research and technology development.

At NCMR, critical path research is conducted in support of NASA’s mission objectives. For long-term manned space exploration, many mission operations and life-support technologies are crucially affected by fluids and transport phenomena. The center’s vision is to become a focal point for microgravity fluids and combustion research that will develop a knowledge base for the design and development of reliable, efficient and cost-effective space systems. A major part of the effort will be to aid in the development of the next-generation technologies that will have to operate for long periods of time in alien environments under extreme conditions. NCMR promotes the idea that “Research for
Design” must be performed to compensate for the limited databases available to designers and builders of space hardware. Through research for design, scientists will become intimately involved at an earlier stage of the hardware development process. To promote free-flow of information, NCMR will hold directed in- and out-reach workshops with industry that will bring together systems engineers, hardware builders and scientists.

**Department of Biomedical Engineering**

319 Wickenden Building (7207)  
Phone 216-368-4063; Fax 216-368-4969  
Patrick E. Crago, Chair  
e-mail xx220@po.cwru.edu  
http://bme.cwru.edu

**Background**

Biomedical engineering (BME) uniquely advances human health and the biological sciences by creating and applying technology based on phenomena described by the biological and physical sciences. Graduates in biomedical engineering are employed in industry, hospitals, research centers, government, and universities. Biomedical engineers also use their undergraduate training as a basis for careers in business, medicine, law, and other professions.

Biomedical engineering was established in 1968 at Case Western Reserve University. As one of the pioneer programs in the world, we now have a strong and well-established program in research and education with many unique features. It was founded on the premise that engineering principles provide an important basis for innovative and unique solutions to biomedical problems. This philosophy has been the guide for the successful development of our program, which has been emulated by many other institutions. Quantitative engineering for biomedical applications remains the cornerstone of our program and distinguishes it from biomedical science programs. In addition to dealing with biomedical problems at the tissue and organ-system level, our educational programs have a growing emphasis on cellular and subcellular mechanisms for understanding of fundamental processes as well as for systems approaches to solving clinical problems. Current programs lead to the B.S., M.S., combined B.S./M.S., Ph.D., and M.D./Ph.D. in biomedical engineering. In all of the BME programs at Case Western Reserve, the goal is to educate engineers who can apply engineering methods to problems involving living systems. The Case School of Engineering and the School of Medicine are located in close proximity on the same campus. The Biomedical Engineering faculty carry joint appointments in the two schools and participate fully in the teaching, research, and decision-making committees of both schools. The department is in close proximity to several major medical centers (University Hospitals, Cleveland Clinic Foundation, The VA Medical Center, and MetroHealth Medical Center). As a result, we have an unusually free flow of academic exchange and collaboration in research and education among the Schools and Institutions. Our BME programs take full advantage of faculty cooperation among University departments, which adds significant strength to our programs.

The educational philosophy is to develop in students

**Mastery of Fundamentals**

- Acquire a strong integrated background in the fundamentals of mathematical, chemical, physical, and biomedical sciences and engineering.
- Become knowledgeable in a special discipline of biomedical engineering such as biomaterials, tissue engineering, biomechanics, instrumentation, biomedical imaging, biomedical sensors, modeling, and biomedical systems.
- Measure phenomena relevant to medicine and biology using state-of-the-art instrumentation.
- Describe biomedical phenomena by mathematical modeling.

**Creativity**

- Design devices, materials, instruments, models, and software for biomedical science and health applications.
- Expand the knowledge base through innovative approaches to biomedical research.

**Societal Awareness**

- Understand issues presented by the biomedical community, and translate them into solvable engineering problems.
- Recognize the role of biomedical engineering in developing technology for commercial application and economic development of society.

**Leadership Skills**

- Communicate technical information to both technical and non-technical audiences.
- Work effectively in a team setting with others of differing backgrounds.

**Professionalism**

- Recognize and respond to biomedical ethical issues.
- Acquire skills for self-instruction and life-long learning.

**Faculty**

**Primary Appointments**

Patrick E. Crago, Ph.D. (Case Western Reserve University)  
Professor and Chairperson; Allen H. and Constance T. Ford Professor  
Control of neuroprostheses for motor function; neuromuscular control systems

Ravi V. Bellamkonda (Brown University)  
Associate Professor  
Biomaterials; neural tissue engineering; 3D hydrogel based scaffolds; gene and protein delivery vehicles; vascular grafts and nerve regeneration

Jiannim Cui, Ph.D. (State University of New York - Stony Brook)  
Assistant Professor  
Molecular and biophysical mechanisms of ion channel function and modulation; the role of ion channels in cardiac excitation and arrhythmias

Cheri Deng, Ph.D. (Yale University)  
Professor  
Nanoscale instrumentation for biomaterials; bone and cartilage

Dominique Durand, Ph.D. (University of Toronto, Canada)  
Professor  
Director, Neural Engineering Center  
Neural engineering; neuroprostheses; neural dynamics; electric and magnetic stimulation of the nervous system; neural interfaces with electronic devices; analysis and control of epilepsy

Steven J. Eppell, Ph.D. (Case Western Reserve University)  
Assistant Professor  
Nanoscale instrumentation for biomaterials; bone and cartilage

Igor Efimov, Ph.D. (Moscow Institute of Physics & Technology)  
Professor  
Nanoscale instrumentation for biomaterials; bone and cartilage

Elmer W. Lindseth Associate Professor, Biomedical Engineering  
Research in ultrasound, contrast agents and angiogenesis

Jinming Gao, Ph.D. (Harvard University)  
Assistant Professor  
Biomolecular engineering; imaging-guided drug delivery; controlled-release drug delivery; elastic biomaterials
Miklos Gratzl, Ph.D. (Technical University of Budapest, Hungary)

Associate Professor
Biochemical sensors; fine chemical manipulation of microdroplets and single cells; cancer research and neurochemistry at the single cell level; cost-effective biochemical diagnostics in microliter body fluids

Warren M. Grill, Ph.D. (Case Western Reserve University)

Assistant Professor of Biomedical Engineering
Neural engineering and neural prostheses; modeling and simulation of stimulation and electrodes; neural control of genitourinary and motor function; anatomy and neurochemistry of neural circuits

Robert F. Kirsch, Ph.D. (Northwestern University)

Associate Professor
Functional neuromuscular stimulation; biomechanics and neural control of human movement; modeling and simulation of musculoskeletal systems; identification of physiological systems

Dmitri E. Kourennii, Ph.D. (Moscow Institute of Physics & Technology)

Assistant Professor
Synaptic transmission and networking in the retina; ion channels; bio-physics, pharmacology, modulation; second messengers in neurons; nitric oxide functional and pathological roles; signal processing in the retina

Roger Marchant, Ph.D. (Case Western Reserve University)

Professor
Director, Center for Cardiovascular Biomaterials
Surface modification of cardiovascular devices; molecular level structure and function of plasma proteins; liposome drug delivery systems; mechanisms of bacterial adhesion to biomaterials

J. Thomas Mortimer, Ph.D. (Case Western Reserve University)

Professor Emeritus
Director, Applied Neural Control Laboratory
Neural prostheses; electrical activation of the nervous system; bowel and bladder assist device; respiratory assist device; selective stimulation and electrode development; electrochemical aspects of electrical stimulation

Niels F. Otani, Ph.D. (University of California, Berkeley)

Associate Professor
Cardiac bioelectricity and excitable tissues; simulation of cardiac action potential propagation; nonlinear dynamics applied to excitable tissues; improved drug therapies and electrical intervention strategies for arrhythmias

P. Hunter Peckham, Ph.D. (Case Western Reserve University)

Professor
Director, Functional Electrical Stimulation Center
Neural prostheses, implantable stimulation and control; control of movement; rehabilitation engineering

Andrew M. Rollins, Ph.D. (Case Western Reserve University)

Assistant Professor, Biomedical Engineering
Biomedical diagnosis, novel optical methods for high-resolution, minimally invasive imaging, tissue characterization and analyte sensing, real-time microstructural and functional imaging using coherence tomography

Yoram Rudy, Ph.D. (Case Western Reserve University)

M. Frank & Margaret C. Rudy Professor of Cardiac Bioelectricity
Director, Cardiac Bioelectricity Research & Training Center (CBRTC)
Cardiac bioelectricity and electrophysiology of the heart; modeling cardiac excitation and arrhythmias at the cellular, tissue, and whole heart levels; cardiac mapping; noninvasive imaging of cardiac electrical function and arrhythmias

Gerald M. Saidel, Ph.D. (The Johns Hopkins University)

Professor
Mass & heat transport and metabolic analysis in cells, tissues, & organs; mathematical modeling, simulation, parameter estimation; optimal experimental design; metabolic dynamics; minimally invasive thermal tumor ablation; slow release drug delivery

David L. Wilson, Ph.D. (Rice University)

Professor
Medical image processing; image segmentation, registration, and analysis; quantitative image quality of X-ray fluoroscopy and fast MRI; interventional MRI treatment of cancer

Secondary Appointments

James M. Anderson, Ph.D. (Oregon State University), M.D. (Case Western Reserve University)

Professor, Pathology, University Hospitals

Haribara Baskaran, Ph.D. (Pennsylvania State University)

Assistant Professor, Chemical Engineering, Case Western Reserve University

Marco Cabrera, Ph.D. (Case Western Reserve University)

Assistant Professor, Pediatric Cardiology

Modeling and control of metabolic processes; metabolic regulation in hypoxia, ischaemia and exercise

Ronald L. Cechner, Ph.D. (Case Western Reserve University)

Associate Professor, Anesthesiology, University Hospitals

3-D imaging of tissue

John Chae, M.D. (New Jersey Medical School)

Assistant Professor, Physical Medicine and Rehabilitation

Application of neuroprotheses in hemiplegia

Hillel J. Chiel, Ph.D. (Massachusetts Institute of Technology)

Professor, Biology

Biomechanical and neural basis of feeding behavior in the marine mollusk Aplysia californica; neuromechanical system modeling; analysis of neural network dynamics

David Dean, Ph.D. (City University of New York)

Assistant Professor, Neurosurgery and Anatomy, University Hospitals

Morphometrics; craniofacial imaging

Louis F. Dell’Osso, Ph.D. (University of Wyoming)

Professor, Neurology, VA Medical Center

Pedro J. Diaz, Ph.D. (Case Western Reserve University)

Assistant Professor, Radiology, MetroHealth Medical Center

Magnetic resonance imaging; image processing

Jeffrey L. Duek, Ph.D. (Case Western Reserve University)

Professor, Radiology, University Hospitals

Applications of functional imaging

Brian Johnstone, Ph.D. (University College, University of London)

Assistant Professor, Orthopaedics, Case Western Reserve University

Michael W. Keith, M.D. (Ohio State University)

Professor, Orthopaedic Surgery, MetroHealth Medical Center

Restoration of motor function in bands

Kenneth R. Laurita, Ph.D. (Case Western Reserve University)

Assistant Professor, Cardiology, MetroHealth Medical Center

Optical imaging in cardiac electrophysiology

Zhenghong Lee, Ph.D. (Case Western Reserve University)

Assistant Professor, Radiology, Nuclear Medicine, University Hospitals

R. John Leigh, M.D. (University of Newcastle-Upon-Tyne, U.K.)

Professor, Neurology, VA Medical Center

Normal and abnormal motor control of the eye

Jonathan Lewin, M.D., Ph.D., (Yale University)

Professor, Radiology, University Hospitals

Magnetic resonance imaging; flow visualization

Raymond F. Muzic, Jr., Ph.D. (Case Western Reserve University)

Associate Professor, Radiology, University Hospitals

Experiment design and analysis for positron emission tomography

Mark S. Rzeszotarski, Ph.D. (Case Western Reserve University)

Assistant Professor, Radiology, MetroHealth Medical Center

Radiological imaging; magnetic resonance imaging, ultrasound

Ronald J. Triolo, Ph.D. (Drexel University)

Associate Professor, Orthopaedics, VA Medical Center

Restoration of lower extremity function

Albert L. Waldo, M.D. (State University of New York)

Professor, Cardiology, University Hospitals

Cardiac electrophysiology and cardiac excitation mapping

Nicholas P. Ziats, Ph.D. (Case Western Reserve University)

Assistant Professor, Pathology, University Hospitals

Vascular grafts; vascular cells; blood vessels
重大生物医学工程

**Freshman Year**

**Fall**
- EBME 105, Introduction to Biomedical Engineering (3-0-3)
- CHEM 111, Chemistry for Engineers (4-0-4)
- MATH 121, Calculus for Science and Engineering I (4-0-4)
- ENGR 131, Elementary Computer Programming (2-2-3)
- ENGL 150, Expository Writing (3-0-3)
- PHED 101, Physical Education (0-3-0)

Total: (15-3-16)

**Spring**
- ENGR 145, Chemistry of Materials (4-0-4)
- MATH 122, Calculus for Science and Engineering II (4-0-4)
- PHYS 121, General Physics I (4-0-4)
- H/SS ................................................................ (3-0-3)
- PHED 102, Physical Education (0-3-0)

Total: (15-3-15)

**Sophomore Year**

**Fall**
- EBME 201, Physiology - Biophysics I (3-0-3)
- MATH 223, Calculus for Science and Engineering III (3-0-3)
- PHYS 122, General Physics II (4-0-4)
- BME Specialty Sequence or Science Elective (3-0-3)
- H/SS ................................................................ (3-0-3)

Total: (16-0-16)

**Spring**
- EBME 202, Physiology - Biophysics II (3-0-3)
- MATH 224, Intro to Dynamic Systems (3-0-3)
- ENGR 210, Intro to Circuits & Instrumentation (3-3-4)
- BME Specialty Sequence or Science Elective (3-0-3)
- H/SS ................................................................ (3-0-3)

Total: (15-3-16)

**Junior Year**

**Fall**
- EBME 306, Introduction to Biomaterials (3-0-3)
- EBME 313, Biomedical Engineering Lab I (1-3-2)
- ENGL 398N, Professional Communication (3-0-3)
- EBME 308, Biomedical Systems & Circuits (3-0-3)
- ENGR 225, Thermo, Fluids, Heat & Mass Transfer (4-0-4)

Total: (14-6-16)

**Spring**
- EBME 314, Biomedical Engineering Lab II (1-3-2)
- EBME 310, Principles of Biomedical Instrumentation (3-0-3)
- EBME 360, BME Instrumentation Lab (0-3-1)
- ENGR 200, Mechanics and Materials (3-0-3)
- H/SS ................................................................ (3-0-3)
- BME Specialty Sequence (3-0-3)
- BME Specialty Sequence (3-0-3)

Total: (16-6-18)

**Senior Year**

**Fall**
- EBME 398, Senior Project (0-9-3)
- or EBME 380, Design in BME (1-6-3)
- BME Specialty Sequence (3-0-3)
- BME Specialty Sequence (3-0-3)
- Statistics (3-0-3)
- H/SS ................................................................ (3-0-3)

Total: (12-9-15) or (13-6-15)

**Spring**
- EBME 309, Modeling of Biomedical Systems (3-0-3)
- EBME 359, BME Computer Simulation Lab (0-3-1)
- BME Specialty Sequence (3-0-3)
- H/SS ................................................................ (3-0-3)
- BME Specialty Sequence (3-0-3)
- Open Elective (3-0-3)

Total: (15-3-16)

d. Students take at least one math or science course approved by BME department.

e. STAT 312, STAT 353, or STAT 332 fulfill the statistics requirement.

Check with sequence advisor to determine the most appropriate class.

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a. This is a typical program. Specialty sequences are designed with courses in a desired order that might vary from the one here. Programs must be planned with a faculty adviser in the Department of Biomedical Engineering.

b. This optional course is limited to freshmen. This can be replaced by an open elective.

c. Courses are chosen depending on the BME specialty sequence as listed below.

d. Students take at least one math or science course approved by BME department.

e. STAT 312, STAT 353, or STAT 332 fulfill the statistics requirement.

Check with sequence advisor to determine the most appropriate class.
BME Specialty Sequence Classes

To ensure depth in a particular area, students take one of the seven specialty sequences listed below. Students should consult the website of the Department of Biomedical Engineering to learn more about the educational program and to determine the best order for taking courses in a particular sequence.

**Biomechanics**
- EMAC 181, ECIV 310, EMAE 250, EMAE 271, and EMAE 372; and technical electives from EBME 307, EBME 311, EBME 324, EBME 402, EMAE 377, EMAE 350, EBME 307, EMAE 415, EMAE 370

**Biomaterials (polymeric)**
- EMAC 270, CHEM 223, EMAE 351, and EBME 303; and technical electives from EBME 416, EBME 405, EMAE 377, CHEM 360, EBME 311, EMAE 376, EBME 406, EBME 408, EMAC 276, and EMAC 352, EMAE 351, and EMAC 377.

**Biomaterials (orthopedic)**
- EMSE 201, ECIV 310, EMAE 303, and EBME 270; and technical electives from EBME 405, EMSE 316, EBME 416, EMSE 202, EMSE 270, EMSE 313, EMAE 411, EMAE 372, EMAC 276, EMAE 250, EBME 303, EBME 311, EBME 406, EBME 408, EMAE 415

**Biomaterials (Tissue Engineering)**
- CHEM 223, ECE 360, EMAC 270, and ECE 340; and technical electives such as EBME 405, EBME 416, EMAE 377, BIOC 307, CBIO 453, EBME 406, EBME 408, ECE 364, EMAE 376, BIOC 308, and EBME 303.

**Biomedical Computing & Imaging**
- ECES 233, ECES 337, and EBME 320; and technical electives from ECES 281, EBME 431, ECES 375, EBME 324, ECES 340, ECES 391, MIDS 329, EBME 461, ECES 375, ECES 341, ECES 338, and MATH 304

**Biomedical Instrumentation (devices)**
- ECES 245, ECES 281, and ECES 344; and technical electives from EEAP 382, EEAP 309, ECES 315, ECES 403, EBME 320, EMAE 324, ECES 321, EMAE 418, PHYS 226, ECES 282, ECES 322, ECES 344, ECE 370, ECE 380, and ECES 381.

**Biomedical Systems & Control**
- ECES 304, ECES 313, ECES 322, and EMAE 181; and technical electives ECES 306, MATH 201, EBME 324, OPRE 345, EBME 402, EBME 407, EBME 320, MATH 201, OPRE 345, EBME 461, EBME 307, and ECES 346.

**Notes**
- This gives 129 credits. Varies from sequence to sequence.
1. Construct models of biomedical systems, and solve them using a combination of modern computer applications and theory.
2. Measure physical phenomena relevant to medicine and biology using state-of-the-art instrumentation.
3. Design electronic instruments useful to the medical community.
4. Understand problems presented by the medical community, and translate them into solvable engineering problems.
5. Write effectively in a technical style.
6. Speak effectively to both technical and non-technical audiences, and
7. Work effectively in a team setting.

To be successful in developing the subset of skills technical in nature in the list above:
8. Students must be well-trained in biological, mathematical, scientific, and engineering fundamentals.

Students, upon graduating from our program, should be:
9. Aware of real-life contemporary biomedical problems,
10. Sensitive to biomedical ethical issues,
11. Knowledgeable in one of the specialty areas central to the discipline of biomedical engineering.

Some B.S. graduates are employed in industry and medical centers. Others continue studies in biomedical engineering and other fields. Students with engineering ability and an interest in medicine may consider the undergraduate biomedical engineering program as an exciting alternative to conventional premedical programs. The undergraduate program has three major components (1) Engineering Core, (2) BME Core, and (3) BME Specialty Sequence. The Engineering Core provides a broad background in mathematics, sciences, and engineering. A typical program of study is shown in the table. The BME Core integrates engineering with biomedical science to solve biomedical problems. Hands-on experience in BME is developed through the undergraduate laboratory and project courses. In addition, by choosing a BME specialty sequence, the student can learn in depth about a specific area. This integrated program is designed to ensure that BME graduates are competent engineers. Students may select open electives for educational breadth or depth or to meet entrance requirements of medical school or other professional career choices. BME faculty serve as student advisors to guide students in choosing the program of study most appropriate for individual needs and interests.

**Biomedical Engineering Specialty Electives**

Common BME specialties are biomaterials (orthopaedic, polymeric, tissue engineering), biomechanics (prosthetics and tissues), biomedical instrumentation (devices & sensors), biomedical computing and imaging, and biomedical systems & control. Courses for these specialties are presented in the table. Complete descriptions and suggested schedules for approved specialties are available on the department’s web page (bme.case.edu). These specialties provide the student with a solid background in a well-defined area of biomedical engineering. To meet specific educational needs, students may choose alternatives from among the suggested electives or design unique specialties subject to departmental guidelines and faculty approval.

**Co-op and Internship Programs**

Opportunities are available for students to alternate studies and work in industry as a co-op student, which is integrated in a 5-year program. Alternatively, students may obtain employment as summer interns.

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**Minor in Biomedical Engineering**

A minor in biomedical engineering is offered to students who have taken the Engineering Core requirements. The minor consists of 15 credit hours based on two required courses, EBME 201/EBME 202 and an approved set of three electives chosen from among EBME 303, EBME 306, EBME 308, EBME 309/359, EBME 310/360, EBME 311, EBME 320, and EBME 324.

**B.S./M.S. Program**

Undergraduates with a strong academic record may apply in their junior year for admission to the integrated B.S./M.S. program. A senior research project that begins in the summer after the junior year is designed to expand into an M.S. thesis. Also, the student begins to take graduate courses in the senior year. With continuous progress in research during three summers and the academic years, this program can lead to both the B.S. and M.S. in 5 years.

**Graduate Programs**

The objective of our graduate education program is to educate biomedical engineers for careers in industry, academia, health care, and government, and to advance research in biomedical engineering. The department provides a learning environment that encourages students to apply biomedical engineering methods to advance basic scientific discovery, integrate knowledge across the spectrum from basic cellular and molecular biology through tissue, organ, and whole body physiology and pathophysiology, and to exploit this knowledge to design diagnostic and therapeutic technologies that improve human health. The unique and rich medical, science, and engineering environment allows research projects ranging from basic science through engineering design and clinical application.

Numerous fellowships and research assistantships are available to support graduate students in their studies.

**M.S. Programs**

The M.S. program in biomedical engineering provides breadth in biomedical engineering and biomedical sciences with depth in an engineering specialty. In addition, students are expected to develop the ability to work independently on a biomedical research or design project. The M.S. requires a minimum of 30 credit hours. With an M.S. research thesis (Plan A), a minimum of 21 credits hours is needed in regular course work and 9 hours of thesis research (EBME 651). With an M.S. project (Plan B), a minimum of 27 credits is needed in regular course work, and three hours of project research (EBME 601).

**Master of Engineering and Management - Biomedical Entrepreneurship**

Biomedical engineering students may apply for the Biomedical Entrepreneurship concentration in the Master of Engineering (MEM) program. The MEM is a joint degree offered by The Institute for the Integration of Management and Engineering (TIIME), in the Case School of Engineering and the Weatherhead School of Management. The objective of this program is to develop biomedical engineers with the business and management context required to enable them to drive innovation within biomedical companies while serving in a technical capacity.

Students can enter the program as undergraduates. The program does not interfere with undergraduate degree requirements. The curriculum includes courses integrating engineering and management, as well as industrial internships. By making use of summers
for both course work and internships, the degree is completed in one additional year beyond the B.S., for a total of five years.

Students should apply through TIME.

Ph.D. Program in Biomedical Engineering

For those students with primary interest in research, the Ph.D. in biomedical engineering provides additional depth and breadth in engineering and the biomedical sciences. Under faculty guidance, students are expected to undertake original research motivated by a biomedical problem. Research possibilities include the development of new theory, devices, or methods for diagnostic or therapeutic applications as well as for measurement and evaluation of basic biological mechanisms.

The Ph.D. program requires a minimum of 13 courses beyond the B.S. degree. There are four required core courses (EBME 403, 409, 451, 452). The balance of the courses can be chosen with significant flexibility to meet the career goals of the student, and to satisfy requirements of depth and breadth. Programs of study must include three graduate level courses in biomedical sciences and two courses whose content is primarily mathematical. Two semesters of departmental seminar attendance (EBME 611, 612) and three semesters of teaching experience (EBME 400T, 500T, 600T) are also required. Ph.D. programs of study are reviewed and must be accepted by the Graduate Education Committee and the department chairperson. Eighteen hours of EBME 701 registration are required.

Ph.D. candidacy requires passing certain milestones. A student is advanced to Ph.D. candidacy after passing the Ph.D. Qualifying Exam and obtaining approval of the Ph.D. short proposal. The Ph.D. is completed when the dissertation has been written and defended, and when at least two manuscripts have been submitted for publication and at least one of the two is accepted.

Ph.D. Program in Biophysics-Bioengineering

This program, which is administered through the School of Medicine is jointly sponsored with the Department of Physiology and Biophysics. A full description is available in the section on the School of Medicine.

Ph.D. Program in Neuroscience-Bioengineering

This program, which is administered through the School of Medicine is jointly sponsored with the Department of Neurosciences. A full description is available in the section on the School of Medicine.

Ph.D./M.D. Programs

Students with outstanding qualifications may apply to either of two M.D./Ph.D. programs. Students interested in obtaining a combined M.D./Ph.D., with an emphasis on basic research in biomedical engineering, are strongly encouraged to explore the Medical Scientist Training Program (MSTP), administered by the School of Medicine. Alternatively, the Physician Engineer Training Program (PETP) was established to train future physicians who also possess expertise in state-of-the-art engineering medical technologies, with a research focus on applied biomedical engineering. The PETP is administered through the BME Department. It is expected that graduates of the PETP will have a strong interest in the biomedical industrial sector, clinical medicine, or in academic positions in biomedical engineering, rather than the traditional M.D./Ph.D. career pathway in academic medicine.

Both M.D./Ph.D. programs require approximately 7-8 years of intensive study after the B.S.

Research Areas

Several research thrusts are available to accommodate various student backgrounds and interests. Strong research collaborations with clinical and basic science departments of the university and collaborating hospitals bring a broad range of opportunities, expertise, and perspective to student research projects.

Biomaterials/Tissue Engineering

Materials for implantation, including neural and cardiovascular tissue engineering, biomimetic materials, liposomal and controlled drug delivery, and biocompatible polymer surface modifications. Analysis of synthetic and biologic polymers by AFM, nanoscale structure-function relationships of orthopedic biomaterials.

Biomedical Image Processing and Analysis

MRI, PET, untrasound, optical coherence tomography, cardiac electrical potential mapping, human visual perception, image guided intervention.

Biomedical Sensing

Optical sensing, electrochemical and chemical fiber-optic sensors, chemical measurements in cells and tissues, endoscopy.

Cardiac Bioelectricity

Cardiac electrophysiology (at ion-channel, cell, and tissue levels), models of cellular activity, mechanisms of cardiac arrhythmias, optical imaging of electrical propagation in the heart, noninvasive electrocardiographic imaging.

Neural Engineering and Neural Prostheses

Neuronal mechanisms; neural interfacing for electric and magnetic stimulation and recording; neural dynamics, ion channels, second messengers, nitric oxide, signal processing in the retina; neural prostheses for control of limb movement, bladder, bowel, and respiratory function.

Transport and Metabolic Systems Engineering

Modeling and analysis of tissue responses to heating (tumor ablation, implanted artificial heart) and of cellular metabolism related to organ and whole-body function in health (exercise) and disease (cardiac).

Facilities

The administrative offices of the Department of Biomedical Engineering are located in the Wickenden Building, which houses many BME research laboratories as well as the Center for Cardiovascular Biomaterials (CCB) and the Cardiac Bioelectricity Research and Training Center (CBRTC). Within the CCB are the laboratories for biomaterials microscopy, biopolymer & biomaterial interfaces, and molecular simulation. Other biomaterials related laboratories include Cell and Tissue Engineering and Biomaterials Protein Engineering. The CBRTC includes laboratories for High-Performance Cardiac Simulation and Display, Cardiac Cell Experiments, Cardiac Cell Imaging, and Cardiac Optical and Electrical Mapping. Optical laboratories deal with Microspectroscopic Diagnostics and Fiberoptic Biosensors. Diagnostic optical and electrochemical techniques are developed in the laboratory for Microchemical Sensors. The laboratory for Biomedical Image Processing and Analysis works on images from the molecular level to the tissue-organ level. Primary BME faculty are also directors of laboratories in other locations. The Endoscopy Research Laboratory is the center for work on Optical Computed Tomography. The Applied Neural Control Laboratory is a major facility for basic research and animal experimentation in the development of neural prostheses. The Neural Engineering Center
and Laboratory is a major facility for basic research and animal experimentation. The focus is on recording and controlling neural activity to increase our understanding of the nervous system and to develop neural prostheses. The Functional Electrical Stimulation Center develops techniques for restoration of movement in paralysis, control of the nervous system, and implantable technology. Also, it promotes technology transfer and disseminates information about biomedical electrical stimulation. The Rehabilitation Engineering Center evaluates clinical functionality of neuroprostheses.

The department faculty and students have access to the facilities and major laboratories of the Case School of Engineering and of the School of Medicine. Faculty have numerous collaborations at University Hospitals, MetroHealth Medical Center, VA Medical Center, and the Cleveland Clinic Foundation. These provide extensive research resources in a clinical environment for both undergraduate and graduate students.

Biomedical Engineering (EBME)

Undergraduate Courses

EBME 105. Introduction to Biomedical Engineering (3)
Biomedical engineering fields of activity. Research, development, and design for biomedical problems, diagnosis of disease, and therapeutic applications.

EBME 201. Physiology-Biophysics I (3)

EBME 202. Physiology-Biophysics II (3)
Biological control systems. Cardiovascular, renal, respiratory, gastro-intestinal, and immune systems.

EBME 300. Dynamics of Biological Systems: A Quantitative Introduction to Biology (3)
(See BIOL 300.) Cross-listed as BIOL 300.

EBME 303. Structure of Biological Materials (3)
Structure of proteins, nucleic acids, connective tissue and bone from molecular to microscopic levels. Principles and applications of instruments for imaging, identification, and measurement of biological materials. Prereq: EBME 202. Cross-listed as EMAC 303.

EBME 306. Introduction to Biomedical Materials (3)
Applications of biomaterials in different tissue and organ systems. Relationship between physical and chemical structure of materials and biological system response. Choosing, fabricating and modifying materials for specific biomedical applications. Prereq: EBME 201 and EBME 202.

EBME 307. Biomechanical Prosthetic Systems (3)
Introduction to the basic biomechanics of human movement and applications to the design and evaluation of artificial devices intended to restore or improve movement lost due to injury or disease. Measurement techniques in movement biomechanics, including motion analysis, electromyography, and gait analysis. Design and use of upper and lower limb prostheses. Principles of neuroprostheses with applications to paralyzed upper and lower extremities.

EBME 308. Biomedical Signals and Systems (4)

EBME 309. Modeling of Biomedical Systems (3)
Mathematical modeling and computer simulation techniques with biomedical applications. Nonlinear dynamics and finite difference equations as applied to cellular and physiological systems. Theoretical models of excitable tissues (nerve and muscle). Application of electromagnetic field theory to bioelectric systems. Volume conductor fields generated by nerve, muscle, and cardiac excitation.

EBME 310. Principles of Biomedical Instrumentation (3)

EBME 311. Artificial Organs (3)

EBME 313. Biomedical Engineering Laboratory I (2)
Experiments for measurement, assisting, replacement, or control of various biomedical systems. Prereq: EBME 201, EBME 202 and ENGR 210. Coreq: ENGL 398N.

EBME 314. Biomedical Engineering Laboratory II (2)
Continuation of EBME 313. Prereq: EBME 201, EBME 202 and ENGR 210.

EBME 320. Medical Imaging Fundamentals (3)
Physical principles of medical imaging. Imaging devices for x-ray, ultrasound, magnetic resonance, etc. Image quality descriptions. Patient risk. Prereq: EBME 201, EBME 202, EBME 308, and EBME 310 or equivalent.

EBME 324. Laboratory Computing in Biomedical Engineering (3)

EBME 350. Quantitative Molecular Bioengineering (3)
The teaching objective of this course is to equip the students with a “molecular toolbox”—a set of quantitative skills that permit intelligent design of engineering solutions for medical problems at the molecular level. The core of the course will build on the physical and chemical principles in equilibrium, kinetics, and mass transport. Specific biomedical examples in bioengineering systems will be used throughout the course to illustrate the importance of understanding and application of these principles in problem solving. Prereq: ENGR 225.

EBME 359. Biomedical Computer Simulation Laboratory (1)
Computer simulation and mathematical models of biomedical systems. MATLAB software tools are used to demonstrate the basic properties of dynamical systems, numerical methods and their application to biomedical problems. Coreq: EBME 309.

EBME 360. Biomedical Instrumentation Laboratory (1)
A laboratory which focuses on the basic components of biomedical instrumentation and provides hands-on experience for students in EBME 310, Biomedical Instrumentation. The purpose of the course is to develop design skills and laboratory skills in analysis and circuit development. Coreq: EBME 310.

EBME 380. Design for Biomedical Engineers (3)
Design a useful product with potential commercial value. This course offers a design experience that builds on the fundamentals of Biomedical Engineering through the effective use of teams and team design. Prereq: EBME 310.

EBME 396. Special Topics in Undergraduate Biomedical Engineering I (1-18)
(Credit as arranged.) Prereq: Consent of instructor.

EBME 398. Senior Project Laboratory I (3)

EBME 399. Senior Project Laboratory II (3)

Graduate Courses

EBME 400T. Graduate Teaching I (0)
This will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to consist of direct student contact, but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational opportunity for the student. Students in this course may be expected to perform both contact (C) and non-contact (NC) teaching in this course sequence. Examples are: de-
EBME 402. Muscles, Biomechanics, and Control of Movement (4)

EBME 403. Biomedical Transducers (3)
Analysis and design of transducers: optical, photo-electric, electrochemical, electrical, mechanical, electromechanical, and thermo-electric. Applications to biomedical systems. Prereq: EBME 310 and EBME 360 or consent of instructor.

EBME 405. Materials for Prosthetics and Orthotics (3)

EBME 406. Polymers in Medicine (3)
Distribution of plastic implants in the body, including history and statistics; chemical and physical characteristics of biomedical polymers, including general implant requirements, reactions of the host to implants, reactions of implants to physiological conditions, physiological and biomechanical basis for soft-tissue implants; plastic materials used in medicine and surgery; frontiers in biomedical polymers (current topics directed to the design and development of new biomedical polymers). Prereq: Consent of instructor. Cross-listed as EMAC 471.

EBME 407. Applied Neural Control (3)
Fundamental concepts related to electrical stimulation of the nervous system. Cable equation, currents in volume conductors, electrical models of axons, interaction between axons and electrical fields, tissue damage of electrical stimulation, electrochemistry of electrical stimulation, electrodes for electrical stimulation, applications to neuromuscular, sensory, and other physiological systems. Prereq: EBME 451 and EBME 409.

EBME 408. Tissue and Cellular Engineering (3)
Tissue engineering approach for augmentation or replacement of compromised tissue function in nerve, microvessels, skin and cartilage. Integrative exploration of the use of three-dimensional polymeric scaffolds and drug delivery vehicles, and gene therapy and cellular engineering for functional repair of injured tissues. Prereq: Consent of instructor.

EBME 409. Systems and Signals in Biomedical Engineering (3)
Modeling concepts (probability, kinetics, mass transport, parameter estimation); dynamic systems (nonlinear, lumped, distributed, Laplace transform, matrices, eigenvalues, linearization, stability, phase-plane); signal analysis (continuous and discrete, time and frequency domains, spectral representation, Fourier analysis, data sampling, noise analysis, filtering, aliasing); numerical methods (initial-value problems, finite differences, Fourier transforms, matrix operations, nonlinear estimation, image processing, power spectrum analysis, MATLAB implementation). Prereq: EBME 308 or equivalent.

EBME 410. Medical Imaging Fundamentals (3)
Physical principles of medical imaging. Imaging devices for x-ray, ultrasound, magnetic resonance, etc. Image quality descriptions. Patient risk. Prereq: EBME 308 and EBME 310 or equivalent.

EBME 411. Artificial Organs (3)
Engineering for replacement or augmentation of tissues (e.g., nerve or vascular) and organs (e.g., kidney and heart). Chemical, electrical, mechanical, materials, pathological and surgical aspects. Prereq: EBME 451 and EBME 452.

EBME 412. Biomedical Signal Processing (3)

EBME 414. Laboratory Computing in Biomedical Engineering (3)
Hardware and software aspects of computer systems for laboratory applications. Analog and digital interfacing. Signal conditioning and sample requirements. Computer control of laboratory instruments and data acquisition. Biomedical applications. Prereq: EBME 308 or equivalent.

EBME 416. Biomaterials in Drug Delivery (3)
Fundamental principles in design and engineering of molecular architectures of biomaterials for biomedical applications. Structure-function relationships at the molecular level. Tailoring the surface and bulk structures for applications in drug delivery, tissue engineering, and biomedical imaging. Prereq: EBME 303 or EMAC 303. Coreq: EBME 306.

EBME 417. Structure and Function of Excitable Cells (3)
Ion channels are the molecular basis of membrane excitability in all cell types, including neuronal, heart, and muscle cells. This course presents the structure and the mechanism of function of ion channels at the molecular level. It introduces the basic principles and methods in the ion channel study including the ionic basis of membrane excitability, thermodynamic and kinetic analysis of channel function, voltage clamp and patch clamp techniques, and molecular and structural biology approaches. The course will cover structure of various potassium, calcium, sodium, and chloride channels and their physiological function in neural, cardiac, and muscle cells. Exemplary channels that have been best studied will be discussed to illustrate the current understanding of the molecular mechanisms of channel gating and permeation. Prereq: Consent of instructor.

EBME 418. Electronics for Biomedical Engineering (3)

EBME 427. Movement Biomechanics and Rehabilitation (3)
Introduction to the basic biomechanics of human movement and applications to the design and evaluation of artificial devices intended to restore or improve movement lost due to injury or disease. Measurement techniques in movement biomechanics, including motion analysis, electromyography, and gait analysis. Design and use of upper and lower limb prostheses. Principles of neuroprostheses with applications to paralyzed upper and lower extremities. Term paper required. Prereq: Consent of instructor.

EBME 431. Physics of Imaging (3)
Description of physical principles underlying the spin behavior in MR and Fourier imaging in multi-dimensions. Introduction of conventional, fast, and chemical-shift imaging techniques. Spin echo, gradient echo, and variable flip-angle methods. Projection reconstruction and sampling theorems. Bloch equations, T1 and T2 relaxation times, RF penetration, diffusion and perfusion. Flow imaging, MR angiography, and functional brain imaging. Sequence and coil design. Prerequisite may be waived with consent of instructor. Prereq: PHYS 122 or PHYS 124 or EBME 410. Cross-listed as PHYS 431.

EBME 447. Rehabilitation for Scientists and Engineers (3)
Medical, psychological, and social issues influencing the rehabilitation of people with spinal cord injury, stroke, traumatic brain injury, and limb amputation. Epidemiology, anatomy, pathophysiology and natural history of these disorders, and the consequences of these conditions with respect to impairment, disability, handicap and quality of life. Students will directly observe the care of patients in each of these diagnostic groups throughout the full continuum of care starting from the acute medical and surgical interventions to acute and subacute rehabilitation, outpatient medical and rehabilitation management and finally to community re-entry. Prereq: Consent of department.

EBME 451. Physiological Processes I (3)

EBME 452. Physiological Processes II (3)
Heart and vascular system. Respiratory, renal, and regulatory systems. Gastro-intestinal system and metabolism. Prereq: Consent of instructor.
EBME 460. Advanced Topics in NMR Imaging (3)
Frontier issues in understanding the practical aspects of NMR imaging. Theoretical descriptions are accompanied by specific examples of pulse sequences, and basic engineering considerations in MRI system design. Emphasis is placed on implications and trade-offs in MRI pulse sequence design from real-world versus theoretical perspectives. Prereq: EBME 431 or PHYS 431. Cross-listed as PHYS 460.

EBME 461. Biomedical Image Processing and Analysis (3)
Principles of image processing and analysis with applications to biomedical images from the nano-scale to 3D whole organ imaging. Topics include image filtering, enhancement, restoration, registration, morphological processing, and segmentation. Prereq: EBME 409 or equivalent.

EBME 478. Computational Neuroscience (3)
Computer simulation of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural circuits, as well as to cable theory, passive and active compartmental modeling, numerical integration methods, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week. Cross-listed as EECS 478.

EBME 479. Seminar in Computational Neuroscience (3)
Readings and discussion in the recent literature on computational neuroscience, adaptive behavior, and other current topics. Cross-listed as BIOL 479.

EBME 500T. Graduate Teaching II (0)
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to consist of direct student contact, but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational opportunity for the student. Students in this course may be expected to perform both contact (C) and non-contact (NC) teaching in this course sequence. Examples are: develop teaching or lecture materials (NC); run recitation groups (C); provide laboratory assistance (C) or (NC); present individual lectures (C), tutor (C); prepare and grade exams/quizzes/homework (NC). Prereq: Ph.D. student in Biomedical Engineering.

EBME 501. Bioelectric Phenomena (3)

EBME 502. Cardiac Excitation, Rhythm, and Control (3)

EBME 503. Biomolecular Forces (3)
Advanced course on the theory, measurement, and analysis of the intermolecular physical forces that dominate cell and molecular interactions in dynamic aqueous systems. The aim of this course is to provide students involved in biomaterials engineering and studies on cell and molecular interactions with (i) a quantitative and fundamental understanding of the intermolecular forces (electrostatic, van der Walls, solvation forces) that direct cell and molecular adhesion, self-assembling systems (bilayers, cell membranes) and specific and non-specific receptor-ligand binding; (ii) the ability to develop mechanistic models for surface adhesion, self-assembly, cell surface binding and signal transduction; and (iii) skills for measurement and quantitative analysis of forces (nano- to pico-Newton levels) in the “near-surface” (1-10 nm) domain by atomic force microscopy and related force measurement techniques. Prereq: EBME 405 or EBME 406, undergraduate electricity and magnetism, undergraduate physical chemistry, or consent of instructor.

EBME 504. Transport Processes of Biomedical Systems (3)

EBME 507. Motor System Neuroprostheses (3)
Design and implementation of neuroprostheses. Transformation of muscle action into limb movement. Musculoskeletal modeling and simulation. Control of the musculoskeletal system by neural stimulation. Prereq: Consent of instructor.

EBME 511. Nonlinear Wavefront Dynamics in Cardiac Bioelectricity (3)
Mathematical and descriptive analysis of atrial fibrillation and flutter and various types of action potential reentry. Specific aspects include phase resetting, electrical restitution and alternans generation, conduction velocity variation, spiral wave propagating patterns and stability, and propagation failure. Computer models will be used to illustrate the concepts with simulations related to the physiology, diagnosis, and treatment of abnormal cardiac rhythm. Prereq: EBME 409.

EBME 513. Biomedical Optical Diagnostics (3)
Engineering design principles of optical instrumentation for medical diagnostics. Elastic and inelastic light scattering theory and biomedical applications. Confocal and multi-photon microscopy. Light propagation and optical tomographic imaging in biological tissues. Design of minimally invasive spectroscopic diagnostics. Prereq: EBME 403 or PHYS 326 or consent.

EBME 517. Quantitative Neurophysiology (3)
This course provides a unique opportunity to gain advanced knowledge in the area of neurophysiology, neuroscience, and cellular biophysics/physiology from the quantitative point of view. The instructors are from different departments which will give students the rare opportunity to learn and understand the material from various angles. The mathematical load varies depending on the topic, however the familiarity with or willingness and ability to learn basic important mathematical concepts such as differentiation, probability, or matrices is essential. The course will start by studying the laws of physics that govern the behavior of ions in biological solutions and near the cell membrane. The next part of the course deals with the voltage-gated ion channels of the excitable cell: activity, structure, functions, and models. The third part is devoted to modeling electrical activity of a neuron. The fourth part describes the synaptic interaction between neurons, from presynaptic calcium dynamics to postsynaptic membrane and ligand-gated channels. The last part applies the acquired knowledge to understanding a neuronal network (hippocampus). Along with the lectures, the students will prepare a model of the neuronal circuit using the NEURON software. This project will be in constant development during the course, i.e., the complexity of the model will increase as long as new material is learned. Prereq: MATH 224, EBME 451, or BIOL 375/475, or permission of department.

EBME 519. Parameter Estimation for Biomedical Systems (3)
Linear and nonlinear parameter estimation of static and dynamic models. Identifiability and parameter sensitivity analysis. Statistical and optimization methods. Design of optimal experiments. Applications to cells, tissues, and organs. Prereq: EBME 409 or consent of instructor.

EBME 523. Chemical and Optical Sensors (3)

EBME 550. Neuromechanics Seminar (0)
Current research in neuromechanical systems, including movement control in natural organisms, biologically inspired robots, and hybrid (artificial/natural) neural prosthetic systems. Presentations by students, faculty, and visiting scholars. Cross-listed as BIOL 550, EECS 550, and EMAE 550.

EBME 600T. Graduate Teaching III (0)
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to consist of direct student contact, but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational opportunity for the student. Students in this course may be expected to perform both contact
lum. Chemical engineering undergraduates are members of the science can be integrated with the chemical engineering curriculum. A minor in macromolecular chemical engineering provides depth and specialization for undergraduates majoring in materials, environmental engineering, management/entrepreneurship, and law (mainly for patent law). The Bachelor of Science degree is accepted by graduate schools in engineering, chemistry, medicine, and materials related industries, in government, and are readily employed. Chemical engineers work in the chemical and materials related industries, in government, and are readily accepted by graduate schools in engineering, chemistry, medicine, and law (mainly for patent law). The Bachelor of Science degree is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.  

The department offers Bachelor of Science in Engineering, Master of Science, and Doctor of Philosophy degree programs that provide preparation for work in all areas of chemical engineering. Breadth sequences in biochemical engineering, biomedical engineering, computing, electrochemical engineering, electronic materials, environmental engineering, management/entrepreneurship, polymer science, systems and control, or advanced studies provide depth and specialization for undergraduates majoring in chemical engineering. In addition, for students with a strong interest in polymer engineering, a minor in macromolecular science can be integrated with the chemical engineering curriculum. Chemical engineering undergraduates are members of the student chapter of the American Institute of Chemical Engineers (AIChE). The AIChE chapter sponsors social events, field trips to local industry, technical presentations by outside speakers, and employment counseling. Information about the AIChE can be obtained through the department, the chapter president or the chapter advisor. There are fifteen full-time faculty members, all of whom are pursuing active research programs. The research of the faculty is aimed at advanced and cutting-edge areas of chemical engineering.

**Faculty**

Peter N. Pintauro, Ph.D. (University of California, Los Angeles)  
Professor and Department Chair  
Electrochemical engineering, membrane fabrication, modeling transport in ion-exchange membrane, organic electrochemical synthesis, fuel cells

John C. Angus, Ph.D. (University of Michigan)  
Kent Hale Smith Professor of Engineering  
Chemical vapor deposition of diamond, electrochemistry of diamond gallium nitride synthesis

Harilaha Baskaran, Ph.D. (The Pennsylvania State University)  
Assistant Professor  
Transport Phenomena in Biology and Medicine

Robert V. Edwards, Ph.D. (Johns Hopkins University)  
Professor  
Laser anemometry, mathematical modeling, data acquisition

Donald L. Feke, Ph.D. (Princeton University)  
Professor and Interim Associate Provost for Planning and Assessment  
Colloidal phenomena, dispersive mixing, fine particle processing

Nelson C. Gardner, Ph.D. (Iowa State University)  
Associate Professor  
High-gravity separations, sulfur removal processes

Jeffrey T. Glass, Ph.D. (University of Virginia), M.B.A. (Duke University)  
Joseph S. Toot Professor of Engineering  
Plasma processing and materials characterization of thin films, measurement of device properties

Howard L. Greene, Ph.D. (Cornell University)  
Principal Researcher  
Catalysis and reactor design

Robert E. Harris, Ph.D. (Northeastern University), M.B.A. (Case Western Reserve University)  
Adjunct Professor of Engineering  
Process design, process synthesis, analysis, design and simulation

Uziel Landau, Ph.D. (University of California, Berkeley)  
Professor  
Electrochemical engineering, modeling of electrochemical systems, electrodeposition, batteries and fuel cells

Chung-Chian Liu, Ph.D. (Case Institute of Technology)  
Wallace R. Persons Professor of Sensor Technology & Control  
Electrochemical sensors, electrochemical synthesis, electrochemistry related to electronic materials

J. Adin Mann, Jr., Ph.D. (Iowa State University)  
Professor  
Surface phenomena, interfacial dynamics, colloid science, light scattering, biomembranes, molecular electronics

Heidi B. Martin, Ph.D. (Case Western Reserve University)  
Nord Assistant Professor of Engineering  
Conductive Diamond Films; Electrochemical Sensors; Chemical Modification of Surfaces for Electrochemical and Biomedical Applications; Biomaterials; Microfabrication of Sensors and Devices

Philip W. Morrison, Jr., Ph.D. (University of California, Berkeley)  
Associate Professor  
Materials synthesis, in-situ diagnostics of thin film and particle formation processes

Syed Qutubuddin, Ph.D. (Carnegie Mellon University)  
Professor  
Surfactant and polymer solutions, separations, nanoparticles, novel polymeric materials, nanocomposites
Undergraduate Programs

The Case School of Engineering prepares and challenges its students to take leadership positions in engineering and computer science. The increasing role of technology in virtually every facet of our culture — communications, transportation, construction, health care, the environment, and even our system of wealth distribution — makes it vital that engineering-oriented students have access to progressive and cutting-edge programs stressing the following five areas of excellence:

Bachelor of Science in Engineering Degree
Major in Chemical Engineering

Freshman Year

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<tr>
<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>PHYS 121 General Physics I Mechanics *</td>
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<tr>
<td>CHEM 111 Principles of Chemistry I</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
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<tr>
<td>PHED 101 Physical Education Activities</td>
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Spring

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<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>PHYS 122 General Physics II Electricity &amp; Magnetism *</td>
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<tr>
<td>ENGR 145 Chemistry of Materials</td>
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<tr>
<td>MATH 122 Calculus for Science and Engineering II</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming</td>
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<tr>
<td>Humanities/Social Science Elective</td>
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<tr>
<td>PHED 102 Physical Education Activities</td>
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Sophomore Year

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<th>Class-Lab-Credit Hours</th>
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<tr>
<td>Fall</td>
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<tr>
<td>CHEM 223/323 Organic Chemistry</td>
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<tr>
<td>MATH 225 Calculus for Science &amp; Engineering III</td>
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<tr>
<td>ENGR 225 Thermodynamics, Fluids, Heat &amp; Mass Transfer</td>
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<tr>
<td>ECHE 260 Introduction to Chemical Systems</td>
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<tr>
<td>ECHE 151 Chemical Engineering at Case</td>
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<tr>
<td>Humanities/Social Science or Science Elective I</td>
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Spring

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<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Science Elective II b</td>
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<tr>
<td>MATH 224 Differential Equations</td>
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<tr>
<td>STAT 313 (or STAT 312) Statistics for Experimenters</td>
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<tr>
<td>ECHE 363 Chemical Engineering Thermodynamics</td>
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<tr>
<td>Humanities/Social Science Sequence I</td>
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Junior Year

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<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
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<tr>
<td>ECHE 360 Transport Phenomena for Chemical Systems</td>
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<tr>
<td>ECHE 367 Process Control</td>
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<tr>
<td>ENGR 210 Circuits &amp; Instrumentation</td>
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<tr>
<td>CHEM 290 Advanced Chemical Laboratory Methods</td>
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<tr>
<td>Breadth Elective Sequence I or Humanities/Social Science Elective</td>
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Spring

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<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>ECHE 361 Separation Processes</td>
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<td>ECHE 365 Measurements Laboratory</td>
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<tr>
<td>ENGL 398N Professional Communications</td>
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<tr>
<td>ECHE 364 Chemical Reaction Processes</td>
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<tr>
<td>Humanities/Social Science Elective or Breadth Elective Sequence I</td>
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Senior Year

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<tr>
<td>Fall</td>
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<tr>
<td>ECHE 398 Process Analysis and Design</td>
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<tr>
<td>ECHE 362 Chemical Engineering Laboratory</td>
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<tr>
<td>Materials Elective I</td>
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<tr>
<td>Breadth Elective Sequence II</td>
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<tr>
<td>Humanities/Social Science Sequence II</td>
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Spring

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<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>ECHE 399 Chemical Engineering Design Project</td>
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<tr>
<td>CHEM 302 Introductory Physical Chemistry II</td>
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<tr>
<td>ENGR 200 Statics and Strength of Materials</td>
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<tr>
<td>Breadth Elective Sequence III or Humanities/Social Science Elective</td>
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<tr>
<td>Humanities/Social Science Sequence III</td>
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Hours required for graduation: 131-133 (depending on breadth elective sequence).

a. Selected students may be invited to take PHYS 125, 126 General Physics I, II Honors in place of PHYS 121, 122.

b. Science Elective I and II. Students must take any two of the following courses—PHYS 221 General Physics III. Modern (F, Sp), CHEM 224/324 Organic Chemistry II (Sp), or BIOL 205 Chemical Biology (Sp).

c. One materials elective is required. Suggested courses include EMAC 270 Introduction to Polymer Science (F, Sp); EMAC 276 Polymer Properties and Design (F, Sp); EMSE 314 Electrical, Magnetic, Optical Properties of Materials (F); EMSE 316 Applications of Ceramic Materials; or course approved by the chemical engineering faculty.

d. A three course (9 credit hours minimum) breadth sequence (approved by the Chemical Engineering faculty). Preapproved sequences include biochemical engineering, biomedical engineering, computing, electrochemical engineering, electronic materials processing, environmental engineering, management/entrepreneurship, polymer science, systems and control, and advanced study (B.S./M.S.).
Approved Breadth Elective Sequences

Biochemical Engineering (Advisor: Dr. Qutubuddin)
- BIOC 307, General Biochemistry (4) .................................. Fall, junior
- BIOL 343, Microbiology (3) ........................................ Spring, junior
- ECHE 350, Biochemical Engineering (3) .......................... Spring, senior

Biomedical Engineering (Advisor: Dr. Baskaran)
- EBME 201, Physiology-Biophysics I (3) ......................... Fall, junior
- EBME 202, Physiology-Biophysics II (3) ..................... Spring, junior
- EBME 309, Modeling of Biomedical Systems (3)  
  or
- EBME 310, Biomedical Instrumentation (3) ............... Spring, senior

Computing (Advisor: Dr. Edwards)
- ECES 281 Logic Design and Computer Organization (4)  
  Fall, junior
- EECS 233, Introduction to Data Structures (4) ............ Spring, junior
- EECS 346, Engineering Optimization (3) .................. Fall, senior

Electrochemical Engineering (Advisor: Dr. Landau)
- ECHE 380 Electrochemical Technology (3) ............... Fall, junior
  or
- ECHE 381 Electrochemical Engineering (3) .................. Spring, junior
- ECHE 383 Chemical Engineering Applied to  
  Microfabrication and Devices (3) .......................... Fall, senior
  plus one additional course selected from
- EMSE 314 Electronic, Magnetic, and Optical  
  Properties of Materials (3) .................................. Fall, senior
- EMSE 309 Electromagnetic Fields I (3) ..................... Fall, Spring
- EECS 321 Semiconductor Elec. Dev. (4) .................. Spring, senior
- EMSE 411, Environmental Effects on Materials  
  Behavior (3) ................................................ Spring, senior

Electronic Materials (Advisor: Dr. Morrison)
- ECHE 383 Chemical Engineering Applied to Microfabrication  
  and Devices (3) ................................................ Fall, junior
- EMSE 309 Electromagnetic Fields I (3) ..................... Fall, Spring
- EMSE 314 Electronic, Magnetic, and Optical  
  Properties of Materials (3) .................................. Fall, senior
  or
- EECS 321 Semiconductor Electronic Devices (4) .... Spring, senior

Environmental Engineering (Advisor: Dr. Edwards)
- ECIV 368 Environmental Engineering (3) .................. Spring, junior
  and two of the following:
- ECIV 362 Solid and Hazardous Waste  
  Management (3) ........................................ Spring, junior
- GEOL 436 Aquatic Chemistry (3) ............................. Fall, junior
- ECIV 460 Environmental Remediation (3) ................ Spring, senior
- ECIV 464 Environmental Engineering  
  Microbiology (3) ............................................ Fall, senior

Management/Entrepreneurship (Advisor: Dr. Glass)
- ACCT 303/403, Survey of Accounting (3) ............... Fall, junior
- BAFI 353, Corporation Finance (3) ......................... Fall, senior
  plus one additional course selected from
- MKMR 301, Marketing Management (3) .................... Spring, junior
- ENTP 311, New Venture Creation (3) ..................... Spring, junior
- ENTP 310 Entrepreneurial Financing (3) ................ Fall, senior
- ENTP 295 Entrepreneurial Behavior (3) .................. Fall, senior

Polymer Science (Advisor: Dr. Mann)
- EMAC 270, Introduction to Polymer Science (3) ....... Fall, Spring
  plus any two courses selected from
- EMAC 276, Polymer Properties and Design (3) ........ Fall, Spring
- EMAC 376, Polymer Engineering (3) ....................... Spring, junior
- EMAC 377, Polymer Processing (4) ........................ Spring, senior
- EMAC 378, Polymer Production and Technology (3) Spring, senior

Systems and Control (Advisor: Dr. Martin)
- EECS 346, Engineering Optimization (3) ............... Spring, junior
- ECES 281 Logic Design and Computer  
  Organization (4) ......................................... Fall, senior
- EECS 306, Control Engineering II ......................... Spring, senior
  or
- ECHE 463, Model Based Control (3)

Advanced Study Sequence (Advisor: Dr. Morrison)
- ECHE 460, Thermodynamics (3)  
  or
- ECHE 475, Chemical Engineering Analysis (3) .......... Fall, senior
- ECHE 651 Master’s Thesis (3) ............................... Fall, senior
- ECHE 651 Master’s Thesis (3) ............................... Spring, senior
e. In these sequences, coordinate your choice of breadth electives with  
  your choice for the Materials Elective.
f. This sequence is designed for students entering the five-year B.S./M.S.  
  program. Students taking this sequence should rearrange the  
  scheduling of the elective sequence and humanities/social science  
  courses in the junior and senior years to accommodate these courses.
Societal Awareness

- Understanding of the technological and human resource needs of industry, government, and society.
- A sufficiently broad education to understand the impact of engineering on society.
- Opportunities to explore other cultures and learning environments through a Junior Year in Edinburgh program and a summer Chemical Engineering Laboratory course at University College London.

Leadership Skills

- Multiple and integrated opportunities to develop written and oral communication skills.
- Develop specialized knowledge in a series of breadth electives, such as biomedical engineering, biochemical engineering, computing, electrochemical engineering, electronic materials, environmental engineering, management/entrepreneurship, polymer science, control, or research.
- Leadership roles in group-based course activities encouraging a “can do” positive attitude and developing skills in teamwork.

Professionalism

- A commitment to excellence and unquestioned integrity.
- An understanding of safety and ethical issues, and the environmental consequences of the practice of chemical engineering.
- Opportunities for professional development through the Cooperative Education Program.

Elective Sequences

A distinctive feature of the chemical engineering program is the three-course breadth elective sequence taken during the junior and senior years that permits a student to major in chemical engineering and, at the same time, pursue an interest in a related field. Nine elective sequences have standing departmental approval: biomedical engineering, biomedical engineering, computing, electrochemical engineering, electronic materials, environmental engineering, management/entrepreneurship, polymer science, and systems and control. There is also an advanced study sequence for combined B.S./M.S. students.

Minor in Polymer Engineering

For students wanting to pursue an interest in polymers, but major in chemical engineering, two five-course minor sequences, Polymer Processing and Characterization, and Polymer Production are available.

Polymer Processing and Characterization
EMAC 270, Introduction to Polymer Science (F, Sp)
EMAC 376, Polymer Engineering (F, Sp)
EMAC 377, Polymer Processing (F)
EMAC 372, Polymer Processing and Testing Laboratory (Sp)
EMAC 575, Polymer Rheology

Polymer Production
EMAC 270, Introduction to Polymer Science (F,Sp)
EMAC 272, Polymer Analysis Laboratory (Sp)
EMAC 276, Polymer Properties and Design (Sp)
EMAC 378, Polymer Production and Technology (Sp)
EMAC 398, Polymer Sci. & Engr. Project (F, Sp)

Minor Sequence in Chemical Engineering

A minor sequence in chemical engineering is available for students majoring in engineering, chemistry, or physics. A minimum of 15 credits must be completed, and must include ECHE 260 Introduction to Chemical Systems
ENGR 225 Thermodynamics, Fluid Mechanics, Heat and Mass Transfer (F,Sp)
ECHE 360 Transport Phenomena for Chemical Systems (F)
and any two of the following
ECHE 361 Separation Processes (Sp)
ECHE 363 Thermodynamics of Chemical Systems (Sp)
ECHE 364 Chemical Reaction Processes (Sp)
ECHE 365 Measurements Laboratory (Sp)
ECHE 367 Process Control (F)

Five-Year Combined B.S./M.S. Program

This program offers outstanding undergraduate students the opportunity to obtain an M.S. degree, with a thesis, in one additional year of study beyond the B.S. degree. (Normally, it takes 2 years beyond the B.S. to earn an M.S. degree.) In this program, an undergraduate student can take up to nine hours of graduate credit that simultaneously satisfies undergraduate requirements. Typically, students in this program start their research leading to the M.S. thesis in the fall semester of the senior year. The department endeavors to support such students through the following summer and academic year at the normal stipend for entering graduate students. The B.S. degree is awarded at the completion of the senior year. Application for admission to the five year B.S./M.S. program is made after completion of five semesters of course work. Minimum requirements are a 3.2 grade point average and the recommendation of the department.

Five-and-a Half Year Cooperative B.S./M.S. Program

The cooperative bachelor’s/master’s program enables outstanding students who are enrolled in the cooperative program to earn an M.S. in one semester beyond the B.S. degree. Students complete six credits of a graduate project (ECHE 660) during the second co-op period and follow an Advanced Study elective sequence. The courses ECHE 460, ECHE 461, and an agreed-upon mathematics course are used to satisfy both graduate and undergraduate requirements. At the end of the fifth year, the student receives the B.S. degree. Upon completion of an additional 12 credits of graduate work the following semester, the student receives the M.S. degree (non-thesis). Application for admission to the five-and-a-half-year co-op B.S./M.S. program is made during the second semester of the junior year (this semester is taken in the fall of the fourth year). Minimum requirements are a 3.2 grade point average, good performance in the previous co-op assignment, and the recommendation of the department.

Graduate Programs

Master of Science Program

Each M.S. candidate must complete a minimum of 27 hours of graduate-level credits. These credits can be distributed in one of two ways.

Plan A.

Students electing Plan A take 19 hours of graduate-level course work (six courses plus ECHE 401, Chemical Engineering Commu-
Ronizations) and complete at least 9 credit hours of M.S. thesis research.

Plan B.
Part-time students, and those in the 5-1/2-year B.S./M.S. cooperative program, may opt for Plan B, which requires completion of 24 credit hours (eight courses) of approved graduate course work and a 3 credit hour project replacing the M.S. thesis. In special cases, a student may be permitted to complete a 6 credit project. In this case only seven courses will be required.

All M.S. students are required to take the following courses: ECHE 460, Thermodynamics of Chemical Systems (3); ECHE 461, Transport Phenomena (3); ECHE 462, Chemical Reaction Engineering (3); and ECHE 475, Chemical Engineering Analysis (3) or an equivalent graduate-level math course. The other courses should be technical graduate-level courses selected after consultation with the advisor. In special circumstances, e.g., students have taken a similar or complementary course at another university, one of the required courses may be waived from the Program of Study. All full-time M.S. students are expected to do some teaching as part of their education. Also, at various points during their thesis research, students will be required to present seminars and reports on their progress.

Master of Engineering Program
The Department of Chemical Engineering also participates in the practice-oriented Master of Engineering program offered by the Case School of Engineering. In this program, students complete a core program. The Department of Chemical Engineering participates in the Chemical and Materials Processing and Synthesis sequence.

Doctor of Philosophy Program
The degree of Doctor of Philosophy is awarded in recognition of deep and detailed knowledge of chemical engineering and comprehensive understanding of related subjects together with a demonstration of the ability to perform independent investigations, to suggest new areas for research, and to communicate results in an acceptable manner. The minimum course requirements for the Ph.D. degree in chemical engineering are as follows:

Depth Courses
All programs of study must include ECHE 401, Chemical Engineering Communications (1), ECHE 460, Thermodynamics (3), ECHE 461, Transport Phenomena (3), and ECHE 462, Chemical Reaction Engineering (3), plus a minimum of three other chemical engineering courses.

Breadth and Basic Science Courses
A minimum of six courses outside the department must be taken. These can be chosen from other engineering departments and the departments of mathematics, chemistry, physics, biology, and geological sciences. A minimum of two elective courses must be in mathematics.

Comments on Ph.D. Guidelines
The department anticipates that from time to time special cases will arise which are exceptions to the above guidelines, e.g., a student may have taken a graduate-level thermodynamics course at another school. In these cases, the student must attach a statement to the program of study justifying the departure from the guidelines. It should be noted that the above guidelines are a minimum requirement. Only in rare circumstances will programs of study be approved with only 12 courses (36 credit hours). A total of 15 courses (45 credit hours) is typical for the Ph.D. degree. It is expected that the elective courses will form a coherent whole

with a concentration in one area, e.g., systems, polymers, surface science, etc., rather than a smattering of introductory courses in many diverse subjects. All programs are chosen with the approval of the student’s faculty advisor.

Other Requirements for the Ph.D. Degree
Students who wish to enter the Ph.D. program must pass a general examination covering material through the beginning graduate level courses. A thesis proposal and an independently generated proposal are also required. All Ph.D. students must satisfy the residency requirements of the university and the Case School of Engineering. Some teaching is also required. In addition, at various points in the course of the dissertation research, students will be required to prepare reports and seminars on their work, and defend their dissertation. The Chemical Engineering Graduate Student Handbook contains a more detailed description of the department’s Ph.D. requirements and a time schedule for their completion.

Current Research Topics
The research in the department is sponsored by a variety of state and federal agencies, by private industry, and by foundations. current active research topics include:

Electrochemical Engineering
- Fuel cell technology
- Membrane synthesis and modeling
- Bipolar discrete electrodes
- Microelectronic materials, fabrication and processing
- Solid-state electrochemical and biomedical sensors
- Modeling of electrochemical systems, batteries and fuel cells
- Microfabrication by electrodeposition
- Electrodeposition of semiconductors and alloys
- Diamond electrodes
- Corrosion protection

Biochemical Engineering
- Biotransport
- Design of microvascular flow analogs
- Predictive methods for cancer metastasis potential
- Sensors for neurologically active molecules
- Biotelemetric micro systems

Advanced Materials Processing
- Combustion and plasma synthesis of thin films
- Low pressure synthesis of diamond
- Synthesis of bulk gallium nitride
- Aerosol synthesis
- Fine particle processing strategies
- Colloidal route to nanoparticles
- Monolayers and ultrathin films
- Computation of phase diagrams
- Langmuir Blodgett multilayers
- Polymeric surfactants and polymer-substrate interactions
- Polymer nanocomposites

Process Engineering
- Acoustic separations
- Process monitoring
- Separation using microemulsions
- Carbon dioxide sequestration
- Process intensification using centrifugal fields
- Spreading phenomena
- Rheology of emulsions and coatings, microemulsions and micelles
Facilities

The department is housed in the Albert W. Smith Building on the Case Quadrangle. Professor Smith was chair of industrial chemistry at Case from 1911 to 1927. Under his leadership a separate course of study in chemical engineering was introduced at Case in 1913. Professor Smith was also a close associate of Herbert Dow, the Case alumnus who founded Dow Chemical in 1890 with the help and support of Professor Smith. The Albert W. Smith Chemical Engineering Building contains two classrooms, one designed for computer and television instruction; the undergraduate Unit Operations Laboratory; a high bay area for process-related research; reinforced concrete, vertically vented chamber for hazardous and high-pressure research; a constant temperature and humidity room; an instrument room; and the normal complement of offices and research laboratories. The department has unusually strong facilities for electrochemical and fuel cell research, for microfabrication, and for chemical vapor deposition and thin film synthesis. In addition, a full range of biochemical, analytical and materials characterization instrumentation is available in the Case School of Engineering. Analytical instrumentation is available within the Department of Chemical Engineering, the Department of Chemistry, and the Materials Research Laboratory.

Chemical Engineering (ECHE)

Undergraduate Courses

ECHE C100. Co-op Seminar I for Chemical Engineering (1) Professional development activities for students returning from cooperative education assignments. Prereq: COOP 001.

ECHE C200. Co-op Seminar II for Chemical Engineering (2) Professional development activities for students returning from cooperative education assignments. Prereq: COOP 002 and ECHE C100.

ECHE 151. Introduction to Chemical Engineering at Case (0) Introduction to the Chemical Engineering Department and its activities: faculty and faculty research areas, breadth elective sequences, cooperative education, Summer Lab in London, Junior Year in Edinburgh, industrial employment opportunities, non-traditional employment opportunities. Required of Chemical Engineering students before their junior year.

ECHE 250. Honors Research I (1-3) A special program which affords students the opportunity to conduct research under the guidance of one of the faculty. At the end of the first semester of the sophomore year, students who have a strong interest in research are encouraged to discuss research possibilities with the faculty. Assignments are made based on mutual interest. Subject to the availability of funds, the faculty employs students through the summers of their sophomore and junior years, as members of their research teams.

ECHE 251. Honors Research II (1-3) (See ECHE 250.) Prereq: ECHE 250.


ECHE 361. Separation Processes (3) Analysis and design of separation processes involving distillation, extraction, absorption, adsorption, and membrane processes. Design problems and the physical and chemical processes involved in separation. Equilibrium stage, degrees of freedom in design, graphical and analytical design techniques, efficiency and capacity of separation processes. Prereq: ECHE 260 and ECHE 363.

ECHE 362. Chemical Engineering Laboratory (4) Experiments in the operation of separation and reaction equipment, including design of experiments, technical analysis, and economic analysis. Experiments cover distillation, liquid-liquid extraction, heat transfer, fluidized beds, control, membrane separations, and chemical and electrochemical reactors. Prereq: ECHE 360, ECHE 361, ECHE 365, and ECHE 364.

ECHE 362L. Chemical Engineering Laboratory in London (4) A version of ECHE 362 taught during the summer at University College of London. Prereq: ECHE 360, ECHE 363, and ECHE 364.


ECHE 365. Measurements Laboratory (3) Laboratory introduction to measurement techniques in engineering. Matching measurements to approximate and exact physical models is stressed. Extraction of physical parameters and estimation of the errors in the parameter estimates is an important part of the course. Examples cover steady and unsteady state heat transfer, momentum transfer, and the first law of thermodynamics. Prereq: ECHE 360.

ECHE 367. Process Control (4) Feedback control of chemical processes. The course involves extensive use of computer software and all exams are taken using the computer. Topics include: analysis of linear dynamical systems using Laplace transforms, derivation of unsteady state mathematical models of simple chemical processes, dynamic simulation of linear and nonlinear models, design of PID controllers by model inverse methods, tuning of controller to accommodate process model uncertainty, two degrees of freedom controllers, feed-forward and cascade control. Prereq: MATH 224.


ECHE 381. Electrochemical Engineering (3) Engineering aspects of electrochemical processes including current and potential distribution, mass transport and fluid mechanical effects. Examples from industrial processes including electroplating, industrial electrolysis, corrosion, and batteries. Prereq: ECHE 260 or permission of instructor. Cross-listed as ECHE 480.

ECHE 383. Chemical Engineering Applied to Microfabrication and Devices (3) Silicon based microfabrication and micromachining require many chemical engineering technologies. Microfabricated devices such as sensors are also directly related to chemical engineering. The applications of chemical engineering principles to microfabrication and micromachining are introduced. Oxidation processing, chemical vapor deposition, etching and patterning techniques, electroplating and other technologies are discussed.
ECHE 398. Process Analysis and Design (3)

ECHE 399. Chemical Engineering Design Project (3)
A capstone course for chemical engineering seniors. Uses material taught in previous and concurrent courses in an integrated fashion to solve chemical process design problems. Emphasis is placed on applying modern computer-based design tools. Practicality, economics, scheduling, decision making with uncertainty, and proposal and report preparation. Numerous small exercises and one comprehensive process design project done by the class. Prereq: ECHE 398.

Graduate Courses
ECHE 400T. Graduate Teaching I (0)
All Ph.D. students are required to take this course. The experience includes elements from the following tasks: development of teaching or lecture materials, teaching recitation groups, providing laboratory assistance, tutoring, exam/quiz/homework preparation and grading, mentoring students. Prereq: Entering Ph.D. student in Chemical Engineering.

ECHE 401. Chemical Engineering Communications (1)
Introductory course in communication for Chemical Engineering graduate students: preparation of first proposal for thesis, preparation of technical reports and scientific papers, literature sources, reviewing proposals, and manuscripts for professional journals, and making effective technical presentations.

ECHE 460. Thermodynamics of Chemical Systems (3)
Phase equilibria, phase rule, chemical reaction equilibria in homogeneous and heterogeneous systems, ideal and non-ideal behavior of fluids and solutions, thermodynamic analysis of closed and open chemical systems with applications. Prereq: ECHE 363.

ECHE 461. Transport Phenomena (3)

ECHE 462. Chemical Reaction Engineering (3)

ECHE 463. Techniques of Model-based Control (3)
Strategies of process control centered around the use of process models in the control system. Topics include single loop, feedforward, cascade and multivariable internal model control. Tuning controllers to accommodate process uncertainty. Treatment of control effort and output constraints in model predictive control and modular-multivariable control. Prereq: ECHE 367. Cross-listed as EECS 463.

ECHE 464. Surfaces and Adsorption (3)
Thermodynamics of interfaces, nature of interactions across phase boundaries, capillary wetting properties of adsorbed films, friction and lubrication, flotation, detergency, the surface of solids, relation of bulk to surface properties of materials, non-catalytic surface reaction. Prereq: CHEM 335 or equivalent.

ECHE 465. Catalysis (3)
Nature of catalytic processes, chemisorption, catalyst pore structure and surface area, role of lattice imperfections, geometric and electronic factors, dynamics and selectivity, typical reaction mechanisms, design of catalytic reactors.

ECHE 466. Colloid Science (3)

ECHE 467. Statistical Theories of Materials (3)
The classic ensembles of statistical thermodynamics will be developed and used to compute molecular properties, properties of fluids, liquids and solids. Molecular dynamics for computing properties will be explained and illustrated. Monte Carlo techniques will be discussed. An introduction to the theory of transport coefficients will be given. Applications will include interfacial systems, polymer systems and electrochemical systems.

ECHE 469. Chemical Engineering Seminar (0)
Distinguished outside speakers present current research in various topics of chemical engineering science. Graduate students also present technical papers based on thesis research.

ECHE 474. Biotransport Processes

ECHE 475. Chemical Engineering Analysis (3)

ECHE 480. Electrochemical Engineering (3)
Engineering aspects of electrochemical processes including current and potential distribution, mass transport and fluid mechanical effects. Examples from industrial processes including electroplating, industrial electrolysis, corrosion, and batteries. Prereq: ECHE 260 or permission of instructor. Cross-listed as ECHE 381.

ECHE 483. Chemical Engineering Applied to Microfabrication and Devices (3)
Silicon based microfabrication and micromachining require many chemical engineering technologies. Microfabricated devices such as sensors are also directly related to chemical engineering. The applications of chemical engineering principles to microfabrication and micromachining are introduced. Oxidation processing, chemical vapor deposition, etching and patterning techniques, electroplating and other technologies are discussed. Graduate students will submit an additional final paper and presentations. Prereq: ECHE 363 and ECHE 371.

ECHE 500T. Graduate Teaching II (0)
All Ph.D. students are required to take this course. The experience will include elements from the following tasks: development of teaching or lecture materials, teaching recitation groups, providing laboratory assistance, tutoring, exam/quiz/homework preparation and grading, mentoring students. Prereq: Ph.D. student in Chemical Engineering.

ECHE 560. Advanced Chemical Thermodynamics (3)
Chemical and phase equilibria in complex, multi-phase systems. Review of relevant theory. Sources of thermochemical data, methods of calculation and applications to phase diagrams, materials synthesis, electrochemistry, corrosion, water chemistry, silicon processing, chemical vapor deposition. Prereq: ECHE 460 or equivalent.

ECHE 561. Advanced Transport Phenomena (3)
(Extension of ECHE 461.) In-depth examination of methods of solving transport problems. Emphasis on coupled systems where two or more transport processes interact. Prereq: ECHE 461.

ECHE 575. Advanced Chemical Engineering Analysis (3)
Advanced analytical techniques for exact and approximate engineering analysis. Scale analysis and recursion techniques; asymptotic analysis of ordinary differential equations (regular and singular perturbations, WKB theory); approximation of integrals; method of characteristics, shocks; application to heat, mass and momentum transfer. Prereq: ECHE 475.

ECHE 600T. Graduate Teaching III (0)
All Ph.D. students are required to take this course. The experience will include elements from the following tasks: development of teaching or lecture materials, teaching recitation groups, providing laboratory assistance...
Mission Statement

Our mission is to prepare students for leadership roles in civil and environmental engineering. The department will provide facilities and research expertise to advance the state of the civil engineering profession within the mission of the Case School of Engineering. Students will be taught to address problems building on solid technical foundations while taking advantage of advanced technologies. Our graduates will adhere to high technical and ethical standards, in service to the public. Graduates will be prepared for the pursuit of advanced learning in civil engineering and related fields, as well as for the practice of civil and environmental engineering at the highest professional levels.

Faculty

Robert L. Mullen, Ph.D. (Northwestern University), P.E. Professor and Chair
- Computational mechanics; finite elements; boundary elements
- Mechanics education.

J. Ludwig Figueroa, Ph.D. (University of Illinois, Urbana-Champaign), P.E. Professor
- Dynamic behavior of soils and transportation materials, pavement evaluation; computer application to geotechnical and transportation materials engineering

Dario A. Gasparini, Ph.D. (Massachusetts Institute of Technology), P.E. Professor
- Structures; wind and earthquake engineering; applied random processes

Arthur A. Huckelbridge, D.Eng. (University of California, Berkeley), P.E. Associate Professor
- Structures; design and dynamics; earthquake engineering, bridge engineering

Aaron A. Jennings, Ph.D. (University of Massachusetts), P.E. Professor
- Environmental and geo-environmental engineering, groundwater contamination, hazardous waste management, uncertainty analysis for environmental models

Vassilis P. Panoskalsis, Ph.D. (University of California, Berkeley) Associate Professor
- Constitutive modeling of civil engineering materials; thermomechanics of solids; viscoelasticity, plasticity, damage mechanics; fatigue; computational mechanics

Adel S. Saada, Ph.D. (Princeton University), P.E. Frank H. Neff Professor
- Mechanics of materials; static and dynamic mechanical behavior of soils; foundation engineering

Karen L. Skabal, Ph.D. (University of Michigan) Assistant Professor
- Biomodeling; ex-situ remediation, colloid behavior in environmental systems, and contaminated sediment dynamics.

Secondary Faculty

Thomas P. Kicher, Ph.D. (Case Institute of Technology) Professor of Mechanical and Aerospace Engineering
- Elastic stability; plates and shells; composite materials; dynamics and optimization

Undergraduate Program

The faculty of the civil engineering department believe very strongly that undergraduate education should prepare students to be productive engineers upon receiving the degree. For this reason, particular emphasis in undergraduate teaching is placed on the application of engineering principles to the solution of problems. After completing a broad civil engineering core program undergraduate students must choose an elective sequence in one of the areas of civil engineering of particular interest, such as structural, geotechnical, environmental, construction management or engineering mechanics.

In order to provide undergraduates with experience in industry, the department attempts to arrange summer jobs for the three
summers between their semesters at Case Western Reserve University. By working for organizations in all areas of design and construction, students can gain an invaluable knowledge of the way the industry functions. This experience lets them gain more from their education and makes them more attractive to prospective employers upon graduation.

A cooperative education program is also available, which requires the student to spend two full semesters working full-time in an engineering capacity with a contractor, consulting engineer, architect, or materials supplier during the course of his or her education. The aim of the program is to enable students to make their education more meaningful by gaining familiarity with the industry they will work in after graduation and to help students finance their education.

The accredited undergraduate program in civil engineering at Case Western Reserve University has been designed so that the student chooses a sequence of four (4) or more approved elective courses. The sequence is intended to give students the chance to pursue in some depth a particular area related to their careers as civil engineers. Samples of courses from which elective sequences could be chosen follow the civil engineering curriculum in this bulletin. In addition, the students are required to do a senior project in their area of interest.

Students enrolled in other majors may elect to pursue a minor in civil engineering or in environmental engineering. A minimum of 15 credit hours is required. The approval of the department is required.

Most classes at Case Western Reserve University are small, and the student has close contact with the faculty. Students have an opportunity to gain practical experience as well as earn a supplemental income by assisting faculty members on consulting work during vacation periods.

### Educational Objectives

**Mastery of Fundamentals:**
- Graduates will master the fundamentals of mathematics and the sciences that form the basis for engineering.

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### Bachelor of Science in Engineering Degree

#### Major in Civil Engineering

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Class-Lab-Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
</tr>
<tr>
<td>Open elective or Humanities/Social Science ...............</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>CHEM 111 Principles of Chemistry for Engineers ..........</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>CMPS 131 Elementary Computer Programming ................</td>
<td>(2-2-3)</td>
</tr>
<tr>
<td>ENGL 150 Expository Writing ..................................</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>MATH 121 Calculus for Science and Engineering I ..........</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>PHED 101 Physical Education Activities ....................</td>
<td>(0-3-0)</td>
</tr>
<tr>
<td><strong>Total</strong> ......................................................</td>
<td>(16-5-17)</td>
</tr>
</tbody>
</table>

| **Spring** |                          |
| Open elective or Humanities/Social Science ............... | (3-0-3) |
| ENGR 145 Chemistry of Materials ................................ | (4-0-4) |
| MATH 122 Calculus for Science and Engineering II .......... | (4-0-4) |
| PHED 102 Physical Education Activities .................... | (0-3-0) |
| PHYS 121 General Physics I .................................... | (4-0-4) |
| **Total** ...................................................... | (15-3-15) |

| **Sophomore Year** |                          |
| **Fall** |                        |
| Humanities or Social Science Sequence I ................... | (3-0-3) |
| ECIV 160 Surveying and Computer Graphics .................. | (2-3-3) |
| EECS 251 Numerical Methods I .................................. | (2-2-3) |
| ENGR 200 Statics and Strength of Materials ............... | (3-0-3) |
| MATH 223 Calculus for Science and Engineering III ....... | (3-0-3) |
| PHYS 122 General Physics II ................................... | (4-0-4) |
| **Total** ...................................................... | (17-5-19) |

| **Spring** |                          |
| Humanities or Social Science Sequence II ................. | (3-0-3) |
| ECIV 310 Strength of Materials ................................ | (3-0-3) |
| EMAE 181 Dynamics ............................................. | (3-0-3) |
| ENGR 210 Introduction to Circuits and Instrumentation .... | (3-2-4) |
| MATH 224 Elementary Differential Equations ............... | (3-0-3) |
| **Total** ...................................................... | (15-2-16) |

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>Class-Lab-Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
</tr>
<tr>
<td>Humanities or Social Science Sequence III ...............</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ECIV 211 Civil Engineering Materials ......................</td>
<td>(1-3-3)</td>
</tr>
<tr>
<td>ECIV 320 Structural Analysis I ................................</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGL 398N Professional Communications ....................</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGR 225 Thermodynamics, Fluid Mechanics, Heat and Mass Transfer ..................</td>
<td>(3-0-4)</td>
</tr>
<tr>
<td><strong>Total</strong> ......................................................</td>
<td>(13-3-16)</td>
</tr>
</tbody>
</table>

| **Spring** |                          |
| ECIV 322 Structural Design I .................................. | (2-2-3) |
| ECIV 330 Soil Mechanics ....................................... | (3-2-4) |
| ECIV 351 Engineering Hydraulics and Hydrology ............ | (3-0-3) |
| ECIV 368 Environmental Engineering .......................... | (2-2-3) |
| Approved Elective ............................................... | (3-0-3) |
| **Total** ...................................................... | (13-6-16) |

| **Senior Year** |                          |
| **Fall**        |                        |
| Humanities or Social Science Elective ..................... | (3-0-3) |
| ECIV 340 Construction Management ............................ | (3-0-3) |
| ECIV 398 Civil Engineering Senior Project .................. | (0-6-3) |
| Approved Elective ............................................... | (3-0-3) |
| **Total** ...................................................... | (12-6-15) |

| **Spring** |                          |
| Humanities or Social Science Elective ..................... | (3-0-3) |
| ECIV 360 Civil Engineering Systems ......................... | (3-2-3) |
| PHYS 221 or approved Natural Sciences substitute .......... | (3-0-3) |
| Approved Elective ............................................... | (3-0-3) |
| **Total** ...................................................... | (15-2-15) |

**Hours required for graduation:** 129

a. One of these courses must be a humanities/social science course.

b. Must be part of an approved sequence.

c. May substitute EMAE 250.
Samples of Courses from Which Elective Sequences Could Be Chosen

The approved electives constitute a sequence of four courses in one of the major areas of civil engineering. They are chosen by the student to coincide with his or her interests.

**Structural Engineering**
- ECIV 321, Structural Analysis II (3)
- ECIV 323, Structural Design II (3)
- ECIV 405, Solid Mechanics I (3)
- ECIV 406, Constitutive Modeling Theories (3)
- ECIV 411, Applied Elasticity (3)
- ECIV 415, Structural Modeling and Experimental Methods (3)
- ECIV 420, Finite Element Analysis (3)
- ECIV 421, Advanced Reinforced Concrete Design (3)
- ECIV 422, Advanced Structural Steel Design (3)
- ECIV 423, Prestressed Concrete Design (3)
- ECIV 430, Foundation Engineering (3)

**Geotechnical Engineering**
- ECIV 323, Structural Design II (3)
- ECIV 405, Solid Mechanics I (3)
- ECIV 406, Constitutive Modeling Theories (3)
- ECIV 411, Applied Elasticity (3)
- ECIV 420, Finite Element Analysis (3)
- ECIV 430, Foundation Engineering (3)
- ECIV 431, Special Topics in Geotechnical Engineering (3)
- ECIV 433, Soil Dynamics (3)
- GEOL 110, 119, Physical Geology (3), Lab (1)
- GEOL 330, Geophysical Field Methods (4)

**Engineering Mechanics**
- ECIV 405, Solid Mechanics I (3)
- ECIV 406, Constitutive Modeling Theories (3)
- ECIV 411, Applied Elasticity (3)
- ECIV 420, Finite Element Analysis (3)
- ECIV 433, Soil Dynamics (3)
- EMAE 372, Relation of Materials to Design (3)

**Environmental Engineering**
- ECIV 361, Water Resources Engineering (3)
- ECIV 362, Solid and Hazardous Waste Management (3)
- ECIV 370, Unit Operations and Processes in Environ. Engineering (3)
- ECIV 450, Environmental Engineering Chemistry (3)
- ECIV 460, Environmental Remediation (3)
- GEOL 220, Environmental Geology (3)
- GEOL 321, Hydrogeology (3)

**Construction Engineering & Management**
- Two of the four elective courses must be from within civil engineering.
- ACCT 303, Survey of Accounting (3)
- BAFI 355, Corporation Finance (3)
- BLAW 329, Law & Management (3)
- ECIV 341, Construction Scheduling and Estimating (3)
- ECIV 430, Foundation Engineering (3)
- ECON 361, Managerial Economics (3)
- LHRP 251, Industrial Relations & Administrative Practices (3)
- LHRP 311, Labor Problems (3)

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**Minor in Civil Engineering**

Students enrolled in other majors may elect to pursue a minor in Civil Engineering. A minimum of 15 credit hours is required, as follows:

**Required Course**
- ENGR 200, Statics and Strength of Materials (3)

**Select a minimum of 12 credit hours from one of the following areas (approval of the department is required):**

**Solid Mechanics**
- ECIV 310, Strength of Materials (3)
- ECIV 405, Solid Mechanics I (3)
- ECIV 406, Constitutive Modeling Theories (3)
- ECIV 411, Applied Elasticity (3)
- ECIV 415, Structural Modeling & Experimental Methods (3)
- ECIV 420, Finite Element Analysis (3)

**Structural & Geotechnical Engineering**
- ECIV 320, Structural Analysis I (3)
- ECIV 321, Structural Analysis II (3)
- ECIV 322, Structural Design I (3)
- ECIV 323, Structural Design II (3)
- ECIV 330, Soil Mechanics (4)
- ECIV 430, Foundation Engineering (3)
- ECIV 433, Soil Dynamics (3)

**Construction Engineering and Management**
- Two of the courses must be
  - ECIV 340, Construction Management (3)
  - ECIV 341, Construction Scheduling and Estimating (3)
- Two or more courses chosen from ACCT 305, BAFI 355, BLAW 329, ECON 361, LHRP 251, LHRP 311.

**Minor in Environmental Engineering**

Select a minimum of 15 credit hours from the following list of courses (approval of the department is required):

**Environmental Engineering**
- ENGR 225, Thermodynamics, Fluid Mechanics, Heat & Mass Transfer (4)
- GEOL 321, Hydrogeology (3)
- ECIV 351, Engineering Hydraulics and Hydrology (3)
- ECIV 361, Water Resources Engineering (3)
- ECIV 362, Solid and Hazardous Waste Management (3)
- ECIV 368, Environmental Engineering (3)
- ECIV 370, Unit Operations and Processes in Environ. Engineering (3)
- ECIV 450, Environmental Engineering Chemistry (3)
- ECIV 460, Environmental Remediation (3)
  - Computer use is an integral part of the civil engineering curriculum. From required courses in computer programming and numerical analysis to subsequent use and development of civil engineering programs, the student fully utilizes the computer as a planning, analysis, design, and managerial tool. All sequences are constructed to provide a balance of marketable skills and theoretical bases for further growth. With departmental approval other sequences can be developed to meet students’ needs.
• Graduates will have a thorough knowledge of the technical requirements for the practice of the profession of civil engineering and be prepared for advanced scholarship.

Creativity:
• Graduates will be proficient in state of the art analytical and computational techniques for the modeling, analysis and design of civil engineering systems.

Societal Awareness:
• Graduates will have an understanding of the legal, social economic and environmental constraints within which the civil engineering profession must operate.
• Graduates will be aware of the special role the profession of civil engineering plays in the protection of public health, safety and welfare.

Leadership Skills:
• Graduates will be aware of the moral and ethical standards expected of leaders in the profession of civil engineering.
• Graduates will be able to function effectively and lead professional teams as well as work independently.

Professionalism:
• Graduates will be aware of the moral and ethical standards expected of the leaders in the profession of civil engineering.
• Graduates will be prepared for and aware of the necessity for a lifetime of learning and continued professional growth including professional registration.

Graduate Program in Civil Engineering
The graduate programs in structural engineering, geotechnical engineering, engineering mechanics and environmental engineering prepare students for careers in industry, professional practice, research and teaching. Experience has shown that job opportunities are excellent for students who receive advanced degrees in civil engineering at Case Western Reserve University. Recent advanced degree recipients have found positions in universities, consulting firms, petroleum companies, plant design firms, and aerospace firms, among others.

Each student’s program of course work and research is tailored to his or her interests, in close consultation with the faculty advisor. For students working toward the Master of Science degree there are two possible plans, A and B. In plan A, a research thesis is required. In plan B, a project and additional course work are substituted for the thesis. For students working toward the Doctor of Philosophy degree a research thesis is required.

Graduate Program in Engineering Mechanics
The graduate program in engineering mechanics prepares the students for a career in research and analysis in solid and computational mechanics. Courses in mechanics of solids, applied plasticity, damage mechanics, viscoelasticity, viscoplasticity, stability, dynamics, finite elements and boundary integral methods, computational mechanics, constitutive methods, fracture mechanics, plates and shells give the student the necessary knowledge and skill to study the behavior of modern materials and structures as well as advance the state of the art. For more information contact the chair of the Department of Civil Engineering.

Facilities

Bingham Structures Laboratory
The major component of this laboratory is a 14-foot by 60-foot structural test slab, which is the top flange of a 12-foot deep reinforced concrete box girder. Load and tiedown points are provided by 3-inch diameter holes spaced at 2-foot centers. Loading is accomplished by hydraulic jacks. The laboratory also contains 200k, 50k, 25k universal testing machines, and two (2) 55k MTS hydraulic actuators with a controller and a separate hydraulic service manifold system.

Fracture Mechanics Laboratory
This laboratory is equipped with two (2) MTS servo-hydraulic materials test systems. Capabilities include: fracture toughness evaluation of various materials, crack growth kinetics under different loading histories, and microstructural damage analysis and micromechanics studies. The second MTS unit is capable of applying simultaneous axial and torsional loads. An environmental chamber is available. There is equipment available for fracture surface characterization and image analysis and a grinding-polishing unit.

Structures and Materials Models Laboratory
This laboratory is a facility for both instructional and research use. Small-scale models made of different materials (steel, concrete, wood, plastic) are tested to study the response of the prototype structural elements and/or assemblies. It is equipped with four 42-inch by 72-inch steel testing tables and aluminum reaction frames, and a series of portable strain indicators and companion switch and balance units.

Bingham Concrete Laboratory
A well-equipped concrete laboratory is available for undergraduate instruction. A 100 percent humidity room is available for curing concrete specimens. Other equipment includes a concrete mixer, screening equipment, an air entrainment meter, facilities for prestressing specimens, and a 400k axial compression machine.

Environmental Engineering Laboratory
This laboratory is one in a suite of new laboratories that support environmental engineering teaching and research. The facilities include a teaching laboratory, an advanced instrumentation laboratory, a remediation research laboratory and an electronic classroom/software laboratory. The Environmental Engineering laboratory is equipped for conventional Standard Methods analysis of water, wastewater, soil, solid waste and air samples (pH meters, furnaces, ovens, incubators, hoods, etc.) and for anaerobic and aerobic microbiology work. The lab also offers generous bench top space for student teams to explore laboratory procedures and provides direct access to research, instrumentation, and computational facilities.

Environmental Instrumentation Laboratory
This laboratory is equipped for state-of-the-art analysis of sophisticated environmental contaminants. The room supports a computer controlled Dionex DX-500 IC/HPLC system, a computer controlled Varian SPECTRAA 200/SIPS 10 (flame & furnace) AA system, and a computer controlled Hewlett Packard 6890 GC/MS analysis system for organic and inorganic pollutant analysis. Where appropriate, machines have been equipped with autosamplers to improve productivity.
Remediation Research and Colloid Science Laboratory

This laboratory is designed to support physical research on the applied science and design of remediation engineering and the analysis of colloidal particles. The laboratory provides a modeling floor for the assembly of laboratory scale remediation schemes, and provides immediate access to instrumentation and computational facilities for data analysis.

Soil Mechanics Laboratory

This laboratory has a full array of both instructional and research units; notable are automated triaxial units for generalized extension and compression tests, units permitting simultaneous application of hydrostatic, axial, and torsional static and dynamic stresses, a cubical device for true triaxial testing, units by means of which one dimensional consolidation in the triaxial cell can be automatically achieved, and various pore pressure force and deformation measuring devices. Tests are monitored and instantly evaluated by data acquisition-computer systems. Also available is a longitudinal and torsional resonant column device and a large size oedometer equipped with bender elements. The laboratory has a SP2000 high speed camera to study dynamic phenomena and a Bioquant surface analyzer to study fabric. A 20 g-tons fully automated centrifuge with a servo-hydraulic earthquake shaker is in operation. A controlled climate room is in regular use.

The Asphalt Concrete Laboratory

This laboratory is properly equipped to prepare and test (following ASTM standard specifications) both cylindrical and beam asphalt concrete specimens. Engineering and material properties of asphalt concrete specimens, such as Marshall stability, resilient modulus, Poisson’s ratio, fracture toughness, and fatigue characteristics, among others, can be determined in a controlled temperature environment between 20°F and 100°F.

Image Processing Laboratory

The department has a New Image Processing Laboratory for development of automatic visual inspection methods for pavements, structures and other materials. Equipment available includes:

- Spectral Dynamics Corp. SD330A Real Time Spectrometer
- Ariel DSP-16 2-channel, 16-bit A/D system with 2 megabytes of memory/50kHz conversion rate
- Ariel TMS320025 Processing Board for real time FFT
- Matrox MVP-AT Display System with 1024 x 1024 pixel display with 16.7 million simultaneous colors (with NP accelerator)
- PC/AT 486 and Pentium class computers with interconnection to Data Acquisition equipment
- HP Scanner
- Over 30 various video cameras with both CCD and tube sensors and a wide range of image speeds and luminosity requirements are available. Both color and black/white systems in standard RS-170, NTSC, RGB, and high-resolution formats are used in the lab.

Neff Civil Engineering Undergraduate Computer Laboratory

This laboratory provides Civil Engineering students with access to all the computer resources needed for both course work and research. The laboratory is supplemented by other facilities provided by the University. The Neff Laboratory has Pentium class computers running Windows/NT operating system. All of the computers in the Neff lab can act as independent workstations or provide access via a fiber optic link to other campus computers.

Computational Mechanics Laboratory

This laboratory includes seven (7) SUN workstations running UNIX, for graduate instructional and research use. The workstations are connected to the network via a fiber optic link.

Research

Research under way in civil engineering includes work in analytical, design and experimental areas and is sponsored by industry, state, and federal government sources. Major areas of research interest are:

Structures
Random vibration
Engineering materials
Behavior of reinforced and prestressed concrete
Wind engineering
Small-scale modeling under static and dynamic loads
Earthquake analysis and design of structures
Fatigue strength of reinforced concrete bridge decks
Finite element methods
Boundary element method
Passive and active control of the vibration of structures
Transient response of nonlinear structures
Blast loading of structures

Engineering Mechanics
Adaptive finite element and boundary element methods
Transient response of nonlinear layered composites
Modeling of micro electromechanical systems
Finite element and boundary element modeling of piezoelectric material
Biomechanics of the human mid face and mandible
Finite element modeling of coupled systems
Fracture mechanics of brittle matrix composites
Modeling of concrete, of geomaterials and of asphalt concrete
Constitutive theories and numerical implementation; plasticity, viscoplasticity, viscoelasticity and damage mechanics
Shape memory alloys, smart materials
Finite deformation viscoelasticity and numerical implementation; application to rubber materials
High and low-cycle fatigue
Fracture mechanics of steel, concrete, and ceramics
Plasticity of metal matrix composites
Structural mechanics of implants

Geotechnical/Pavement Materials
Static behavior of anisotropic clays and sands
Soil liquefaction
Fracture of over consolidated clay
Bifurcation and shear banding in soils
Centrifuge modeling of static and dynamic soil behavior
Dynamic soil structure interaction
Video imaging analysis of pavement surface distress
Non-destructive testing evaluation of soils and pavement materials
Micromechanical behavior of asphalt concrete under fatigue loading
Measurement of dynamic soil properties
Vibration of high-speed trains
Stability of tailings dams

Environmental Engineering
Environmentally conscious manufacturing
Remediation of “old” metal-contaminated soils
Ex-situ “heap” remediation
Brownfields/structural remediation
Environmental modeling/software development
Environmental decision analysis
Geoenvironmental engineering
Preferential pathway flow development
Environmental fluid mechanics
Sediment remediation
Contaminated sediment dynamics
Colloid-facilitated contaminant transport in porous media
In-situ remediation of non-aqueous phase liquids
Influence of remediation techniques on hydraulic conductivity in clay soils
Forces at clay-water-contaminant interfaces
Environmental microbiology
Bioremediation

Civil Engineering (ECIV)

Undergraduate Courses

ECIV 160. Surveying and Computer Graphics (3)
Principles and practice of surveying; error analysis, topographic mapping, introduction to photogrammetry and GIS; CAD. Laboratory.

ECIV 211. Civil Engineering Materials (3)

ECIV 300. Undergraduate Research (3)
Research conducted under the supervision of a sponsoring Civil Engineering faculty member. Research can be done on an independent topic or as part of an established on-going research activity. The student will prepare a written report on the results of the research. Course may fulfill one technical elective requirement. Prereq: Consent of the instructor and department.

ECIV 310. Strength of Materials (3)

ECIV 320. Structural Analysis I (3)

ECIV 321. Structural Analysis II (3)
Stiffness and flexibility formulations for plane frames, grids, and space frame with classical and matrix methods. Introduction to nonlinear analysis and stability. Structural behavior of arches, cable networks, and other structural systems. Prereq: ECIV 320.

ECIV 322. Structural Design I (3)

ECIV 323. Structural Design II (3)
Continuation of ECIV 322. Torsion of concrete members, reinforcing steel details, compression reinforced flexural members, two-way slabs, slender columns, torsion of steel members, lateral and local buckling of steel members, plate girders, prestressed concrete design and wood design. Design laboratory. Prereq: ECIV 320 and ECIV 322.

ECIV 330. Soil Mechanics (4)
The physical, chemical, and mechanical properties of soils. Soil classification, capillarity, permeability, and flow nets. One dimensional consolidation, stress and settlement analysis. Shear strength, stability of cuts, embankments, retaining walls, and footings. Standard laboratory tests performed for the determination of the physical and mechanical properties of soils. Laboratory. Prereq: ECIV 310.

ECIV 340. Construction Management (3)
Selected topics in construction management including specifications writing, contract documents, estimating, materials and labor, bidding procedures and scheduling techniques. The course is augmented by guest lecturers from local industries.

ECIV 341. Construction Scheduling and Estimating (3)
The focus is on scheduling, and estimating and bidding for public and private projects. This includes highways as well as industrial and building construction. The use of computers with the latest software in estimating materials, labor, equipment, overhead and profit is emphasized. Prereq: ECIV 340 and consent of instructor.

ECIV 351. Engineering Hydraulics and Hydrology (3)
Application of fluid statics and dynamics to Civil Engineering Design. Hydraulic machinery, pipe network analysis, thrust, hammer, open channel flow, sewer system design, culverts, flow gauging, retention/detention basin design. Applied hydrology, hydrograph analysis and hydraulic routing will also be introduced. Coreq: ENGR 225.

ECIV 360. Civil Engineering Systems (3)

ECIV 361. Water Resources Engineering (3)
Water doctrine, probabilistic analysis of hydrologic data, common and rare event analysis, flood forecasting and control, reservoir design, hydrologic routing, synthetic streamflow generation, hydroelectric power, water resource quality, water resources planning. Prereq: ECIV 351.

ECIV 362. Solid and Hazardous Waste Management (3)

ECIV 368. Environmental Engineering (3)
Principle and practice of environmental engineering. Water and waste water engineering unit operations and processes including related topics from industrial waste disposal, air pollution and environmental health.

ECIV 370. Unit Operations and Processes in Environmental Engineering (3)
Physical, chemical, and biological operations and processes for the treatment of water supplies and municipal, industrial, and hazardous waste streams. Emphasis will be given to theoretical understanding and analysis of the involved processes and the design of treatment operations. Laboratory. Prereq: ECIV 368.

ECIV 396. Civil Engineering Special Topics I (1-3)
Special topics in civil engineering in which a regular course is not available. Conferences and report. Prereq: Consent of instructor.

ECIV 397. Civil Engineering Special Topics II (3)
Special topics in civil engineering in which a regular course is not available. Conferences and report. Prereq: Consent of instructor.

ECIV 398. Civil Engineering Senior Project (3)
A project emphasizing research and/or design must be completed by all civil engineers.

Graduate Courses

ECIV 400T. Graduate Teaching I (0)
This series of three courses will provide Ph.D. students with practical experience in teaching at the University level and will expose them to effective teaching methods. Each course assignment will be organized in coordination with the student’s dissertation advisor and the department chairperson. Assignments will successively require more contact with students, with duties approaching the teaching requirements of a faculty member in the Ph.D. student’s area of study. Prereq: Ph.D. student in Civil Engineering.

ECIV 405. Solid Mechanics I (3)
ECIV 406. Constitutive Modeling Theories (3)

ECIV 411. Applied Elasticity (3)

ECIV 415. Structural Modeling and Experimental Methods (3)
Types of structural behavior, structural modeling, dimensional analysis and similitude requirements. Experimental stress analysis review. Fabrication, instrumentation and testing of small-scale models (steel, plastic, aluminum, wood). Materials and techniques. Case studies of models in design. Prereq: ECIV 211, ECIV 320 and consent of instructor.

ECIV 420. Finite Element Analysis (3)

ECIV 421. Advanced Reinforced Concrete Design (3)
Properties of plain and reinforced concrete, ultimate strength of reinforced concrete structural elements, flexural and shear design of beams, bond and cracking, torsion, moment redistribution, limit analysis, yield line analysis of slabs, direct design and equivalent frame method, columns, fracture mechanics concepts. Prereq: ECIV 322 and consent of instructor.

ECIV 422. Advanced Structural Steel Design (3)
Selected topics in structural steel design including plastic design, torsion, lateral buckling, torsional-flexural buckling, frame stability, plate girders, and connections, including critical review of current design specifications relating to these topics. Prereq: ECIV 322.

ECIV 423. Prestressed Concrete Design (3)
Design of prestressed concrete structures, mechanical behavior of concrete suitable for prestressing and prestressing steels, load balancing, partial prestressing, prestressing losses, continuous beams, prestressed slab design, columns. Prereq: ECIV 325 or ECIV 421 and consent of instructor.

ECIV 424. Structural Dynamics (3)
Modeling of structures as single and multidegree of freedom dynamic systems. The eigenvalue problem, damping, and the behavior of dynamic systems. Deterministic models of dynamic loads such as wind and earthquakes. Analytical methods, including modal, response spectrum, time history, and frequency domain analyses. Prereq: ECIV 321 and consent of instructor.

ECIV 425. Structural Design for Dynamic Loads (3)
Structural design problems in which dynamic excitations are of importance. Earthquake, wind, blast, traffic, and machinery excitations. Human sensitivity to vibration, mechanical behavior of structural elements under dynamic excitation, earthquake response and earthquake-resistant design, wind loading, damping in structures, hysteretic energy dissipation, and ductility requirements. Prereq: ECIV 424.

ECIV 426. Structural Reliability (3)

ECIV 427. Theory of Structural Stability (3)

ECIV 430. Foundation Engineering (3)

ECIV 431. Special Topics in Geotechnical Engineering (3)
Static and dynamic horizontal loading of piles; dynamics of pile driving; behavior of a group of piles including yielding. Soil-foundation-structure interaction due to static loading. Slope stability analysis using circular and non-circular failure surfaces. Use of available computer programs in analysis and design. Prereq: ECIV 450.

ECIV 432. Mechanical Behavior of Soils (3)
Soil statics and stresses in a half-space-dimensional consolidation and sand drain theory; stress-strain relations and representations with rheological models. Critical state and various failure theories and their experimental justification for cohesive and noncohesive soils. Laboratory measurement of rheological properties, pore water pressures, and strength under combined stresses. Laboratory. Prereq: ECIV 330 and consent of instructor.

ECIV 433. Soil Dynamics (3)

ECIV 435. Rock Mechanics and Design (3)

ECIV 437. Pavement Analysis and Design (3)
Analysis and design of rigid and flexible airfield and highway pavements. Pavement evaluation and rehabilitations, overlay design. Prereq: ECIV 330.

ECIV 450. Environmental Engineering Chemistry (3)
Fundamentals of inorganic, organic, and physical chemistry with emphasis on the types of problems encountered in the environmental engineering field. Equilibria among liquid, gaseous, and solid phases; kinetics to the extent that time permits. A strong mathematical approach is taken in solving the equilibrium and kinetic problems presented. Equilibrium specification software for solution of more complex problems. Topics that will be covered in the course include chemical equilibria, acid/base reactions, mathematical problem solving approach, graphical approaches, titration curves, solubility of gases and solids, buffering systems, numerical solution of equilibrium problems, thermodynamics, oxidation-reduction reactions, principles of quantitative chemistry and analytical techniques, introduction to the use of analytical instrumentation, and chemical kinetics. Prereq: ECIV 368 or consent of instructor.

ECIV 460. Environmental Remediation (3)
Evolution of proactive environmental engineering to recover contaminated air, water, and soil environments. Lake and river remediation, contaminated sediments, indoor air quality, chemical spills, underground storage tanks, contaminated soils, solid and hazardous waste sites, superfund remediation. Prereq: ECIV 368 or consent of instructor.

ECIV 464. Environmental Engineering Microbiology (3)
This course presents an introduction to microbiology and microbial processes in natural and engineered environmental systems. Topics include redox chemistry and the stoichiometry of microbial reactions, biogeochemical cycling of nutrients and elements, microbial classification, cell metabolism, enzyme and growth kinetics, microbial ecology and diversity, biodegradation of environmental pollutants, and methods and applications in microbial ecology and environmental bioremediation.
ECIV 500T. Graduate Teaching II (0)
This series of three courses will provide Ph.D. students with practical experience in teaching at the University level and will expose them to effective teaching methods. Each course assignment will be organized in coordination with the student’s dissertation advisor and the department chairperson. Assignments will successively require more contact with students, with duties approaching the teaching requirements of a faculty member in the Ph.D. student’s area of study. Prereq: Ph.D. student in Civil Engineering.

ECIV 505. Solid Mechanics II - Advanced Elasticity (3)
Boundary value problems in linear and nonlinear elasticity using complex variables, Green’s functions, and integral transform techniques; thermoelasticity; wave propagation; micromechanics and the equivalent inclusion method; dislocations; composite materials; thin films; energy methods. Prereq: ECIV 405 or consent of instructor.

ECIV 510. Computational Mechanics (3)

ECIV 520. Random Processes in Engineering (3)
Random vectors and second moment theory. Time and frequency domain characterization of random processes and fields. Poisson and Markov processes. Random vibration. The first passage problem. Digital simulation of random processes and analysis of time series. Applications focus on stochastic models for phenomena such as earthquakes, wind turbulence, ocean waves, traffic flow, and others related to civil engineering. Prereq: Consent of instructor.

ECIV 521. Stochastic Materials Behavior (3)
Applications of random processes to characterization of material structure; elements of quantitative stereology; micromechanical stochastic modeling of stress-strain behavior and static strength; modeling of fatigue strength and crack growth; stochastic simulation of material structure and deformation processes. Prereq: ECIV 520 and consent of instructor.

ECIV 560. Environmental Engineering Modeling (3)

ECIV 561. Groundwater Analysis (3)
Principles of mass transport through porous media, formulation of saturated and unsaturated flow equations in alternative coordinate systems, analytical and numerical solutions of flow equations, application of existing groundwater software, analysis of solute transport problems.

ECIV 583. Theory of Plates and Shells (3)
Analysis of flat plates subjected to various load and boundary conditions; coupled bending membrane response resulting from both material properties and large deformations; momentum theory of shells, classical bending analysis of shells of revolution, and higher order shell theory. Prereq: ECIV 411.

ECIV 584. Theory of Plasticity and Damage Mechanics (3)

ECIV 585. Fracture Mechanics (3)
Crack tip fields, stress intensity factors, singular solutions, energy changes with crack growth, cohesive zone models, fracture toughness, small scale yielding, experimental techniques, fracture criteria, J-integral, R-curve, fatigue cracks, fracture of composites, dynamic fracture. Prereq: ECIV 405 or ECIV 411 and consent of instructor.

ECIV 587. Advanced Mechanics Seminar (3)
Advanced topics in mechanics of solids. Thermodynamics with internal variables; thermoelasticity; plasticity; gradient theories; finite theories of plasticity; damage mechanics; endochronic plasticity; non-linear fracture mechanics; probabilistic mechanics. Prereq: ECIV 406, ECIV 420, ECIV 505 or consent of instructor.

ECIV 600T. Graduate Teaching III (0)
This series of three courses will provide Ph.D. students with practical experience in teaching at the University level and will expose them to effective teaching methods. Each course assignment will be organized in coordination with student’s dissertation advisor and the department chairperson. Assignments will successively require more contact with students, with duties approaching the teaching requirements of a faculty member in the Ph.D. student’s area of study. Prereq: Ph.D. student in Civil Engineering.

ECIV 601. Independent Study (1-18)
Plan B.

ECIV 611. Civil Engineering Graduate Seminar (0)
Distinguished outside speakers present current research in various topics of Civil Engineering. Graduate students also present technical papers based on thesis research.

ECIV 651. Thesis M.S. (1-18)
Plan A.

ECIV 660. Special Topics (1-18)
Topics of special interest to students and faculty. Topics can be those covered in a regular course when the student cannot wait for the course to be offered.

ECIV 701. Dissertation Ph.D. (1-18)
ECIV 702. Appointed Dissertation Fellow (9)

Department of Electrical Engineering and Computer Science

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The Department of Electrical Engineering and Computer Science spans the technologies at the forefront of our economy and our society. Professionals in these fields are responsible for developing microprocessors and personal computers, and the operating systems, computer software, and Internet applications which run on them. Almost every modern device contains an integral computer chip. New developments in such areas as medical electronics, automotive safety and control, automated manufacturing, and entertainment electronics continue to provide opportunities for our graduates.

The Department of Electrical Engineering and Computer Science (EECS) is structured into four programs: electrical engineering, computer engineering, systems and control engineering, and computer science. Each area offers a degree program which leads to the Bachelor of Science degree. All engineering programs in the department are accredited by the Accreditation Board for Engineering and Technology (ABET). The department also offers a Bachelor of Arts in computer science for those students who wish to combine a technical degree with a broad education in the liberal arts. At the graduate level the department offers the Master of Science and Doctor of Philosophy degrees in electrical engi-
neering, computer engineering, systems & control engineering, and computing and information sciences.

History

The Electrical Engineering component of the department taught its first electrical engineering class in 1886 making it one of the oldest in the nation. The department has always been innovative and first in many things. The Systems & Control Engineering program was the first of its kind to be accredited by ABET and grew out of the Systems Research Center, originally founded in 1959. The computer engineering program was the nation’s first ABET accredited computer engineering program.

Education

The EECS department is dedicated to producing high-quality graduates who will take positions of leadership. We recognize that the increasing role of technology in virtually every facet of our culture—communications, transportation, health care, the environment, and even our system of wealth distribution — makes it vital that engineering-oriented students have access to progressive and cutting-edge programs stressing excellence in:

• mastery of fundamentals
• creativity
• social awareness
• leadership skills and
• professionalism.

Emphasizing these core values will help ensure that tomorrow’s graduates are valued and contributing members of our global society and that they will carry on the tradition of engineering leadership established by our alumni.

Statement of Educational Philosophy

Our goal is to graduate students who have fundamental technical knowledge of their profession and the requisite technical breadth and communications skills to become leaders in creating the new techniques and technologies which will advance their fields.

To achieve this goal, the department offers a wide range of technical specialties consistent with the breadth of electrical engineering & computer science, including recent developments in the field. Because of the rapid pace of change in these fields our degree programs emphasize a broad technical background that equips students for future developments. As a result, our programs include a wide range of electives and our students are encouraged to develop individualized programs which can combine many aspects of electrical engineering and computer science. The department prepares students for careers in engineering with degrees in electrical engineering, computer engineering, computer science or systems & control engineering.

The department programs emphasize a mastery of fundamentals which will enable students to deal with new technological developments and interact with professionals in other fields. This is achieved by ensuring that our graduates have:

• a strong background in the fundamentals of chemistry, physics, mathematics, and computing
• an ability to design and construct engineering models by applying fundamental knowledge of mathematics, science, and engineering
• an ability to analyze engineering models utilizing state of the art engineering techniques, skills, and tools
• an ability to design and construct experiments to collect data, and to analyze and interpret the resulting data to develop and verify engineering models

• a broad education necessary to understand the impact of electrical engineering solutions in a modern society.

Technological development continues to result in new technologies and/or new problems. We ensure that our graduates are creative and able to apply their engineering knowledge to new problems by:

• training them in the modeling, behavior, and specification of engineering components, systems, and/or processes
• training them in the planning, design, implementation, and operation of systems, components, and/or processes that meet engineering constraints
• providing significant design experience which involves problem definition, research, solution formulation, economics, communications, teamwork, and project management

We live in a complex technological society which requires that our graduates have a broad education necessary to understand the consequences of engineering solutions in the broader context of their impact upon people and the environment. We ensure that our graduates are socially aware by:

• requiring that they have an extensive education in the humanities and social sciences
• by providing opportunities for and encouraging them to pursue additional studies in the humanities, social sciences and business.

We expect our students to become leaders in creating and applying new technologies by:

• developing their written and oral communication skills, including the use of modern electronic tools such as presentation software, the World Wide Web, and e-mail
• providing group activities which develop teamwork and communications skills
• teaching them how to find technical information and research engineering problems, especially using electronic resources
• going outside the boundaries of individual textbooks as a preparation for life-long learning
• providing opportunities for students to develop and demonstrate leadership in professional organizations, engineering and research.

We develop our students as professionals by developing their communications and leadership skills and additionally by:

• training them to understand professional and ethical responsibility
• committing them to the highest standards of such responsibility and excellence in all their professional endeavors
• providing them with the highest standards of such responsibility and excellence in all their professional endeavors
• providing them with opportunities for professional development through the Co-Operative Education Program

Faculty

B. Ross Barmish, Ph.D. (Cornell University)
Department Chair, Nord Professor
Control systems, robustness, probabilistic methods, Monte Carlo simulation

Randall D. Beer, Ph.D. (Case Western Reserve University)
Professor
Computational neuroscience, autonomous robotics

Michael S. Branicky, Sc.D. (Massachusetts Institute of Technology)
Associate Professor
Intelligent systems and control, hybrid systems, learning, real-time and distributed control over networks, applications to robotics and flexible manufacturing

Marc Buchner, Ph.D. (Michigan State University)
Associate Professor
Computer simulation of complex systems, control of industrial systems, analysis of discrete event and combined systems
Vira Chankong, Ph.D. (Case Western Reserve University)
Associate Professor
Large-scale and multi-objective optimization and its application to engineering problems, manufacturing and production systems, improvement of magnetic resonance imaging, decision theory, and risk analysis

Funda Ergun, Ph.D. (Cornell University)
Schroeder Assistant Professor
Program testing routing and quality of service in high speed networks, packet classification, randomized algorithms, learning theory

George W. Ernst, Ph.D. (Carnegie Institute of Technology)
Associate Professor
Learning problem solving strategies, artificial intelligence, expert systems, program verification

Steven L. Garverick, Ph.D. (Massachusetts Institute of Technology)
Associate Professor
Mixed-signal integrated circuit design, microelectromechanical system integration, sensor/actuator interfacing, data conversion, wireless communication, analog neural network circuits, medical instrumentation

Dov Hazony, Ph.D. (University of California, Los Angeles)
Professor
Network syntheses, ultrasonics, communications

Vincenzo Liberatore, Ph.D. (Rutgers)
Assistant Professor
Distributed Systems, internet computing, randomized algorithms

Wei Lin, Ph.D. (Washington University)
Associate Professor
Nonlinear dynamic systems and geometric control theory, H-infinity and mixed H-2/H-infinity and robust control, adaptive control, system parameter estimation, adaptive and nonlinear control for robotics manipulators

Kenneth Loparo, Ph.D. (Case Western Reserve University)
Professor
Stability and control of nonlinear and stochastic systems, analysis and control of discrete event systems, intelligent control systems and failure detection. Recent applications work focuses on the control and failure detection of rotating machines.

Behnam Malakooti, Ph.D. (Purdue University)
Professor
Industrial engineering, computer-aided manufacturing, man-machine systems, AI, Multiple criteria decision making and optimization

Mehran Mehregany, Ph.D. (Massachusetts Institute of Technology)
Silicon and silicon carbide microelectromechanical systems (MEMS), micromachining and microfabrication and related integrated circuits, materials, and modeling issues

Frank Merat, Ph.D. (Case Western Reserve University), PE (Ohio)
Associate Professor and Associate Chair for Undergraduate Studies
Wireless networks, RF communications, optical MEMS devices, computer vision and image processing, neural networks

Mihajo D. Mesarovic, Ph.D. (Serbian Academy of Science)
Professor
Complex systems theory, global issues and sustainable development

Wyatt Newman, Ph.D. (Massachusetts Institute of Technology)
Professor
Mechatronics, high-speed robot design, force and vision-based machine control, artificial reflexes for autonomous machines, rapid prototyping, agile manufacturing

Gultekin Ozsoyoglu, Ph.D. (University of Alberta, Canada)
Professor
Database theory, logic databases, database query and optimization

Z. Meral Ozsoyoglu, Ph.D. (University of Alberta, Canada)
Professor
Database theory, logic databases, database query and optimization

C.A. Papachristou, Ph.D. (Johns Hopkins University)
Professor
VLSI design and CAD, computer architecture and parallel processing, design automation, embedded system design

Stephen M. Phillips, Ph.D. (Stanford University), PE (Ohio)
Associate Professor
Applications of control and signal processing to robotics and automation

Andy Podgurski, Ph.D. (University of Massachusetts at Amherst)
Associate Professor
Software engineering methodology and tools, software architecture and design, distributed systems, software testing and reliability estimation

Daniel Saab, Ph.D. (University of Illinois at Urbana-Champaign)
Associate Professor
Computer architecture, VLSI system design and test, CAD design automation

S. Cenk Sahinalp, Ph.D. (University of Maryland)
Assistant Professor
Design, analysis and experimental evaluation of algorithms for pattern matching and indexing; data compression, communication networks and computational molecular biology

N. Sreenath, Ph.D. (University of Maryland)
Associate Professor
Large-scale systems, policy analysis, sustainable development, integrated assessment, global and environmental issues (water resources and global climate change), control theory applications and medical informatics

Massood Tabib-Azar, Ph.D. (Rensselaer Polytechnic Institute)
Professor
Semiconductor material and device characterizations, optical signal processing, novel high-frequency and high-power devices and circuits, spectroscopy and low-temperature measurement, novel super-resolution near-field imaging probes, quantum computing

Lee J. White, Ph.D. (University of Michigan)
Professor and Associate Chair for Graduate Studies
Software testing, current projects include regression testing, study of domain testing, specification-based testing and testing of object-oriented software

Darrin Young, Ph.D. (University of California, Berkeley)
Assistant Professor
Micromachined sensors, high-Q passive components and integrated low-power analog circuits for wireless communications

GQ (Guo-Qiang) Zhang, Ph.D. (Cambridge University, England)
Associate Professor
Programming languages, theory of computation, logic and topology in computer science

Associated Faculty

Secondary Faculty

Coleman B. Brosilow, Ph.D. (Brooklyn Polytechnic Institute)
Professor, Chemical Engineering

Robert V. Edwards, Ph.D. (Johns Hopkins University)
Professor, Chemical Engineering

Joseph Koonce, Ph.D. (University of Wisconsin, Madison)
Professor, Biology Department

Adjunct Faculty

Joan Carletta, Ph.D. (Case Western Reserve University)
Adjunct Assistant Professor

Howard Chizeck, Sc.D. (Massachusetts Institute of Technology)
Adjunct Professor

Benjamin F. Hobbs, Ph.D. (Cornell University)
Adjunct Professor

Pat Howard, Ph.D. (Case Western Reserve University)
Adjunct Assistant Professor

Peter Kinman, Ph.D. (University of Southern California)
Adjunct Assistant Professor

Geoffrey Lockwood, Ph.D. (University of Toronto, Canada)
Adjunct Assistant Professor (Cleveland Clinic)

Marvin Schwartz, Ph.D. (Case Western Reserve University)
Adjunct Assistant Professor

Peter Tsivitse
Adjunct Professor
Emeritus Faculty
Paul C. Claspy, Ph.D. (Case Institute of Technology)
Emeritus Associate Professor

Communications, and imaging, lasers and electro-optics

Robert E. Collin, Ph.D. (Imperial College, University of London, England)
Emeritus Professor

Electromagnetic theory, antennas, propagation, microwave components and systems

Sheldon Gruber, Sc.D. (Massachusetts Institute of Technology)
Emeritus Professor

Signal processing, machine vision and industrial inspection

Wen H. Ko, Ph.D. (Case Institute of Technology)
Emeritus Professor

Solid state sensors and devices, biomedical implants, telemetry

Irv Lefkowitz, Ph.D. (Case Institute of Technology)
Emeritus Professor

Automation and computer control of industrial processes

Osman K. Mawardi, Ph.D. (Harvard University)
Emeritus Professor

Plasma Physics, energy conversion and storage, applied superconductivity

Harry W. Mergler, Ph.D. (Case Institute of Technology)
Leonard Case Emeritus Professor

Digital systems, systems engineering, logic design computer control, metrology

Yoh-Han Pao, Ph.D. (Pennsylvania State University)
George S. Dituely Emeritus Professor

Pattern recognition, signal and image processing, computational intelligence, intelligent systems

Frederick J. Way III
Emeritus Professor

Research Activities
EECS programs at Case Western Reserve encompass a wide spectrum of activities. Some of the major activities include biorobotics and computational intelligence, automation and robotics, solid-state devices and MEMS, communications, nanoelectronics and nanometrology techniques, global and large-system modeling, software engineering, and databases and bioinformatics. Much of this research is multi-disciplinary in nature involving faculty members from Materials Science and Engineering, Biology, Psychology, Civil Engineering, and Mechanical and Aerospace Engineering.

The faculty of the department actively pursue research in the areas described below. Students pursue their thesis research under the supervision of a faculty member who is a recognized authority in his field. Support for thesis research comes from a related research project or program under the direction of the faculty. For further information on research opportunities, the department chair should be contacted.

Algorithms - Professors Ergun, Liberator, and Sahinalp

Basic theoretical and applied work in randomized algorithms, program testing and correcting, learning theory, learning theory, multivariate optimization, data structures, string and sequence algorithms, combinatorial and statistical pattern matching and indexing, embedding of metric spaces, data compression and complexity of communication, algorithmic analysis of massive data sets, sketching and streaming models, parallel computation and circuit layouts, experimental algorithmics and performance evaluations.

Automation, Sensing, Actuation and Machine Intelligence - Professors Barmish, Branicky, Liberator, Loparo, Malakooti, Merat, Newman, Pao and Phillips

Research activities include neural network applications; pattern recognition; artificial intelligence; hybrid systems, process automation; intelligent machine tool control; in-process gauging and control; adaptive learning methods applicable to robotics; system identification and adaptive control; intelligent control; the application of artificial intelligence to robotics systems and manufacturing; compliant control of robotics systems; non-contact inspection of production quality; machine vision for robotics applications; agile manufacturing systems; machine vision and image processing; rapid prototyping of computer-generated 3-D objects in engineering materials; computational intelligence, principles and applications; distributed computational intelligence in network client/server mode; computational intelligence and associative memories; robustness considerations and related statistical techniques.

Circuits and Computer-Aided Design - Professors Garverick, Young and Merat

Research activities include SiC circuits, and mixed-signal CMOS integrated circuit design for applications in MEMS, biomedical instrumentation, and robotics, MEMS RF high-Q tuning components for mobile communication circuits, MEMS sensors for biomedical and inertial sensing applications, microfabrication and integrated circuits process development.

Computer Networks - Professors Ergun, Liberator, Malakooti and Sahinalp

Research activities include data dissemination, background distributed computing, distributed middleware and services, overlay networks, quality of service, routing, random graphs for network modeling, and packet filtering and classification; development of intelligent networks using intelligent mobile agents.

Computational Genomics - Professors Sahinalp, M. Ozsoyoglu, Pao and Buchner

Current research activities include: (1) computational studies of large scale genome duplication and other genome-wide rearrangements; (2) phylogenetics of the human genome, (3) algorithmic tools for pattern/motif search and discovery.

Computational Neuroscience and Autonomous Robotics - Professor Beer

Using computer simulation and theoretical analyses of models of complete neural/body/environment systems, this research pursues two objectives. First, it seeks to better understand the neural mechanisms of behavior in animals. Second, it seeks to apply biological control principles to the design of autonomous robots with the flexibility and robustness of animals. The tools employed in this work include continuous-time recurrent neural networks, evolutionary algorithms, and dynamical systems theory. This research is highly interdisciplinary, and includes collaborators from the Department of Biology and the Department of Mechanical and Aerospace Engineering.

Control Applications - Professors Barmish, Branicky, Buchner, Loparo, Liberator, Lin and Phillips

Topics include: (1) The development of anti-lock braking systems using fuzzy logic control methods; (2) Development of methods of automotive control and computer assisted tools for engineering analysis and design (e.g., development of computer
based tools for system level failure mode effect analysis); (3) Developing technology for advanced power train, energy management, sensing and control strategies for electric vehicles; (4) the use of methods of control engineering to solve problems involving industrial and manufacturing processes; (5) developing advanced analysis and design tools for robotic assembly, agile manufacturing, (6) control over networks (QoS provisioning and multi-agent software).

Control, Filtering and Robustness - Professors Barmish, Lin and Loparo
Topics include: (1) nonlinear control theory work addressing questions regarding the behavior, stability and control of dynamic systems that are inherently nonlinear in the relationships between their inputs, outputs, and internal states; (2) stochastic control theory work involving the study of the behavior, stability and control of dynamic systems that possess an element of randomness in their operation over time; (3) stochastic filtering theory work, investigating the extraction of information about internal variables of a system on the basis of (possibly noise corrupted) measurements of system outputs; and (4) Robust control and analysis with emphasis on new Monte Carlo techniques and models for addressing system uncertainty.

Database Systems - Professors M. Ozsoyoglu and G. Ozsoyoglu
This research area focuses on performance issues in relational databases, database query processing and distributed database query processing, file allocation in distributed databases, database design, object-oriented databases, statistical database security problems, and relational interfaces for non-relational databases.

Design Methodologies and Design Automation - Professors Saab and Papachristou
This research area is concerned with the development of behavioral and structural level design methodologies and tools for the creation of VLSI-based systems and for multiple-processor architectures. Central to this work is the continued development of a third-generation design automation system for VLSI.

Electromagnetics, High Frequency Communications and Devices - Professors Hazony, Ko, Merat, Tabib-Azar and Young
Research activities include electromagnetic propagation and scattering, high frequency acoustic circuits, generation and detection of extremely sharp pulses, in situ monitoring in aggressive environments, biotelemetry, wireless communications for in situ arrays of biosensors.

Expert Systems - Professors Ernst, Malakooti, Merat, Paoand and Zhang
The research on expert systems is primarily concerned with using artificial intelligence techniques to represent and reason about knowledge. Current research includes: (1) common-sense reasoning; (2) development of multiple criteria based expert systems for solving design and facility layout problems; and (3) applied research in a number of different challenging applications, such as fault diagnosis in discrete event systems. Most of these applications are based on knowledge which has been extracted from experts in the application domains.

Fault Detection and Diagnosis - Professors Loparo and Lin
Research combining advanced theoretical topics with solutions to industrial problems of high relevance and economic importance. Topics include: (1) the detection specific identification of failure events in systems and, when possible, the detection of incipient failures, through the use of nonlinear filtering of measured system inputs and outputs; and (2) the use of nonlinear dynamics and chaos theory for failure detection, the use of chaos concepts and other advanced model-based methods for vibration signature analysis.

Global Systems Analysis and Sustainable Development - Professor Mesarovic and Sreenath
This research addresses one of the most challenging tasks of systems science and systems engineering, i.e., to understand the world as a system and develop methods to assess the evolution of the system. In order to advance understanding of the global system, two principle obstacles are being addressed: complexity by using a multi-level, hierarchical architecture and uncertainty by interactive human/computer reasoning support process. The focus of the research is on interaction between global issues which represents a distinguishing characteristic of the global future (referred to as the global problematique). A range of issues are considered-from demographic transition and aging to carrying capacity, prospects for global climate change, impact of financial markets on development, etc. Collaborative research with a global network of universities is underway through the UNESCO Global-problematic Education Network Initiative (Genie). The Network is made up of fifteen universities from countries around the world strategically selected in order to provide a global coverage. Joint research with member institutions is conducted via the Internet. The research ranges from modeling and methods of complex systems analysis under true uncertainty analysis of specific issues such as global coordination of greenhouse gas emission reduction policies, water resources and health carrying capacity of Africa, etc.

Identification and Adaptive Control - Professors Lin and Buchner
Research directed towards specific application problems and the development of new theory. Topics include: (1) adaptive control of nonlinear systems, adaptive control of multi-input, multi-output systems having unknown and time varying input-output delays; (2) predictive adaptive control of non-minimum phase systems and the development computationally efficient methods of predictive control; (3) development and application of methods for real-time identification of parameters for linear systems having unknown input-output delays, and for nonlinear systems.

Industrial, Production, Operational, Management Systems - Professors Malakooti and Chankong
Optimization, multiple criteria decision making, and artificial intelligence techniques are used to improve quality, productivity, and cost efficiency of real-world problems including development of computer aided and integrated manufacturing/production planning and control; facility layout design, assembly line balancing; pattern recognition and clustering applied to group technology family formation; scheduling, machine set-up, tool life, and machinability. Research activities include applying optimization, decision making, multiple objectives (criteria), AI, artificial neural networks, pattern recognition/clustering to facility layout design, group technology, and assembly systems as well as developing multiple objective optimization and analysis for machine set-up, supervision, tool life, machinability, and sensing devices.

Intelligent Systems, Neural Nets And Fuzzy Logic - Professors Loparo, Pao, Branicky, Merat, Malakooti and Tabib-Azar
The use of methods of “machine intelligence” to accomplish control of systems. Particular topics of interest include: (1) the use of feed forward artificial neural nets to detect tool wear in parts
machining processes, and to model load demand of electric power systems; (2) the use of fuzzy logic methods to attain anti-lock braking for automobiles, to control manufacturing processes and chemical processes, to detect events of gait in neuro-prosthetic systems that provide walking for paraplegics using electrical stimulation; (3) the analysis of combined discrete and continuous state ‘hybrid’ dynamic systems; and (4) novel computation techniques such as quantum computing and associated networks.

**Logic, programming, and verification - Professor Zhang**

Research activities include the semantics of programming languages and logic and models for reasoning about software, hardware, and security-critical systems.

**Mathematical Modeling and Systems Analysis of Global Change Phenomena - Professors Mesarovic and Sreenath**

The use of mathematical modeling of global economic and physical phenomena, in conjunction with computer simulation, to develop alternative scenarios of the future. This work involves a determination of what changes are possible within an environmental system, on the basis of the structure of mathematical models that represent its behavior (or hypotheses about its behavior).

**Optimization and Decision Theory and Methods - Professors Malakooti and Chankong**

Basic theoretical work and specific applications. Topics include: (1) Multi-objective optimization theory; (2) Algorithms for machine part formation problems; (3) Clustering algorithms for data compression; (4) Algorithms and tools for VLSI design; (5) Algorithms and methods for facility location and layout in manufacturing systems; (6) the use of systems analysis and decision theory methods to solve problems of the electric utility industry, such as quantification of the implications of transmission constraints for generation costs and resource planning; (7) methods for the design of magnetic resonance imaging (MRI) pulse sequences, for clinical MR images, to allow for the removal of motion artifacts (e.g., in images of the liver) and enhancements of images specific tissue types; and (8) the application of systems analysis and decision theory methods to problems of information flow and control in health care.

**Semiconductor Materials and Devices - Professors Tabib-Azar, Mehregany, Young, Garverick and Ko**

Research activities include design, modeling, fabrication, testing, and application of a wide range of micro-to-nano systems, with particular emphasis on supporting materials technology, including silicon carbide. Example devices include micromachined components, sensors; actuators; opto-mechanical devices including scanners and switches; electronic devices; microwave probes; electromagnetic devices and filters, and wireless communication components and subsystems. Example applications are in fields such as transportation, telecommunications, space, biomedical, and industrial control.

**Signal processing - Professors Buchner, Loparo, Merat and Pao**

Research activities include neural network signal and information processing, image processing, time-frequency signal analysis, processing of genomic information, detection of tornados in radar images using wavelets, two-dimensional periodicity transforms.

**Software Architecture and Design - Professors Podgurski, White and Zhang**

The objective of this research is to develop, specify, and analyze prototypical or reference architectures for important families of software applications, such as those used in Internet commerce, manufacturing, biomedical control, and avionics, and to derive general principles and methodologies such as formal verification for the design of complex software systems.

**Software Testing and Reliability - Professors White and Podgurski**

This research focuses on improving the quality of software. One approach to testing software is to identify and correct defects applied to object-oriented software and specifically to GUI systems. Also there is a research project on data coverage testing, where the emphasis is to predict when testing can be stopped, as further testing can be shown to be only marginal in effectiveness.

**Space Communications and Networks - Professors Ergun, Kinman, Ko, Malakooti, Merat, G. Ozsoyoglu, M. Ozsoyoglu, Papachrostou, Phillips, Sahinalp and Young**

This research is primarily concerned with developing communications and networking solutions for near- and deep-space applications. Current research includes: (1) MEMS tunable antennas for power efficient wireless communications; (2) miniature silicon optical reflectors which can be electrostatically deformed and steered; (3) tiled arrays of processors which can be reconfigured for a variety of communications and signal processing applications; (4) semantic-based database inquiry and data warehousing for space assets; (5) protocols and control architectures for remote teleoperation of robots; (6) protocols and systems for the intelligent routing of data in space networks; (7) wireless networks of biosensors for monitoring of astronauts; and (8) efficient utilization of radio spectrum for space communications, performance modeling of radio communications using advanced coding schemes, Doppler and range measurements to space vehicles.

**Facilities**

**Computer Facilities**

The department computer facilities incorporate both UNIX (primarily Solaris) and Microsoft Windows-based operating systems on high end computing workstations for its educational and research labs. A number of file, printing, database and authentication servers support these workstations as well as the administrative functions of the department. Labs are primarily located in the Olin, Glennan and Smith buildings and are connected to each other via CWRUnet. CWRUnet is a state-of-the-art, high-speed fiber optic campus-wide computer network that interconnects laboratories, faculty and student offices, classrooms and student residence halls at the University. CWRUnet is one of the largest fiber-to-desktop networks anywhere in the world. Every desktop has or will have a 1 Gbps (gigabit per second) connection to the rest of the campus network backbone, which runs on fault-tolerant 10 Gbps and faster fiber-optic links. In an effort to expand network availability to complement the wired network already in place, more than 1,000 wireless access points (WAPs) are being deployed, allowing students with laptops and wireless enabled PDAs to access CWRUnet resources from practically anywhere on campus.

Off campus users, through the use of CWRUnet’s high-capacity virtual private network (VPN) servers, can use their home dial-up or broadband connections to access many on campus resources as well as software as if they were physically connected to CWRUnet.

The department and the University also participate in the Internet2 project, which provides a high-speed, inter-University
network infrastructure allowing for enhanced collaboration between institutions. The Internet2 infrastructure allows students, faculty and staff alike the ability to enjoy extremely high performance connections to other Internet2 member institutions.

Aside from standard services provided through a commodity Internet connection, CWRUnet users can take advantage of numerous on-line databases such as EUCLIDplus, the University Libraries’ circulation and public access catalog, as well as Lexus-Nexus™ and various CD-ROM based dictionaries, thesauri, encyclopedias, and research databases. Many regional and national institutional library catalogs are accessible over the network, as well.

Department Laboratories

Smith Computer Lab
General purpose computer facilities for undergraduate instruction is provided by the Smith Laboratory which contains about 70 PCs, a number of Macintosh power PCs and ten SUN Sparc-5 UNIX workstations.

Jennings Computer Center Labs
Supported by an endowment from the Jennings Foundation, these labs provide our students with the education resources necessary both for their classes and to explore their interest in the art of computing.

Database and Multimedia Laboratory
Primarily funded by NSF equipment grants, this laboratory provides specialized equipment for research into multimedia and database systems.

VLSI Design Laboratory
Supported by the Silicon Research Corporation and industry, this laboratory has a number of UNIX workstations which run CAD software for VLSI design. This laboratory is currently used to develop testing techniques for digital design.

Autonomous Robotics Laboratory
Primarily funded by ONR and other federal sources, this laboratory has a number of computer workstations and robots which are used to conduct research into robotics, autonomous agents and biological simulation.

Electronic Circuits Lab
This laboratory has been primarily supported by the Hewlett-Packard Company and is the basic resource for students taking analog, digital and mixed-signal electronics classes. All instrumentation in the lab is computer-interfaced and students can even conduct experiments from their dorm rooms.

Analog Workstations
266 MHz NT workstations are equipped with LabView software. The workstations have HP-IB instrument interfaces connected to Hewlett-Packard 546xx oscilloscopes, 33120A Waveform Generators, 34401A Digital Multimeters, and E3631A power supplies.

Digital Workstations
450 MHz NT workstations and Sun Workstations support Xilinx FPGA hardware/software.

Digital Workstations
450 MHz NT workstations and Sun Workstations support Xilinx FPGA hardware/software.

Lester J. Kern Computational Laboratory
This laboratory is used by students enrolled in “Electromechanical Energy Conversion,” as well as for research in robotics and mechatronics. Laboratory facilities include: four lab stations for demonstrating machine characteristics and basic steady-state and dynamic system performance, four Sun SPARC UNIX workstations, and real-time data acquisition systems for interaction with lab experiments and control of machines.

Microcomputer Laboratory
This laboratory contains approximately 25 Microcomputers (these are mostly high end Pentiums and a few Macintosh Power PC’s), along with a complement of laser printers, network connections (university fiber optic network and LAN), and scientific software (MATLAB, VISSIM, Mathematica, GINO, LINDO, etc.).

Process Control Laboratory
This laboratory contains process control pilot plants, computerized hardware for process control and demonstration/research facilities. This wet lab has access to steam and compressed air for use in the pilot plants.

Timken Foundation Dynamics and Control Laboratory
Contains mechanical, pneumatic and electrical laboratory experiments for teaching and research purposes. This includes PLCs, motors and robotics systems.

Global Systems Laboratory
This laboratory consists of various PC and Sun Sparc workstations containing databases from the UN, World Watch Institute, World Resources Institute, U.S. Government, etc., and policy and scenario analysis software.

Rockwell Automation Machinery Diagnostics and Control Laboratory
This laboratory is focused upon machinery diagnostics and failure prediction. Several test stands will provide instrumentation for machinery lifetime prediction and sensor development. Additional instrumentation will provide for remote operation of the test stands.

Micro-electronic Device Modeling and Characterization Lab
Affiliated with our Microfabrication Laboratory MFL, this laboratory is equipped with dc measurement capabilities for evaluating semiconductor device performance. Device modeling is done on Sun SPARC and HP workstations.

Hans Jaffe Ultrasonics Laboratory
This laboratory is dedicated to the study and fabrication of specialized ultrasonic transducers. Facilities include pulse receivers, specialized scopes, precision signal generators, and piezoelectric devices.

Center for Automation and Intelligent Systems Research
Supported in part by CAMP, Inc. through the State of Ohio’s Thomas Edison research center program, this educational and research center contains multiple laboratories including:

- Mechatronics Laboratory
- Intelligent Systems Laboratory
- Multimedia and Computations Intelligent Systems Laboratory
- Control and Signal Processing Laboratories.
These laboratories are equipped with a diverse range of modern scientific and CAD workstations, computer controlled robots, materials handling devices, image processing and computer vision systems. These laboratories support research activities in robotics, agile manufacturing, multimedia internet applications to manufacturing, rotating machinery diagnostics, optical sensing and process control.

**MicroFabrication Laboratory**

This laboratory has been funded by many agencies including the State of Ohio and DARPA. The MicroFabrication Laboratory (MFL) is a state-of-the-art clean room facility for the fabrication of microelectromechanical systems (MEMS) and microelectronic devices. The Class 100 facility supports the University’s strong interdisciplinary MEMS research program by providing on-campus fabrication capabilities for a broad range of research projects by investigators from a number of departments within the university; it is also accessible by external organizations for prototype fabrication and R&D. The MFL offers a broad spectrum of micromachining processes, including bulk and surface micromachining, wafer bonding, and micro-molding. These capabilities are augmented by a 2-micron CMOS process for the fabrication of integrated microsensors/microactuators.

**The Center for Computational Genomics**

Established by a $2.2 million grant from the Charles B. Wang Foundation, Inc. this interdisciplinary center (EECS, Genetics, and Biostatistics & Epidemiology) employs computer science to analyze the function of genes and proteins in health and disease. The Center’s lab provides high-power computing resources (2GHz Dells with 1 GB DRAM) for computational genomics research.

**PLC Control and Automation Laboratory**

This laboratory uses Allen-Bradley PLC’s for data acquisition and real-time control of complex processes. Currently the PLCs control a multi-train HO model system and a five-floor, two-car elevator system.

**ENGR 131 Freshman Computing Lab**

This lab is used to support the freshman ENGR 131 Elementary Computer Programming class. The laboratory provides personal computers and Lego Mindstorm robot kits which freshman use to learn about how computers can be used to control mechanisms, as well as to study C/C++ programming.

**Undergraduate Programs**

**Electrical Engineering**

The undergraduate program in electrical engineering, which leads to the Bachelor of Science in Engineering degree, provides a broad foundation in electrical engineering through combined classroom and laboratory work and prepares the student for entering the profession of electrical engineering as well as for further study at the graduate level.

Core courses provide the student with a strong background in mathematics, physical sciences and the fundamentals of engineering. Each electrical engineering student must take the following core courses:

**Breadth Requirements:**
- ENGR 131 Elementary Computer Programming
- ENGR 210 Introduction to Circuits and Instrumentation
- EECS 281 Logic Design and Computer Organization
- EECS 245 Electronic Circuits
- EECS 246 Signals and Systems
- EECS 309 Electromagnetic Fields I
- STAT 332 Statistics of Signal Processing
- EECS 321 Semiconductor Electronic Devices
- EECS 398L
- EECS 399L

**Depth Requirement:**

Each student must show a depth of competence in one technical area by taking at least three courses from one of the following seven areas. Note that this depth requirement may be met using a combination of the above core courses and a selection of open and technical electives.

**Area I: Electromagnetics**
- EECS 309 Electromagnetic Fields I
- EECS 310 Electromechanical Energy Conversion
- EECS 311 Electromagnetic Fields II

**Area II: Signals & Systems**
- EECS 246 Signals and Systems
- EECS 313 Signal Processing
- EECS 347 Network Synthesis
- EECS 351 Communications and Signal Analysis
- EECS 354 Digital Communications
- EECS 396 Hybrid Systems

**Area III: Computer Software**
- EECS 235 Data Structures
- EECS 337 Systems Programming
- EECS 338 Operating Systems

**Area IV: Solid State**
- EECS 321 Semiconductor Electronic Devices
- EMSE 314 Electrical, Optical and Magnetic Properties of Matter
- EECS 322 Integrated Circuits and Electronic Devices

**Area V: Control**
- EECS 304 Control Engineering I
- EECS 310 Electromechanical Energy Conversion
- EECS 383 Microprocessor Applications to Control
- EECS 346 Engineering Optimization
- EECS 396 Hybrid Systems

**Area VI: Circuits**
- EECS 245 Electronic Circuits
- EBME 310 Biomedical Instrumentation
- EECS 344 Electronic Circuit Design
- EECS 382 Microprocessor Based Design
- EBME 418 Biomedical Electronics
- EECS 426 MOS Integrated Circuit Design

**Area VII: Computer Hardware**
- EECS 281 Computer Organization
- EECS 382 Microprocessor Based Design
- EECS 301 Computer Design Lab
- EECS 314 Computer Architecture
- EECS 315 Digital Systems Design

**Statistics Requirement:**
- STAT 332 Statistics of Signal Processing (STAT 333 may be substituted for STAT 332 with approval of advisor)
- Applied Statistics Elective (Class which uses statistics in some aspect of electrical engineering. Student may choose from EECS 351, EECS 354 or other class approved by advisor.)

**Design Requirement:**
- EECS 398L Senior Project I
- EECS 399L Senior Project II

In consultation with a faculty advisor, the student completes the program by selecting technical and open elective courses that
provide in-depth training in one or more of a variety of specialties such as digital and microprocessor-based control, communications and electronics, solid state electronics and integrated circuit design and fabrication. With the approval of their advisors students may emphasize other specialties by selecting elective courses from other programs or departments.

Many courses have integral or associated laboratories in which students gain “hands-on” experience with electrical engineering principles and equipment. Students have ready access to the laboratory facilities and are encouraged to work in the various laboratories during nonscheduled hours in addition to the regularly scheduled laboratory sessions. Opportunities also exist for undergraduate student participation in many of the wide variety of research projects being conducted within the program.

Bachelor of Science in Engineering Degree Major in Electrical Engineering

Freshman Year  
Class-Lab-Credit Hours

Fall
HM/SS elective ................................................................. (3-0-3)
CHEM 111 Chemistry I .................................................... (4-0-4)
MATH 121 Calculus I ....................................................... (4-0-4)
ENGR 131 Elementary Computer Programming ............... (3-0-3)
ENGL 150 Expository Writing ......................................... (3-0-3)
PHED 101 Physical Education ......................................... (0-3-0)
Total ............................................................................... (16-2-17)

Spring
Open elective a ................................................................. (3-0-3)
ENGR 145 Chemistry of Materials ................................... (4-0-4)
PHYS 121 Physics I: Mechanics b .................................... (4-0-4)
MATH 122 Calculus II .................................................... (4-0-4)
PHED 102 Physical Education ......................................... (0-3-0)
Total ............................................................................... (13-4-15)

Sophomore Year

Fall
PHYS 122 Physics II Electricity & Magnetism ..................... (4-0-4)
MATH 223 Calculus III ................................................... (3-0-3)
ENGR 210 Circuits and Instrumentation ............................ (3-2-4)
EECS 281 Computer Organization, Logic Design .............. (3-2-4)
Total ............................................................................... (13-4-15)

Spring
HM/SS Sequence I .......................................................... (3-0-3)
ENGR 225 Thermo, Fluids, Transport ............................... (4-0-4)
MATH 224 Differential Equations .................................... (3-0-3)
EECS 245 Electronic Circuits ......................................... (3-2-4)
EECS 309 Electromagnetic Fields I .................................. (3-0-3)
Total ............................................................................... (16-2-17)

Junior Year  
Class-Lab-Credit Hours

Fall
HM/SS Sequence II ......................................................... (3-0-3)
ENGR 200 Statics & Strength of Materials ....................... (3-0-3)
EECS 246 Signals & Systems .......................................... (3-2-4)
STAT 332 Statistics of Signal Processing e ...................... (3-0-3)
Approved Tech. Elective d ............................................ (3-0-3)
Total ............................................................................... (15-2-16)

Spring
HM/SS Sequence III ......................................................... (3-0-3)
EECS 321 Semiconductor Elect. Devices ......................... (3-2-4)
Applied Statistics Req. .................................................... (3-0-3)
Approved technical elective d ....................................... (3-0-3)
Approved technical elective d ....................................... (3-0-3)
Total ............................................................................... (15-2-16)

Senior Year

Fall
EECS 398L Senior Project Lab I  h ................................... (0-8-4)
ENGL 398N Professional Communications .................... (3-0-3)
Open Elective ................................................................. (3-0-3)
Approved technical elective d ....................................... (3-0-3)
Approved technical elective d ....................................... (3-0-3)
Total ............................................................................... (12-8-16)

Spring
HM/SS elective ............................................................... (3-0-3)
HM/SS elective ............................................................... (3-0-3)
EECS 399L Senior Project Lab II ..................................... (0-8-4)
Open elective ................................................................. (3-0-3)
Approved technical elective d ....................................... (3-0-3)
Total ............................................................................... (12-8-16)

Graduation Requirement: 128 hours total

a. Although not required students may elect to take ENGR 101 Freshman Engineering Field Service Project as their open elective in the freshman year.
b. Selected students may be invited to take PHYS 123, 124 in place of PHYS 121 and PHYS 122.
c. Students may replace this class with STAT 333 Uncertainty in Engineering and Science if approved by their advisor.
d. Technical electives will be chosen to fulfill the depth requirement and otherwise increase the student’s understanding of electrical engineering. Courses used to satisfy the depth requirement must come from the department’s list of depth areas and related courses. Technical electives not used to satisfy the depth requirement are more generally defined as any course related to the principles and practice of electrical engineering. This includes all EEAP courses at the 200 level and above and can include courses from other programs. All non-EEAP technical electives must be approved by the student’s advisor.
e. This course must utilize statistics in electrical engineering applications and is typically EEAP 352 Digital Communications or EEAP 355 RF Communications. Other courses possible with approval of advisor.
f. Co-op students may obtain design credit for one semester of Senior Project Lab if their co-op assignment included significant design responsibility; however, the student is still responsible for such course obligations as reports, presentations and ethics assignments. Design credit and fulfillment of remaining course responsibilities are arranged through the senior project instructor.
g. B.S./M.S. students may also utilize EEAP 398/399 to fulfill eight credits of M.S. thesis provided their thesis has adequate design content to meet the requirements of EEAP 398/399. B.S./M.S. students should see their thesis advisor for details.
Minor in Electrical Engineering

Students enrolled in degree programs in other engineering departments can have a minor specialization by completing the following courses:
- EECS 245 Electronic Circuits I (4)
- EECS 246 Signals and Systems (4)
- EECS 281 Logic Design and Computer Organization (4)
- EECS 309 Electromagnetic Fields (3)
- Approved Technical Elective (3)

Minor in Electronics

The department also offers a minor in electronics for students in the College of Arts and Science. This program requires the

Bachelor of Science in Engineering Degree

Major in Computer Engineering

Freshman Year  Class-Lab-Credit Hours
Fall
Open elective or HM/SS elective \(^\text{a}\) ........................................... (3-0-3)
CHEM 111 Chemistry I ................................................. (4-0-4)
MATH 121 Calculus I ............................................. (4-0-4)
ENGR 131 Elementary Computer Programming ................. (3-0-3)
PHED 101 Physical Education ....................................... (0-3-0)
Total........................................................................... (17-3-17)

Spring
HM/SS elective or open elective \(^\text{a}\) ........................................... (3-0-3)
ENGR 145 Chemistry of Materials .................................. (4-0-4)
PHYS 121 Physics I: Mechanics .................................... (4-0-4)
MATH 122 Calculus II ............................................. (4-0-4)
PHED 102 Physical Education ....................................... (0-3-0)
Total........................................................................... (15-3-15)

Sophomore Year

Fall
HM/SS Sequence I ................................................. (3-0-3)
PHYS 122 Physics II: Electricity & Magnetism .................. (4-0-4)
MATH 223 Calculus III ............................................. (3-0-3)
ENGR 200 Statics & Strength of Materials ....................... (3-0-3)
EECS 233 Introduction to Data Structures ....................... (3-2-4)
Total........................................................................... (16-2-17)

Spring
HM/SS Sequence II .................................................... (3-0-3)
MATH 224 Differential Equations ................................ (3-0-3)
ENGR 210 Circuits and Instrumentation ......................... (3-2-1)
Technical Elective \(^\text{b}\) ................................................. (3-0-3)
EECS 281 Comp. Organization Logic Design .................... (3-2-4)
Total........................................................................... (15-4-17)

Junior Year  Class-Lab-Credit Hours
Fall
HM/SS Sequence III .................................................. (3-0-3)
MATH 304 Discrete Mathematics ................................... (3-0-3)
EECS 337 Systems Programming ................................ (3-2-4)
ENGR 225 Thermodynamics, Fluids, Transport ............... (4-0-4)
Technical elective \(^\text{c}\) ................................................. (3-0-3)
Total........................................................................... (16-2-17)

Spring
ENGL 398N Prof. Communications ................................ (3-0-3)
EECS 301 Digital Laboratory ........................................ (0-4-2)
EECS 314 Computer Architecture ................................ (3-0-3)
EECS 315 Digital Systems Design ................................ (3-2-4)
EECS 338 Intro to Operating Systems \(^\text{d}\) ......................... (3-2-4)
or
Technical elective \(^\text{d}\) ................................................. (3-0-3)
Total........................................................................... (12-8-16) or (12-6-15)

Senior Year

Fall
HM/SS elective ............................................................ (3-0-3)
EECS 318 VLSI/CAD \(^\text{d}\) ................................................. (3-2-4)
or
Technical elective \(^\text{d}\) ................................................. (3-0-3)
Technical elective \(^\text{b}\) ................................................. (3-0-3)
Statistics elective ....................................................... (3-0-3)
Open elective ............................................................. (3-0-3)
Total........................................................................... (15-2-16) or (15-0-15)

Spring
HM/SS elective ............................................................ (3-0-3)
EECS 399M Comp. Eng. Design Project ......................... (0-6-3)
Technical elective \(^\text{b}\) ................................................. (3-0-3)
Open elective ............................................................. (3-0-3)
Open elective ............................................................. (3-0-3)
Total........................................................................... (12-6-15)

Graduation Requirement: 129 hours total

a. One of these must be a humanities/social science course
b. Technical electives are more generally defined as any course related to the principles and practice of computer engineering. This includes all EECS courses at the 200 level and above and can include courses from other programs. All non-EECS technical electives must be approved by the student’s advisor.
c. The student must take either EECS 318 VLSI/CAD (Fall Semester) or EECS 338 Intro. to Operating Systems (Spring Semester), AND a three credit hour technical elective.
Cooperative Education Program

There are many excellent Cooperative Education (CO-OP) opportunities for computer engineering majors. A CO-OP student does two CO-OP assignments in industry or government. The length of each assignment is a semester plus a summer which is enough time for the student to complete a significant computing project. The CO-OP program takes five years to complete because the student is typically gone from campus for two semesters.

B.S./M.S. Program

The department encourages students with at least a 3.5 grade point average to apply for admission to the five-year bachelors/master’s program in the junior year. This integrated program, which permits substitution of M.S. thesis work for the senior design project, provides a high level of fundamental training and in-depth advanced training in the student’s selected specialty. It also offers the opportunity to complete both the Bachelor of Science in Engineering and Master of Science degrees within five years.

Computer Engineering

The Bachelor of Science program in Computer Engineering is designed to give a student a strong background in the fundamentals of mathematics, physics, and computer engineering and science. A graduate of this program should be able to use these fundamentals to analyze and evaluate computer systems, both hardware and software. A graduate should also be able to design and implement computer systems, both hardware and software, which are state of the art solutions to a variety of computing problems. This includes systems which have both a hardware and a software component, whose design requires a well defined interface between the two, and the evaluation of the associated

**Bachelor of Science Degree Major in Computer Science**

**Freshman Year**

<table>
<thead>
<tr>
<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
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</tr>
<tr>
<td>Open elective or HM/SS elective</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>CHEM 111 Chemistry I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>MATH 121 Calculus I</td>
<td>(4-0-4)</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3-0-3)</td>
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<tr>
<td>PHED 101 Physical Education</td>
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<tr>
<td><strong>Total</strong></td>
<td>(17-3-17)</td>
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<tr>
<td><strong>Spring</strong></td>
<td></td>
</tr>
<tr>
<td>HM/SS elective or open elective</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGR 145 Chemistry of Materials</td>
<td>(4-0-4)</td>
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<tr>
<td>PHYS 121 Physics I: Mechanics</td>
<td>(4-0-4)</td>
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<tr>
<td>MATH 122 Calculus II</td>
<td>(4-0-4)</td>
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<tr>
<td>PHED 102 Physical Education</td>
<td>(0-3-0)</td>
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<tr>
<td><strong>Total</strong></td>
<td>(15-3-15)</td>
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<tr>
<td><strong>Sophomore Year</strong></td>
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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>HM/SS Sequence I</td>
<td>(3-0-3)</td>
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<tr>
<td>PHYS 122 Physics II Electricity &amp; Magnetism</td>
<td>(4-0-4)</td>
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<tr>
<td>MATH 223 Calculus III</td>
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<tr>
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<tr>
<td><strong>Total</strong></td>
<td>(16-2-17)</td>
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<tr>
<td><strong>Spring</strong></td>
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</tr>
<tr>
<td>HM/SS Sequence II</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>MATH 224 Differential Equations</td>
<td>(3-0-3)</td>
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<tr>
<td>Technical Elective c</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>MATH 304 Discrete Mathematics</td>
<td>(3-0-3)</td>
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<tr>
<td>EECS 233 Intro Data Structures</td>
<td>(3-2-4)</td>
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<tr>
<td><strong>Total</strong></td>
<td>(15-2-16)</td>
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</table>

**Junior Year**

<table>
<thead>
<tr>
<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>HM/SS Sequence III</td>
<td>(3-0-3)</td>
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<tr>
<td>EECS 340 Algorithms and Data Structures</td>
<td>(3-0-3)</td>
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<tr>
<td>EECS 337 Systems Programming</td>
<td>(3-2-4)</td>
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<tr>
<td>Statistics elective c</td>
<td>(3-0-3)</td>
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<tr>
<td>Technical elective c</td>
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<tr>
<td><strong>Total</strong></td>
<td>(15-2-16)</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>HM/SS elective</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EECS 345 Programming Language Concepts</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EECS 343 Theoretical Computer Science</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EECS 314 Computer Architecture</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EECS 338 Intro to Operating Systems</td>
<td>(3-2-4)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(15-2-16)</td>
</tr>
<tr>
<td><strong>Senior Year</strong></td>
<td></td>
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<tr>
<td><strong>Fall</strong></td>
<td></td>
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<tr>
<td>ENGL 398N Professional Communication</td>
<td>(3-0-3)</td>
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<tr>
<td>EECS 398M Software Engineering</td>
<td>(3-0-3)</td>
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<tr>
<td>Technical elective c</td>
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<td>Open elective</td>
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<td><strong>Total</strong></td>
<td>(15-0-15)</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>HM/SS elective</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EECS 341 Intro. to Database Systems</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EECS 391 Intro. to Artificial Intelligence</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>Technical elective c</td>
<td>(3-0-3)</td>
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<tr>
<td>Open elective</td>
<td>(3-0-3)</td>
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<tr>
<td><strong>Total</strong></td>
<td>(15-0-15)</td>
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</tbody>
</table>

**Graduation Requirement:** 127 hours total

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a. One of these must be a humanities/social science course.
b. ENGR 210 is recommended because it provides flexibility in choice of major and advanced EECS courses.
d. Course other than mathematics or computer science.
e. Technical electives are more generally defined as any course related to the principles and practice of computer science. This includes all EESC and MATH courses at the 200 level and above and can include courses from other programs. All technical electives which are not EECS or MATH courses must be approved by the students advisor.
engineering trade-offs. In addition to these program specific objectives, all students in the EECS department are exposed to societal issues, professionalism, and have the opportunity to develop leadership skills.

**Minor In Computer Engineering**

The minor has a required two course sequence followed by a two course sequence in either hardware or software aspects of computer engineering.

The following two courses are required for any minor in computer engineering:
- EECS 281 Logic Design and Computer Organization (or equivalent)
- EECS 233 Introduction to Data Structures

The two-course hardware sequence is:
- EECS 314 Computer Architecture
- EECS 315 Digital Systems Design

The corresponding two-course software sequence is:
- EECS 337 Systems Programming
- EECS 338 Introduction to Operating Systems

In addition to these two standard sequences, the student may design his/her own with the approval of the minor advisor. A student cannot have a major and a minor, or two minors, in both Computer Engineering and Computer Science because of the significant overlap between these subjects.

**Cooperative Education Program**

There are many excellent Cooperative Education (CO-OP) opportunities for computer engineering majors. A CO-OP student does two CO-OP assignments in industry or government. The length of each assignment is a semester plus a summer which is enough time for the student to complete a significant computing project. The CO-OP program takes five years to complete because the student is typically gone from campus for two semesters.

**B.S./M.S. Program**

Students with a grade point average of 3.2 or higher are encouraged to apply to the B.S./M.S. Program which will allow them to get both degrees in five years. The B.S. can be in Computer Engineering or a related discipline, such as mathematics or electrical engineering. Integrating graduate study in computer engineering with the undergraduate program allows a student to satisfy all requirements for both degrees in five years.

**Computer Science**

The Bachelor of Science program in Computer Science is designed to give a student a strong background in the fundamentals of mathematics and computer science. A graduate of this

### Bachelor of Arts Degree Computer Science

#### Freshman Year

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<th>Class-Lab-Credit Hours</th>
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<tr>
<td>Fall</td>
</tr>
<tr>
<td>Open elective .......... (3-0-3)</td>
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<tr>
<td>MATH 125 Mathematics I (4-0-4)</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming (3-0-3)</td>
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<td>GER course ............. (3-0-3)</td>
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<td>GER course ............. (3-0-3)</td>
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<td>Open elective .......... (3-0-3)</td>
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<tr>
<td>PHED 101 Physical Education (0-4-0)</td>
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<tr>
<td><strong>Total</strong> .............. (16-3-16)</td>
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<table>
<thead>
<tr>
<th>Spring</th>
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<tbody>
<tr>
<td>ENGL 150 Expository Writing (3-0-3)</td>
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<tr>
<td>MATH 126 Mathematics II (4-0-4)</td>
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<td>GER course .......... (3-0-3)</td>
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<td>GER course .......... (3-0-3)</td>
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<td>Open elective ........ (3-0-3)</td>
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<td>PHED 102 Physical Education (0-3-0)</td>
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<td><strong>Total</strong> .............. (16-3-16)</td>
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#### Sophomore Year

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<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>EECS 281 Comp. Organization Logic Design (3-2-4)</td>
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<tr>
<td>GER course ............ (3-0-3)</td>
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<tr>
<td>Logic Design technical elective * (3-0-3)</td>
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<td>Open elective .......... (3-0-3)</td>
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<td>Open elective .......... (3-0-3)</td>
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<td><strong>Total</strong> .............. (15-2-16)</td>
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<tr>
<th>Spring</th>
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<tbody>
<tr>
<td>GER course .......... (3-0-3)</td>
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<tr>
<td>MATH 304 Discrete Mathematics (3-0-3)</td>
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<td>EECS 233 Intro Data Structures (3-2-4)</td>
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<td>Open elective ........ (3-0-3)</td>
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<td>Open elective ........ (3-0-3)</td>
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<td><strong>Total</strong> .............. (15-2-16)</td>
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#### Junior Year

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<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
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<tr>
<td>EECS 337 Systems Programming (3-2-4)</td>
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<tr>
<td>GER course ............ (3-0-3)</td>
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<tr>
<td>Open elective .......... (3-0-3)</td>
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<td>Open elective .......... (3-0-3)</td>
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<td><strong>Total</strong> .............. (12-2-13)</td>
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<thead>
<tr>
<th>Spring</th>
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<tbody>
<tr>
<td>EECS 358 Intro to Operating Systems (3-2-4)</td>
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<tr>
<td>EECS 341 Intro to Database Systems (3-0-3)</td>
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<tr>
<td>EECS 314 Computer Architecture (3-0-3)</td>
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<td>Open elective ........ (3-0-3)</td>
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<td><strong>Total</strong> .............. (12-2-13)</td>
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#### Senior Year

<table>
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<tr>
<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>EECS 340 Algorithms and Data Structures (3-0-3)</td>
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<tr>
<td>Technical elective * (3-0-3)</td>
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<tbody>
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<td>Technical elective * (3-0-3)</td>
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<td>Open elective ........ (3-0-3)</td>
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</tbody>
</table>

#### Graduation Requirement: 120 hours total

a. One technical elective must be a computer science course. The other two technical electives may be computer science, MATH or STAT courses.
procedures should be able to use these fundamentals to analyze and evaluate software systems and the underlying abstractions upon which they are based. A graduate should also be able to design and implement software systems which are state of the art solutions to a variety of computing problems; this includes problems which are sufficiently complex to require the evaluation of design alternatives and engineering trade-offs. In addition to these program specific objectives, all students in the EECS department are exposed to societal issues, professionalism, and have the opportunity to develop leadership skills.

The Bachelor of Arts program in Computer Science is a combination of a liberal arts program and a computing major. It is a professional program in the sense that graduates can be employed as computer professionals, but it is much less technical than the Bachelor of Science program in Computer Science. It is particularly suitable for students with a wide variety of interests. For example, students can major in another discipline in addition to computer science and routinely complete all of the requirements for the double major in a 4 year period. This is possible because over a third of the courses in the program are open electives. Furthermore, if a student is majoring in computer science and a second technical field such as mathematics or physics many of the technical electives will be accepted for both majors. Another example of the utility of this program is that it routinely allows students to major in computer science and take all of the pre-med courses in a 4 year period.

**Minor In Computer Science (B.S. or B.S.E.)**

For students pursuing a B.S. or B.S.E. degree, the following three courses are required for a minor in computer science:

- EECS 233 Introduction to Data Structures
- EECS 338 Introduction to Operating Systems
- EECS 340 Algorithms and Data Structures

A student must take an additional four credit hours of computing courses with the exclusion of ENGR 131. MATH 304 (Discrete Mathematics) may be used in place of three of these credit hours because it is a prerequisite for EECS 340.

**Minor In Computer Science (B.A.)**

For students pursuing B.A. degrees, the following courses are required for a minor in computer science:

- ENGR 131 Elementary Computer Programming
- EECS 233 Introduction to Data Structures
- MATH 125 Mathematics I

Two additional computing courses are also required for this minor.

**Cooperative Education Program**

There are many excellent Cooperative Education (CO-OP) opportunities for computer science majors. A CO-OP student does two CO-OP assignments in industry or government. The length of each assignment is a semester plus a summer which is enough time for the student to complete a significant computing project. The CO-OP program takes five years to complete because the student is typically gone from campus for two semesters.

**B.S./M.S. Program**

Students with a grade point average of 3.2 or higher are encouraged to apply to the B.S./M.S. Program which will allow them to get both degrees in five years. The B.S. can be in Computer Science or a related discipline, such as mathematics or electrical engineering. Integrating graduate study in computer science with the undergraduate program allows a student to satisfy all requirements for both degrees in five years.

**Systems and Control Engineering**

The systems and control engineering B.S. program provides the student with the basic concepts, analytical tools, and engineering methods which are useful in analyzing and designing complex technological and non-technological systems. Problems relating to modeling, decision-making, control, and optimization are studied. Some examples of systems problems which are studied include: computer control of industrial plants, development of world models for studying environmental policies, and optimal planning and management in large-scale systems. In each case, the relationship and interaction among the various components of a given system must be modeled. This information is used to determine the best way of coordinating and regulating their individual contributions to achieve the overall goal of the system. What may be best for an individual component of the system may not be the best for the system as a whole.

There are three elective courses available within our B.S. degree curriculum:

**Control Systems**

The Control Systems sequence is directed toward developing skills in dynamic system modeling, analysis, automation, remote control, real-time data acquisition and feedback control.

**Systems Analysis**

The Systems Analysis sequence focuses on modeling, optimization, decision making and planning methods.

**Industrial and Manufacturing Systems**

The Industrial and Manufacturing Systems sequence provides education in the application of systems analysis, decision making and automation methods to industrial production and manufacturing problems.

All three sequences use concepts of modeling, data analysis, computer simulation, and optimization. Computers play a central role in the systems and control curriculum, not only for engineering and mathematical computation, but also for computer simulation, automatic control, real-time data acquisition and signal processing.

**Minor Program In Systems and Control Engineering**

A total of five courses (15 credit hours) are required to obtain a minor in systems and control engineering.

At least nine credit hours must be selected from:

- EECS 212 Signals, Systems and Control (3)
- EECS 214 Signals, Systems and Control Lab (1)
- EECS 304 Control Engineering I with Laboratory (3)
- EECS 346 Engineering Optimization (3)
- EECS 352 Engineering Economics and Decision Analysis (3)

The remaining credit hours can be chosen from EECS courses with the written approval of the faculty member in charge of the minor program in the Systems and Control Program. A list of suggested EECS courses to complete the minor is:

- EECS 110 Problem Solving & Systems Engineering
- EECS 324 Simulation Methods in Engineering
- EECS 313 Signal Processing
- EECS 306 Control Engineering II
- EECS 350 Production and Operational Systems
- EECS 360 Manufacturing and Integrated Systems

**Cooperative Education Program**

There are many excellent Cooperative Education (CO-OP) opportunities for systems and control engineering majors. A CO-OP student does two CO-OP assignments in industry or govern-
Bachelor of Science in Engineering Degree
Major in Systems and Control Engineering

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Class-Lab-Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
</tr>
<tr>
<td>HM/SS elective</td>
<td>(3-0-3)</td>
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<tr>
<td>CHEM 111 Chemistry I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>MATH 121 Calculus I</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
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</tr>
<tr>
<td>PHED 101 Physical Education</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>(13-4-15)</td>
</tr>
<tr>
<td><strong>Spring</strong></td>
<td></td>
</tr>
<tr>
<td>Open elective</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGR 145 Chemistry of Materials</td>
<td>(4-0-4)</td>
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<tr>
<td>PHYS 121 Physics I: Mechanics b</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>MATH 122 Calculus II</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>PHED 102 Physical Education</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>(15-3-15)</td>
</tr>
<tr>
<td><strong>Sophomore Year</strong></td>
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<tr>
<td><strong>Fall</strong></td>
<td></td>
</tr>
<tr>
<td>PHYS 122 Physics II: Electricity &amp; Magnetism b</td>
<td>(4-0-4)</td>
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<tr>
<td>MATH 225 Calculus III</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGR 210 Circuits and Instrumentation</td>
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<tr>
<td>EECS 281 Computer Organization</td>
<td>(3-2-4)</td>
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<tr>
<td><strong>Total</strong></td>
<td>(12-8-16)</td>
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<tr>
<td><strong>Spring</strong></td>
<td></td>
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<tr>
<td>HM/SS Sequence I</td>
<td>(3-0-3)</td>
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<tr>
<td>EECS 246 Signals and Systems</td>
<td>(3-2-4)</td>
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<tr>
<td>EECS 342 Introduction to Global Systems</td>
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<tr>
<td>EECS 324 Simulation Methods</td>
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<td><strong>Total</strong></td>
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<td><strong>Junior Year</strong></td>
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<td><strong>Fall</strong></td>
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<tr>
<td>HM/SS Sequence III</td>
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<tr>
<td>EECS 304 Control Engineering I</td>
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<td>EECS 305 Control Lab I</td>
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<td>EECS 346 Engineering Optimization</td>
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<td>Open elective</td>
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<td><strong>Total</strong></td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>HM/SS elective</td>
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<tr>
<td>EECS 398N Senior Project Lab a</td>
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<tr>
<td>ENGL 398N Professional Communications</td>
<td>(3-0-3)</td>
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<tr>
<td>EECS 352 Eng. Econ. &amp; Dec. Analysis</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>Approved technical elective c</td>
<td>(3-0-3)</td>
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<tr>
<td><strong>Total</strong></td>
<td>(12-8-16)</td>
</tr>
<tr>
<td><strong>Senior Year</strong></td>
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<tr>
<td><strong>Fall</strong></td>
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<td>HM/SS elective</td>
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</tr>
<tr>
<td>EECS 399N Engineering Projects Lab II</td>
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<td>Approved Technical Elective c</td>
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<tr>
<td>Approved Technical Elective c</td>
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<tr>
<td>Approved Technical Elective c</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(12-8-16)</td>
</tr>
</tbody>
</table>

Graduation Requirement: 127 hours total

a. Although not required, students may elect to take ENGR 101, Freshman Engineering Service Project, as their open elective during the freshman year.
b. Selected students may be invited to take PHYS 124 in place of PHYS 121 and 122.
c. Choose from STAT 312, STAT 332, STAT 333.
d. Co-op students may obtain credit for the first semester of Senior Project Lab if their co-op assignment includes significant design responsibility. This credit can be obtained by submitting a suitable written report and making an oral presentation on the co-op work in coordination with the senior project instructor.
e. Technical electives from an approved list.
Control Systems Analysis and Engineering
EECS 414 Complex Systems Modeling and Analysis
EECS 416 Engineering Optimization
EECS 429 Risk and Decision Analysis
OPRE 432 Simulation
OPRE 426 Stochastic Processes in Operations Research

Graduate Programs

Computer Engineering and Science Graduate Studies
The programs in computer engineering and computing and information sciences are similar in that they each require a strong background in both computer hardware and software, as well as a substantial amount of “hands-on,” experience. The programs differ in that engineering is based mainly in physical sciences, while computer science is more strongly based in mathematical sciences as applied to more abstract notions such as properties of programming languages, analysis of algorithms, complexity considerations, and proof of correctness. The department believes that the success of its graduates at all levels is largely due to the emphasis on project and problem-oriented course material coupled with the broad-based curricular requirements. Doctoral dissertations must be original contributions to the existing body of knowledge in computer engineering and science.

Electrical Engineering and Applied Physics Graduate Studies
The electrical engineering program offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. The programs are comprehensive and basic, emphasizing four major areas in which the faculty are actively engaged in research: (1) automation, sensing, intelligence and actuation; (2) solid state electronics; (3) electromagnetic, high frequency communications and devices; and (4) circuits, signal processing, and computer-aided design. Academic requirements for graduate degrees in engineering are as specified for The Case School of Engineering in this bulletin, however, some exceptions are noted below. All current rules and regulations for this department are detailed in a graduate student handbook, available from the department office, which supersedes any rules contained here. A number of teaching and research assistantships are available, on a competitive basis, for the full support of qualified students. In addition, a limited number of tuition assistantships are also available for partial support of graduate students.

Systems Engineering Graduate Studies
Graduate programs in systems and control engineering include the following areas of concentration: control theory (adaptive control, stochastic filtering and control, nonlinear control), optimization and decision theory (multi-objective and large scale system theory), control of industrial and manufacturing systems (facilities layout, flexible manufacturing), biomedical control system design and analysis (control of neural prostheses, automatic control of therapeutic drug delivery), energy systems (power distribution and production planning, load forecasting), and global and environmental system analysis and control (resource constraints: water, energy etc., carrying capacity and global climate change).

Research funds are used to provide assistantships that support the thesis research of graduate students. Current research funding is provided by Elsag-Bailey, Rockwell Automation, the Ford Motor Company, the Cleveland Advanced Manufacturing Program (CAMP), the Electric Power Research Institute (EPRI), the National Institutes of Health (NIH), National Institute of Nursing Research (NINR), the National Science Foundation (NSF), the U.S. Department of Veterans Affairs-Rehabilitation Research and Development Program (VA-RR&D), the Office of Naval Research (ONR), the U.S. Agency for International Development (US-AID) and United National Education, Scientific Cultural Organization (UNESCO).

Electrical Engineering and Computer Science (EECS)

Undergraduate Courses
EECS 212. Signals, Systems, and Control (3)
EECS 214. Signals, Systems, and Control Laboratory (1)
A laboratory course based on the material in EECS 212. Analysis and simulation using MATLAB/Simulink. Laboratory experiments involving signal processing and control. Coreq: EECS 212.
EECS 216. Fundamental System Concepts (3)
Develops framework for addressing problems in science and engineering that require an integrated, interdisciplinary approach, including the effective management of complexity and uncertainty. Introduces fundamental system concepts in an integrated framework. Properties and behavior of phenomena regardless of the physical implementation through a focus on the structure and logic of information flow. Systematic problem solving methodology using systems concepts. Prereq: MATH 224.
EECS 223. Introduction to Data Structures (4)
The programming language C++; pointers, files, variant records, and recursion. Representation and manipulation of data: one-way and circular linked lists, doubly linked lists; the available space list. Different representations of stacks and queues. Representation of binary trees, trees and graphs. Hashing; searching and sorting. Laboratory. Prereq: ENGR 131.
EECS 245. Electronic Circuits (4)
EECS 246. Signals and Systems (4)
z-transform and digital signal processing. Accompanying laboratory exercises which reinforce classroom lectures. Prereq: ENGR 210 and MATH 224.

EECS 251. Numerical Methods (3)
Introduction to basic concepts and algorithms used in the numerical solution of common problems including solving non-linear equations, solving systems of linear equations, interpolation, fitting curves to data, integration and solving ordinary differential equations. Computational error and the efficiency of various numerical methods are discussed in some detail. Most homework requires the implementation of numerical methods on a computer. Prereq: ENGR 151 and MATH 122.

EECS 281. Logic Design and Computer Organization (4)
Fundamentals of digital systems in terms of both computer organization and logic level design. Organization of digital computers; information representation; boolean algebra; analysis and synthesis of combinational and sequential circuits; datapaths and register transfers; instruction sets and assembly language; input/output and communication; memory. Prereq: ENGR 151.

EECS 285. Engineering in Community Service I (3)
Project-oriented course; students work on 'real' engineering projects of benefit to the community and in partnership with community "customers." Project teams consists of a mix of sophomores, juniors, and seniors. Students perform engineering design tasks as appropriate to their technical background. Emphasis on teamwork, communication skills, customer awareness, and professional responsibility. Prereq: Sophomore standing in EECS.

EECS 290. Special Topics (1-18)
Limited to sophomores and juniors. Prereq: Consent of instructor.

EECS 301. Digital Logic Laboratory (2)
This course is an introductory experimental laboratory for digital networks. The course introduces students to the process of design, analysis, synthesis and implementation of digital networks. The course covers the design of combinational circuits, sequential networks, registers, counters, synchronous/asynchronous Finite State Machine, register based design, and arithmetic computational block. Prereq: EECS 281.

EECS 304. Control Engineering I with Laboratory (3)

EECS 305. Control Engineering I Laboratory (1)
A laboratory course based on the material in EECS 304. Modeling, simulation, and analysis using MATLAB. Physical experiments involving control of mechanical systems, process control systems, and design of PID controllers. Prereq: EECS 212 or equivalent. Coreq: EECS 304.

EECS 306. Control Engineering II with Laboratory (3)
Advanced techniques for control of dynamic systems. State-space modeling, analysis, and controller synthesis; introduction to nonlinear control systems: phase plane methods, bang-bang control, time-optimal control; describing functions analysis and design techniques; discrete time systems and controllers. Advanced control design methods implementation. Prereq: EECS 304.

EECS 309. Electromagnetic Fields I (3)
Maxwell's integral and differential equations, boundary conditions, constitutive relations, energy conservation and Pointing vector, wave equation, plane waves, propagating waves and transmission line characteristics, impedance, reflection coefficient and standing wave ratio, in-depth analysis of coaxial and strip lines, electro- and magneto-quasistatics, simple boundary value problems, correspondence between fields and circuit concepts, energy and forces. Prereq: MATH 223 and PHYS 122. Coreq: MATH 224.

EECS 310. Electromechanical Energy Conversion (4)
Electromechanical dynamics, modeling and control. Forces in quasistatic magnetic systems. Energy conversion properties of rotating machines. Analysis and control of DC servomotors, AC servomotors, reluctance ma-
EECS 324. Simulation Techniques in Engineering (3)
Discrete event systems and simulation concepts. Discrete event simulation with batch and interactive languages. Coreq: ENGL 398.

EECS 329. Design of Object-Oriented Systems (3)
This course provides an opportunity to gain an understanding of the concepts and technology of object-oriented systems and learn system design techniques that take full advantage of this technology. Students also develop competence in programming with the object-oriented features of C++. Prereq: EECS 233.

EECS 337. Systems Programming (4)
Lexical analyzers; symbol tables and their searching; assemblers, one-pass and two-pass, conditional assembly, and macros; linkers and loaders; interpreters, pnodes, threaded codes; introduction to compilation, grammar, parsing, and code generation; preprocessors; text editors, line-oriented and screen-oriented; bootstrap loaders, ROM monitors, interrupts, and device drivers. Laboratory. Prereq: EECS 253 and EECS 281.

EECS 338. Introduction to Operating Systems (4)
CPU scheduling, memory management, concurrent processes, semaphores, monitors, deadlocks, secondary storage management, file systems, protection, UNIX operating system, fork, exec, wait, UNIX System V IPCs, sockets, remote procedure calls, threads. Must be proficient in "C" programming language. Prereq: EECS 337.

EECS 340. Algorithms and Data Structures (3)
Efficient sorting algorithms, external sorting methods, internal and external searching, efficient string processing algorithms, geometric and graph algorithms. Prereq: EECS 253 and MATH 304.

EECS 341. Introduction to Database Systems (3)
Relational model, ER model, relational algebra and calculus, SQL, OBE, security, views, files and physical database structures, query processing and query optimization, normalization theory, concurrency control, object relational systems, multimedia databases, Oracle SQL server, Microsoft SQL server. Prereq: EECS 253.

EECS 342. Introduction to Global Issues (3)
This course is based on the paradigm of the world as a complex system. Global issues such as population, world trade and financial markets, resources (energy, water, land), global climate change, and others are considered with particular emphasis put on their mutual interdependence. A reasoning computer system which contains extensive data and a family of models is used for future assessment. Students are engaged in individual, custom-tailored, projects of creating conditions for a desirable or sustainable future based on data and scientific knowledge available. Prereq: EECS 351.

EECS 343. Theoretical Computer Science (3)
Introduction to mathematical logic, different classes of automata and their correspondence to different classes of formal languages, recursive functions and computability, assertions and program verification, denotational semantics. Prereq: MATH 304. Cross-listed as MATH 343.

EECS 344. Electronic Analysis and Design (3)
The design and analysis of real-world circuits. Topics include: junction diodes, non-ideal opamp models, characteristics and models for large and small signal operation of bipolar junction transistors (BJTs) and field effect transistors (FETs), selection of operating point and biasing for BJT and FET amplifiers. Hybrid-pi model and other advanced circuit models, cascaded amplifiers, negative feedback, differential amplifiers, oscillators, tuned circuits, and phase-locked loops. Computers will be extensively used to model circuits. Selected experiments and/or laboratory projects. Prereq: EECS 245.

EECS 345. Programming Language Concepts (3)
This course studies important concepts underlying the design, definition, implementation and use of modern programming languages including syntax, semantics, names/scope, types, expression, assignment, subprograms, data abstraction, and inheritance. Imperative, object-oriented, concurrent, functional, and logic programming paradigms are discussed. Illustrative examples are drawn from a variety of popular languages, such as C++, Java, Ada, Lisp, and Prolog. Prereq: EECS 233, EECS 337.

EECS 346. Engineering Optimization (3)
Optimization techniques including linear programming and extensions; transportation and assignment problems; network flow optimization; quadratic, integer, and separable programming; geometric programming; and dynamic programming. Nonlinear optimization topics: optimality criteria, gradient and other practical unconstrained and constrained methods. Computer applications using engineering and business case studies. Prereq: MATH 201.

EECS 347. Network Synthesis (3)
Design techniques for the construction of filters, delayers, predictors, analog computer networks, and necessary and sufficient requirements for the realization of practical networks. Prereq: EECS 246 or equivalent. EECS 348. Communication Electronic Circuits (4)

EECS 350. Industrial and Production Systems Engineering (3)
Time and motion study, human factors and safety engineering, man-machine systems, quality control and reliability, project management, scheduling, sequencing, inspection and maintenance of industrial processes.

EECS 351. Communications and Signal Analysis (3)
Fourier transform analysis and sampling of signals. AM, FM and SSB modulation and other modulation methods such as pulse code, delta, pulse position, PSK and FSK. Detection, multiplexing, performance evaluation in terms of signal-to-noise ratio and bandwidth requirements. Prereq: EECS 246 or equivalent.

EECS 352. Engineering Economics and Decision Analysis (3)

EECS 354. Digital Communications (3)

EECS 355. RF Communications (3)
Coverage of modern communications circuits and systems with a particular emphasis upon mobile communications. Cellular communications, modulation methods, user access schemes. Individual system components: tuned small signal amplifiers and power amplifiers, mixers, detectors, and frequency synthesizers. Low-power design considerations. Prereq: EECS 351.

EECS 356. Microwave Engineering (3)
Transmission lines and circuit analysis, waveguides, modes of propagation, impedance matching techniques, scattering matrix, waveguide components, striplines, resonators, microwave theory, filters, microwave solid state devices. Prereq: EECS 311.

EECS 358. Domain Theoretic Methods for Artificial Intelligence (3)

EECS 360. Manufacturing, Operations, and Automated Systems (3)
Introduction to design, modeling, analysis, and optimization of production, automation computer-integrated, and manufacturing systems. Topics include, design of products and processes, statistical quality control: confirming design, design of location/spatial problems, transportation and assignment problems, product-oriented layout (including assembly line balancing), process oriented layout (including quadratic assignment problem and steepest descent exchange heuristics), group technology and clustering, cellular and network flow layouts, machining supervisions optimization and numerical control. Tools for analysis for each of the above problems include optimization of multiple criteria decision-making (MCDM), and heuristics for combinatorial problems. Applications to com-
puter science and engineering problems are also covered. Prereq: Junior or senior level standing in engineering or consent of instructor.

EECS 375. Autonomous Robotics (3)
Introduction to the design, construction and control of autonomous mobile robots. The first half of the course consists of focused exercises on mechanical construction with LEGO, characteristics of sensors, motors and batteries, and control strategies for autonomous robots. In the second half of the course, students design, build and program their own complete robots that participate in a public competition. All work is performed in groups. Biologically-inspired approaches to the design and control of autonomous robots are emphasized throughout. Prereq: Consent of instructor. Cross-listed as BIOL 375.

EECS 381. Hybrid Systems (3)
Today, the most interesting computer code and microprocessor designs are “embedded” and hence interact with the physical world, producing a mixture of digital and analog domains. The class studies an array of tools for understanding and designing these “hybrid systems.” Topics include: basics of language and finite state automata theory, discrete-event dynamic systems, Petri nets, timed and hybrid automata, and hybrid dynamical systems. Simulation, verification, and control concepts and languages for these models. Prereq: MATH 224 and either EECS 246 or MATH 304.

EECS 382. Microprocessor-Based Design (3)
Microprocessor architectures, memory design, timing, polled and interrupt driven I/O, microprocessor support devices, microcontrollers, integrated hardware/software design considerations. Prereq: ENGR 210 and EECS 281.

EECS 383. Microprocessor Applications to Controls (3)
Digital control and its implementation using microprocessors. Z-transforms. Time response characteristics, steady-state error, mapping from the s-plane to the z-plane. Digital controller design-stability testing methods, gain and phase margins, PID controllers, digital filter structures. Prereq: EECS 246 or equivalent.

EECS 385. Engineering in Community Service II (3)
Project-oriented course; students work on “real” engineering projects of benefit to the community and in partnership with community “customers.” Project teams consists of a mix of sophomores, juniors, and seniors. Students perform engineering design, project specification, and technical research as appropriate to their technical background. Emphasis on project planning and organization, teamwork, project management, communication skills, customer awareness, and professional responsibility. Prereq: Junior or Senior standing in EECS.

EECS 391. Introduction to Artificial Intelligence (3)
Overview of artificial intelligence, knowledge representation, search, game-playing, logic rule-based systems, AI programming languages, learning, neural networks, evolutionary algorithms, natural language understanding, planning, robotics. Prereq: ENGR 131.
EECS 394X. Senior Project I (3)
EECS 396L. Special Topics (1-6) (Credit as arranged.) Limited to juniors and seniors.
EECS 396M. Special Topics: Computer Science (1-9)
EECS 396N. Special Topics (1-18)
EECS 397L. Special Topics in Electrical Engineering (1-6) (Credit as arranged.) Limited to juniors and seniors. Prereq: Consent of instructor.
EECS 398L. Senior Project in Electrical Engineering I (4)
EECS 398M. Software Engineering (3)
Issues in the development of complex software systems. Software lifecycle models. Software engineering methodology, requirements, analysis and specification design implementation, validation, and maintenance. Team development of a significant applications program. Prereq: EECS 337.
EECS 398N. Engineering Projects I (3)
Project experience in the application of course material to practical systems engineering problems. Identification of project, literature review, and proposal preparation for EECS 399.

EECS 399L. Senior Project in Electrical Engineering II (4) Prereq: EECS 398L (or concur).
EECS 399M. Computer Engineering Design Project (3)
Capstone course for computer engineering seniors. Material from previous and concurrent courses used to solve hardware and/or software design problems. Formal presentations of the projects scheduled during last week of classes.
EECS 399N. Engineering Projects II (3)
Elective projects with emphasis on engineering design. Capstone engineering project. Prereq: EECS 398N.

Graduate Courses

EECS 400T. Graduate Teaching I (0)
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to involve direct student contact but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational experience for the student. Students in this course may be expected to perform one or more of the following teaching related activities: grading homeworks, quizzes, and exams, having office hours for students, tutoring students. Prereq: Ph.D. student in EECS department.

EECS 401. Digital Signal Processing (3)

EECS 404. Digital Control Systems (3)
Analysis and design techniques for computer based control systems. Sampling, hybrid continuous-time/discrete-time system modeling; sampled data and state space representations, controllability, observability and stability, transformation of analog controllers, design of deadbeat and state feedback controllers; pole placement controllers based on input/output models, introduction to model identification, optimal control and adaptive control. Prereq: EECS 304.

EECS 405. Data Structures and File Management (3)
Fundamental concepts: sequential allocation, linked allocation, lists, trees, graphs, internal sorting, external sorting, sequential, binary, interpolation search, hashing file, indexed files, multiple level index structures, btrees, hashed files. Multiple attribute retrieval; inverted files, multi lists, multiple-key hashing, hash trees. Introduction to data bases. Data models. Prereq: EECS 233 and MATH 304.

EECS 408. Introduction to Linear Systems (3)

EECS 409. Discrete Event Systems (3)
A broad range of system behavior can be described using a discrete event framework. These systems are playing an increasingly important role in modeling, analyzing, and designing manufacturing systems. Simulation, automata, and queuing theory have been the primary tools for studying the behavior of these logically complex systems; however, new methods and techniques as well as new modeling frameworks have been developed to represent and to explore discrete event system behavior. The class will begin by studying simulation, the theory of languages, and finite state automata, and queuing theory approaches and then progress to examining selected additional frameworks for modeling and analyzing these systems including Petri nets, perturbation analysis, and Min-Max algebras.
EECS 410. Ultrasonic Engineering (3)
Acoustical waves in fluids and solids, surface acoustic waves, transmission phenomena, radiators, transducers, filters, flow measurements, pulse echo techniques, flaw detection, sonar, imaging, holography.

EECS 411. Introduction to Logic Programming (3)

EECS 412. Electromagnetic Fields III (3)
Maxwell’s equations, macroscopic versus microscopic fields, field interaction with materials in terms of polarization vectors $\mathbf{P}$ and $\mathbf{M}$. Laplace’s and Poisson’s equations and solutions, scalar and vector potentials. Wave propagation in various types of media such as anisotropic and gyrotropic media. Phase and group velocities, signal velocity and dispersion. Boundary value problems associated with wave-guide and cavities. Wave solutions in cylindrical and spherical coordinates. Radiation and antennas.

EECS 413. Nonlinear Systems I (3)
This course will provide an introduction to techniques used for the analysis of nonlinear dynamic systems. Topics will include existence and uniqueness of solutions, phase plane analysis of two dimensional systems including Poincare-Bendixon, describing functions for single-input single-output systems, averaging methods, bifurcation theory, stability, and an introduction to the study of complicated dynamics and chaos. Coreq: EECS 408.

EECS 414. Complex Systems Modeling and Analysis (3)
The concept of a complex system as a relationship of identifiable subsystems. Modeling of large-scale systems by aggregation, perturbation, via system identification and by the use of fuzzy logic. The structural properties of large-scale systems. A hierarchical, multilevel approach to large-scale systems analysis and synthesis. Coordination by the interaction balance and by interaction prediction principles. Decentralized decision making and control of large-scale systems. Near optimum system design. Structure and stability of fuzzy control systems.

EECS 415. Integrated Circuit Technology I (3)
Review of semiconductor technology. Device fabrication processing, material evaluation, oxide passivation, pattern transfer technique, diffusion, ion implantation, metallization, probing, packaging, and testing. Design and fabrication of passive and active semi-conductor devices. Prereq: EECS 322.

EECS 416. Optimization Theory and Techniques (3)
Underlying theory of linear, nonlinear, multilevel, and multivariable optimization. Techniques include linear programming and extensions, quadratic programming, dynamic programming, decomposition coordination schemes for multilevel optimization. Methods for generating Pareto optimal solutions in multiobjective optimization. Applications to engineering problems. Prereq: MATH 201 or equivalent.

EECS 417. Introduction to Stochastic Control (3)
Analysis and design of controllers for discrete-time stochastic systems. Review of probability theory and stochastic properties, input-output analysis of linear stochastic systems, spectral factorization and Weiner filtering, minimum variance control, state-space models of stochastic systems, optimal control and dynamic programming, statistical estimation and filtering, the Kalman-Bucy theory, the linear quadratic Gaussian problem, and the separation theorem. Prereq: EECS 408.

EECS 418. System Identification and Adaptive Control (3)

EECS 419. Computer System Architecture (3)

EECS 420. Solid State Electronics I (3)

EECS 421. Optimization of Dynamic Systems (3)

EECS 422. Solid State Electronics II (3)

EECS 423. Distributed Systems (3)
Introduction to distributed systems; system models; network architecture and protocols; interprocess communication; client-server model; group communication; TCP sockets; remote procedure call; distributed objects and remote invocation; distributed file systems; file service architecture; name services; directory and discovery services; distributed synchronization and coordination; transactions and concurrency control; security; cryptography; replication; distributed multimedia systems. Prereq: EECS 358.

EECS 425. Computer Communications Networks (3)
Covers computer network architecture. Topics include: network applications; types of networks; network architecture; OSI, TCP/IP and ATM reference models; transmission media; the telephone system; ISDN and ATM error detection and correction; data link protocols; channel allocation; LAN protocols; bridges; routing; congestion control; internetworking; transport services and protocols; TCP/IP and ATM protocols; socket programming; security; Domain Name System; Simple Network Management Protocol; e-mail, WWW; Java; Corba; distributed multimedia. Prereq: EECS 338.

EECS 426. MOS Integrated Circuit Design (3)

EECS 427. MEMS for Sensing and Communication (3)
This course covers basic MEMS fabrication technologies and device operating principles of MEMS resonators and inertial sensors such as accelerometers and gyroscopes. Critical issues regarding sensing resolution and low noise interface electronics design will be discussed. MEMS applications such as low noise oscillators, filters, switches, etc. for wireless communications will also be covered.

EECS 428. Web Computing (3)
The goal of this course is to acquire expertise in state-of-the-art Web technology, including performance evaluation, servers, caching, security, and search engines. Expected work includes bi-weekly homework assignments (includes small projects), final class project suggested by students, midterm, and final. Coreq: EECS 425 or permission of instructor.

EECS 429. Risk and Reliability Methods for Engineers (3)
Probabilistic models and methods for risk, reliability, and quality engineering; Markov decision processes; stochastic dynamic programming; stochastic programming and other methods for risk analysis; failure models; qualitative fault analysis; reliability analysis of systems; life data analysis and accelerated life testing; design of experiments for quality engineering; statistical quality control; and acceptance sampling for quality control.

EECS 430. Object-Oriented Software Development (3)
Covers advanced methodology for the design of large software systems. Topics include: object-oriented analysis and design, encapsulation, inheritance; subtype and parametric polymorphism; object-oriented program-
ming languages; design patterns; application frameworks; software architecture; user-interfaces; concurrent and distributed objects. Prereq: EECS 337 or consent of instructor.

EECS 431. Software Engineering (3)
Design of software systems working from specifications; top-down decomposition using stepwise refinement; object-oriented methods; prototyping. Software metrics and testing; software quality and reliability; maintenance; human factors. Homework involves working in teams on large software projects. Prereq: EECS 337.

EECS 432. Compiler Construction (3)
Top-down and bottom-up recognizers for context-free grammars; LR(k) parsers, error recovery, semantic analysis, storage allocation for block structured languages, optimization, code generation. Homework involves writing a compiler for a block structured language. Prereq: EECS 357.

EECS 433. Database Systems (3)

EECS 434. Microfabricated Silicon Electromechanical Systems (3)

EECS 435. Data Mining (3)
Data Mining is the process of discovering interesting knowledge from large amounts of data stored either in databases, data warehouses, or other information repositories. Topics to be covered includes: Data Warehouse and OLAP technology for data mining, Data Preprocessing, Data Mining Primitives, Languages, and System Architectures, Mining Association Rules from Large Databases, Classification and Prediction, Cluster Analysis, Mining Complex Types of Data, and Applications and Trends in Data Mining. Prereq: EECS 341 or equivalent.

EECS 436. Advances in Databases (3)
Advanced topics in databases will be covered in this course. Query optimization in object-oriented databases, temporal databases, issues in multimedia databases, databases and Web, graphical query interfaces. Basic knowledge in databases is required. Prereq: EECS 433.

EECS 437. Optical Communication (3)
In this course, suitable for graduate students or advanced undergraduates interested in photonics, a broad range of topics will be covered in the field of optical communication, with an aim to provide a sophisticated perspective of current technology and trends in optical communication components, systems, and networks. Prereq: EECS 309.

EECS 438. Biomedical Microdevices (3)
Topics related to current research in Microelectromechanical systems (MEMS) technology for biomedical applications. Review of fabrication technologies for semiconductor and plastic materials, microscale transport behavior, biocompatibility and materials issues, microfluidic devices for biochemical analysis, miniaturized sensors and actuators for implantable medical instrumentation, and microstructures for tissue engineering.

EECS 440. Automata and Formal Languages (3)
(See MATH 410.) Cross-listed as MATH 410.

EECS 445. Formal Verification (3)
Introduction and survey of principles and methodologies in formal specification and verification of systems (hardware, software, hybrid). Prereq: EECS 345 or graduate standing.

EECS 450. Production and Operations Systems (3)
Fundamental theories and techniques, decision making, and artificial intelligence for solving production/manufacturing problems. Formulation, modeling, planning, and control of production problems at three levels: strategic, tactical, and operational (long term, medium, and short term). Specific problems include aggregate planning, project planning, scheduling, line balancing, sequencing, and machine set-up. Special emphasis will be given on decomposition and control of computer integrated systems, on-line and off-line supervisory planning, and man/machine systems.

EECS 452. Random Signals (3)

EECS 454. Analysis of Algorithms (3)
This course presents and analyzes a number of efficient algorithms. Problems are selected from such problem domains as sorting, searching, set manipulation, graph algorithms, matrix operations, polynomial manipulation, and fast Fourier transforms. Through specific examples and general techniques, the course covers the design of efficient algorithms as well as the analysis of the efficiency of particular algorithms. Certain important problems for which no efficient algorithms are known (NP-complete problems) are discussed in order to illustrate the intrinsic difficulty which can sometimes preclude efficient algorithmic solutions. Prereq: MATH 304 and (EECS 340 or EECS 405). Cross-listed as OPRE 454.

EECS 455. Wireless Communications (3)
Cellular telephone systems, wireless networks, receiver architectures, noise characterization, error-correction coding, digital modulation, multiple-access technologies, multipath fading. Prereq: STAT 332 and EECS 351 or consent of instructor.

EECS 456. Microwave Engineering (3)

EECS 458. Introduction to Bioinformatics (3)
Fundamental algorithmic methods in computational molecular biology and bioinformatics discussed. Sequence analysis, pairwise and multiple alignment, probabilistic models, phylogenetic analysis, folding and structure prediction emphasized. Prereq: EECS 340, EECS 233.

EECS 459X. Domain Theoretic Methods for Artificial Intelligence (3)
(See EECS 358.) Cross-listed as MATH 450.

EECS 460. Manufacturing, Design, and Automated Systems (3)
The course is designed primarily for graduate engineering students who wish to know about the fundamentals and modeling of productionautomation/manufacturing systems. The course provides a survey of various topics in production automation and computer-aided and integrated manufacturing with emphasis on decision making, optimization, and modeling. Topics include computerized process planning, on-line and off-line supervisory computer control, computerized discrete production systems, numerical control, monitoring and planning, flexible manufacturing systems, group technology, materials handling systems, man/machine systems and requirements, design and assembly of assembly systems, and computerized facility layout design problems. The course presents a step-by-step and cohesive account of concepts, theories, and procedures for solving modern manufacturing and production problems with emphasis on computer applications. Prereq: Consent of instructor.

EECS 462. Research Topics in Lasers and Optics (3)
Topics related to current research, e.g., laser theory, coherent optics, optical information processing.

EECS 463. Techniques of Model-based Control (3)
Strategies of process control centered around the use of process models in the control system. Topics include single loop, feed forward, cascade and multivariable internal model control. Tuning controllers to accommodate process uncertainty. Treatment of control effect and output constraints in model predictive control and modular-multivariable control. Prereq: EECS 304. Cross-listed as ECHE 463.
EECS 466. Computer Graphics (3)
Theory and practice of computer graphics: object and environment representation including coordinate transformations, image extraction including perspective, hidden surface, and shading algorithms; and interaction. Covers a wide range of graphic display devices and systems with emphasis in interactive shaded graphics. Laboratory. Prereq: EECS 233.

EECS 473. Multimedia and Web Computing (3)
Multimedia is an important application area that will be at the center for next-generation computer systems and software design. It is a fast-changing technology, and, already, in the industry, there is a significant demand for computer scientists/engineers with multimedia system design knowledge. The objective of EECS 473 is to present design issues for multimedia systems from specification to software implementation and testing. This will include multimedia basics, data capture/models/compresion, synchronization models, multimedia servers, OS support for multimedia, multimedia communication systems, and multimedia user interfaces. There will be a project about designing and implementing a multimedia system. Students are expected to know Unix system programming (System V IPCs, fork, exec, etc.), RPC, thread and socket programming. Prereq: ENGR 131, EECS 233, and EECS 438.

EECS 475. Autonomous Robotics (3)
Introduction to the design, construction and control of autonomous mobile robots. The first half of the course consists of focused exercises on mechanical construction with LEGO, characteristics of sensors, motors and batteries, and control strategies for autonomous robots. In the second half of the course, students design, build and program their own complete robots that participate in a public competition. All work is performed in groups. Biologically-inspired approaches to the design and control of autonomous robots are emphasized throughout. Prereq: Consent of instructor. Cross-listed as BIOL 475.

EECS 477. The Dynamics of Adaptive Behavior (3)
Introduction to embodied, situated, and dynamical approaches to the design and analysis of autonomous agents and animals. Topics include recurrent neural networks, coupled neural/body/environment systems, and evolution and analysis of neural circuits. Behavior studied include examples from motor control, perception, learning, and cognition. Prereq: ENGR 131 and MATH 224. Cross-listed as BIOL 477.

EECS 478. Computational Neuroscience (3)
Computer simulation of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural circuits, as well as to cable theory, passive and active compartmental modeling, numerical integration methods, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week. Cross-listed as BIOL 478, EBME 478, and NEUR 478.

EECS 479. Seminar in Computational Neuroscience (3)
Readings and discussion in the recent literature on computational neuroscience, adaptive behavior, and other current topics. Cross-listed as BIOL 479.

EECS 483. Data Acquisition and Control (3)
Data acquisition (theory and practice), digital control of sampled data systems, stability tests, system simulation digital filter structure, finite word length effects, limit cycles, state-variable feedback and state estimation. Laboratory includes control algorithm programming done in assembly language.

EECS 484. Computational Intelligence I: Basic Principles (3)
This course is concerned with learning the fundamentals of a number of computational methodologies which are used in adaptive parallel distributed information processing. Such methodologies include neural net computing, evolutionary programming, genetic algorithms, fuzzy set theory, and “artificial life.” These computational paradigms complement and supplement the traditional practices of pattern recognition and artificial intelligence. Functionalities covered include self-organization, learning a model or supervised learning, optimization, and memorization.

EECS 485. VLSI Systems (3)
Basic MOSFET models, inverters, steering logic, the silicon gate, NMOS process, design rules, basic design structures (e.g., NAND and NOR gates, PLA, ROM, RAM), design methodology and tools (spice, N.mpc, Caesar, mkpla), VLSI technology and system architecture. Requires project and student presentation, laboratory.

EECS 486. Research in VLSI Design Automation (3)
Research topics related to VLSI design automation such as hardware description languages, computer-aided design tools, algorithms and methodologies for VLSI design for a wide range of levels of design abstraction, design validation and test. Requires term project and class presentation.

EECS 487. Computational Intelligence II (3)
This course is concerned with the combined use of the methods of computational intelligence in the performance of complex real-world tasks. Topics covered include learning models of “opaque” systems, design and operation of fuzzy control systems, neural-net computing control of systems, optimal control, learning and variable time systems, data compression, classification, self-organization of objects into categories, inductive reasoning, decision-making, and interpretation of signal and images. Prereq: EECS 484.

EECS 488. Embedded Systems Design (3)
Objective: to introduce and expose the student to methodologies for systematic design of embedded systems. The topics include, but are not limited to, system specification, architecture modeling, component partitioning, estimation metrics, hardware software codeign, diagnostics.

EECS 489. Robotics I (3)
(See EMAE 489.) Prereq: EMAE 181. Cross-listed as EMAE 489.

EECS 490. Computer Processing of Images (3)
Introduction of computer vision methodologies. Includes the images systems: optics and detectors and geometric relationships between scene and image, 3-D scene scanning and imaging techniques including stereovision and laser rangefinders. Digital signal processing in 2-D and optical preprocessing of images. Real-time digital signal transmission of dynamic images and HDTV. Hardware issues in processing of vision information. Prereq: EECS 246 or equivalent or consent of instructor.

EECS 491. Intelligent Systems I (3)
Artificial intelligence and programming techniques used in design and implementation of intelligent systems. Problem solving and game playing by computer, different representation of problems and games, and their associated solution methods. Knowledge representation: logic, semantic networks frames. Programming in LISP and Prolog.

EECS 500. EECS Colloquium (0)
Seminars on current topics in Electrical Engineering and Computer Science.

EECS 500T. Graduate Teaching II (0)
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to involve direct student contact but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational experience for the student. Students in this course may be expected to perform one or more of the following teaching related activities: grading homeworks, quizzes, and exams, having office hours for students, running recitation sessions, providing laboratory assistance. Prereq: Ph.D. student in EECS department.

EECS 515. Decision Theory with Applications (3)
Fundamentals of decision theory and analysis of decision processes in systems. Elementary decision analysis. Single and multiattribute utility theory under both certainty and uncertainty. Bayesian decision analysis. Sequential decision processes including dynamic programming and Markov processes. Analysis of multi-person decision processes and game theory as related to management decisions. Applications to large-scale systems and to decision support systems.

EECS 516. Large Scale Optimization (3)
Concepts and techniques for dealing with large optimization problems encountered in designing large engineering structure, control of interconnected systems, pattern recognition, and planning and operations of...
complex systems; partitioning, relaxation, restriction, decomposition, approximation, and other problem simplification devices; specific algorithms; potential use of parallel and symbolic computation; student seminars and projects. Prereq: EECS 416.

EECS 518. Nonlinear Systems: Analysis and Control (3)

EECS 519. Differential Geometric Nonlinear Control (3)
This advanced course focuses on the analysis and design of nonlinear control systems, with special emphasis on the differential geometric approach. Differential geometry has proved to be an extremely powerful tool for the analysis and design of nonlinear systems, similar to the roles of the Laplace transformation and linear algebra in linear systems. The objective of the course is to present the major methods and results of nonlinear systems and provide a mathematical foundation, which will enable students to follow the recent developments in the constantly expanding literature. This course will also benefit those students from Electrical, Mechanical, Chemical and Biomedical Engineering, who are doing research in the fields that involve nonlinear control problems. Prereq: EECS 408 or equivalent.

EECS 523. Multiobjective and Hierarchical Systems (3)
This course covers basic concepts of hierarchical, multi-level systems, Lagrangian decompositions, and coordination principles. Fundamentals and recent advances in theory, methodology and applications of multiple criteria decision making (MCDM) with single and multiple decision makers are included as are: interactive MCDM methods; multiple objectives for discrete and continuous models; multi-objective programming methods, hierarchical overlapping coordination with single and multiple objectives; multi-objective, multi-stage impact analysis; and applications to large-scale systems and to decision support systems. Cross-listed as OPRE 523.

EECS 526. Integrated Mixed-Signal Systems (3)
Mixed-signal (analog/digital) integrated circuit design. D-to-A and A-to-D conversion, applications in mixed-signal VLSI, low-noise and low-power techniques, and communication sub-circuits. System simulation at the transistor and behavioral levels using SPICE. Class will design a mixed-signal CMOS IC for fabrication by MOSIS. Prereq: EECS 420.

EECS 527. Advanced Sensors: Theory and Techniques (3)
Sensor technology with a primary focus on semiconductor-based devices. Physical principles of energy conversion devices (sensors) with a review of relevant fundamentals: elasticity theory, fluid mechanics, silicon fabrication and micromachining technology, semiconductor device physics. Classification and terminology of sensors, defining and measuring sensor characteristics and performance, effect of the environment on sensors, predicting and controlling sensor error. Mechanical, acoustic, magnetic, thermal, radiation, chemical and biological sensors will be examined. Sensor packaging and sensor interface circuitry. Prereq: EECS 522 or EECS 415 and EECS 454.

EECS 531. Computer Vision (3)
Geometric optics, ray matrices, calibration of monocular and stereo imaging systems. Adaptive camera thresholding and image segmentation, morphological and convolutional image processing. Selected topics including edge estimation and industrial inspection, optimal filtering, model matching, CAD-based vision and range image processing, Neural-net image processing. Model-based computer vision for scene interpretation and autonomous systems. Prereq: EECS 490 or equivalent.

EECS 550. Neuromechanics Seminar (0)
(See EBME 550.) Cross-listed as EBME 550.

EECS 583. Implementation of Non-linear Control (3)
Nonlinear control with emphasis on applications. Basic theory including describing functions, equivalent gains, and Lyapunov stability. Emphasis on digital implementation of nonlinear controllers for high performance applications such as servomechanisms, manipulators, and aerospace systems. Comparison of nonlinear and linear designs. Laboratory experiments and CAD tools for controller performance verification.

EECS 589. Robotics II (3)
Survey of research issues in robotics. Force control, visual servoing, robot autonomy, on-line planning, high-speed control, man/machine interfaces, robot learning, sensory processing for real-time control. Primarily a project-based lab course in which students design real-time software executing on multi-processors to control an industrial robot. Prereq: EECS 489.

EECS 591. Intelligent Systems II (3)
EECS 600. Special Topics (1-18)

EECS 600T. Graduate Teaching III (0)
This course will provide Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to involve direct student contact but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational experience for the student. Students in this course may be expected to perform one or more of the following teaching related activities running recitation sessions, providing laboratory assistance, developing teaching or lecture materials presenting lectures. Prereq: Ph.D. student in EECS department.

EECS 601. Independent Study (1-18)

EECS 602. Advanced Projects Laboratory (1-18)

EECS 620. Special Topics (1-18)

EECS 621. Special Projects (1-18)

EECS 649. Project M.S. (1-9)

EECS 651. Thesis M.S. (1-18)

EECS 701. Dissertation Ph.D. (1-18)

EECS 702. Appointed Dissertation Fellow (9)

Degree Program in Engineering, Undesignated

312 Glennan Building (7220)
Phone 216-368-6482; Fax 216-368-6939
James D. Cawley, Associate Dean
e-mail jxc41@po.cwru.edu

The Undesignated Engineering program prepares students who seek a technological background but do not wish to pursue pure engineering careers. For example, some needs in the public sector, such as pollution remediation, transportation, low-cost housing, elective medical care, and crime control could benefit from engineering expertise. To prepare for careers in fields that address such problems, the Undesignated Engineering program allows students to acquire some engineering background, and combine it with a minor in such programs as management, history of technology and science, or economics.

Undergraduate Program
A student electing an undesignated degree must submit both a proposed course schedule and a clear statement of career goals and of the way in which the proposed program will meet those goals. These documents are to be submitted to the office of the associate dean for undergraduate programs of The Case School of Engineering. The program must be approved by the dean of engineering or designate in consultation with representatives of the major and minor departments. A total of at least 128 semester credits are required for graduation.

Since each student’s program is unique, no typical curriculum can be shown. Every program must fulfill the requirements described below.
1. Engineering Core
2. A minimum of two engineering electives courses selected from two of the following four groups
   a. Thermodynamics or Physical Chemistry (EMAE 150, EMAC 171 and 172, CHEM 301 and 302, or ECHE 363)
   b. Signals, systems or control (EECS 212, EECS 304, ECHE 367)
   c. Materials science (EMSE 201, EMAC 270, EMSE 314, EBME 306, or EECS 321)
   d. Economics, production systems or decision theory (EECS 350, EECS 352, OPRE 345)

Major
The major must contain a minimum of 24 semester credit hours of work in one of the following engineering fields:
- Biomedical engineering
- Chemical engineering
- Civil engineering
- Computer engineering
- Electrical engineering
- Fluid and thermal engineering sciences
- Materials science and engineering
- Polymer science and engineering
- Systems and control engineering

This work includes a senior projects laboratory (3 credits) and usually a course with a physical measurements laboratory.

Minor
The minor program requires a minimum of 15 semester credit hours. Suggested minors for students pursuing the undesignated degree program in engineering are the following. Other minors are available with approval of the Office of Undergraduate Studies.

Engineering
A minor program may be chosen in any engineering field that differs from the major and that, when combined with the major, fulfills a specific purpose or career plan. The purpose of a minor program is to allow more breadth, with less depth in any one engineering area. For example, such a program may appeal to the student who wishes to couple knowledge in systems and control

Bachelor of Science in Engineering Degree
Major in Engineering (Undesignated)

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<th>Freshman Year</th>
<th>Class-Lab-Credit Hours</th>
<th>Junior Year</th>
<th>Class-Lab-Credit Hours</th>
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<tr>
<td>Humanities or Social Science Sequence II ................ (3-0-3)</td>
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<tr>
<td>ENGR 225 Thermodynamics, Fluid Mechanics, Heat and Mass Transfer ........................................ (4-0-4)</td>
<td>(4-0-4)</td>
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<tr>
<td>ENGR 210 Introduction to Circuits and Instrumentation .... (3-2-4)</td>
<td>(3-0-3)</td>
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<tr>
<td>MATH 224 Elementary Differential Equations ............... (3-0-3)</td>
<td>(3-0-3)</td>
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<td>PHYS 221 General Physics III, Modern Physics .......... (3-0-3)</td>
<td>Minor Concentration Course ........................ (3-0-3)</td>
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<td><strong>Total</strong> ................................................................ (15-0-15)</td>
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</tbody>
</table>

**Spring**

| Humanities or Social Science elective ..................... (3-0-3) | (3-0-3) |
| Exxx 398 Engineering Senior Project ........................ (0-6-3) | (0-6-3) |
| Major Concentration Course .................................. (3-0-3) | (3-0-3) |
| Minor Concentration Course .................................. (3-0-3) | (3-0-3) |
| Minor Concentration Course .................................. (3-0-3) | (3-0-3) |
| **Total** ................................................................ (15-0-15) | **Total** ................................................................ (15-0-15) |

**Senior Year**

**Fall**

| Humanities or Social Science elective ..................... (3-0-3) | (3-0-3) |
| Exxx 398 Engineering Senior Project ........................ (0-6-3) | (0-6-3) |
| Major Concentration Course .................................. (3-0-3) | (3-0-3) |
| Minor Concentration Course .................................. (3-0-3) | (3-0-3) |
| Minor Concentration Course .................................. (3-0-3) | (3-0-3) |
| **Total** ................................................................ (15-0-15) | **Total** ................................................................ (15-0-15) |

**Spring**

| Humanities or Social Science elective ..................... (3-0-3) | (3-0-3) |
| Major Concentration Course .................................. (3-0-3) | (3-0-3) |
| Minor Concentration Course .................................. (3-0-3) | (3-0-3) |
| Minor Concentration Course .................................. (3-0-3) | (3-0-3) |
| Open elective ..................................................... (3-0-3) | (3-0-3) |
| **Total** ................................................................ (15-0-15) | **Total** ................................................................ (15-0-15) |

**Hours required for graduation:** 128

a. One of these courses must be a humanities/social science course.
engineering with knowledge in a field such as civil engineering, chemical processing, or computer engineering. Other major and minor combinations that may be of interest are the coupling of a civil engineering major with a metallurgy or materials minor or a combination of electrical and materials science and engineering.

Science
A minor field may be chosen in any field of science wherein the major-minor combination fulfills a unique purpose. Many engineering majors and science minors can be successfully combined. For example, a major in civil engineering coupled with a minor in geology leads to a program aimed at geophysical sciences or oceanography. The student with electrical engineering interests in lasers, optics, solid state, plasmas, and the like may profit by coupling an electrical engineering major with a physics minor. In particular, an engineering major coupled with a minor in biological sciences or in biomedical engineering (plus chemistry) leads to a biomedical engineering background for the student interested in pre-medicine, pre-dentistry, pre-nursing, or pre-biomedical engineering. This combination also provides a unique background for a student interested in biomaterials or a student who wishes to explore the bioelectronics area or biomechanics, systems biology, or a combination that deals with information processing and the computer in biomedical applications.

Management
Many students enter the engineering program at Case Western Reserve in preparation for industrial management careers. Generally, their plan is to work in an engineering capacity and gradually assume management responsibilities. Some of these students plan to take a graduate program in management, such as the Master of Business Administration degree. However, others rely on a combination of undergraduate elective courses, job experience, and industrial training programs for this career preparation.

To serve engineering students whose career goals involve management, a minor program has been developed in cooperation with the Weatherhead School of Management. This program gives the student the options of direct entry into industry in either an engineering or a management tracking program or entry into graduate school to earn the Master of Science degree in engineering or the Master of Business Administration degree.

A management minor requires the following courses
- ACCT 303, Survey of Accountancy (3)
- BAFI 355, Corporation Finance (3)
- OPMT 350, Operations Management (3)
- plus any two of the following
- LHRP 251, Industrial Relations and Administrative Practices (or LHRP 311, Labor Problems (3))
- MIDS 508, Management Information Systems I (3)
- MKMR 301, Marketing Management (3)
- OPRE 201, Introduction to Operations Research (3)
- ORBH 250, Introduction to Organizational Behavior and Management (3)

History of Technology and Science
The purpose of coupling an engineering major with a minor in the history of technology and science is primarily to prepare for entry into the field of history of technology. Beyond this, however, knowledge of the history of technology may be invaluable to engineers who take decision-making roles during their careers. This minor provides a much needed emphasis on the consequences of technology and technological decisions on society and the importance of historical insight in such decisions. The minor program can be tailored to individual interests, based on the following offerings
- HSTY 266, The Engineer in America (3)
- HSTY 306, Engineering in History (3)
- HSTY 307, Development of Chemistry and Chemical Engineering (3)
- HSTY 366, Science, Technology, and Government (3)
- HSTY 377, Nuclear Weapons and Arms Control (3)

Economics
The field of economics is moving rapidly toward a more quantitative approach and is an important field for engineers. The economics minor requires the following courses
- ECON 102, Principles of Macroeconomics (3)
- ECON 103, Principles of Microeconomics (3)
- The following electives in economics are suggested
- ECON 314, Money and Banking (3)
- ECON 326, Econometrics (3)
- ECON 342, Public Finance (3)
- ECON 369, Economics of Industrial Production and Technology (3)
- ECON 386, Urban Economics (3)
- ECON 387, Managerial Economics (3)

Engineering Physics
Rockefeller Building (7079)
Phone 216-368-4017; Fax 216-368-4671
Kenneth D. Singer
E-mail kds4@po.cwru.edu

The engineering physics major allows students with strong interests in both physics and engineering to concentrate their studies in the common areas of these disciplines. The engineering physics major prepares students to pursue careers in industry, either directly after undergraduate studies, or following graduate study in engineering or physics. Many employers value the unique problem solving approach of physics, especially in industrial research and development.

Students majoring in engineering physics complete the Engineering Core as well as a rigorous course of study in physics. Students select a concentration area from an engineering discipline, and must complete a sequence of at least four courses in this discipline. In addition, a senior research project under the guidance of a faculty member in the concentration discipline is required. The project includes a written report and participation in the senior symposium.

Details of the engineering physics program can be found under the department of Physics in the College of Arts and Sciences section.

Department of Macromolecular Science and Engineering

314 Kent Smith Building (7202)
Phone 216-368-4172; Fax 216-368-4202
Alexander Jamieson, Chair
E-mail amj@po.cwru.edu
http://www.scl.cwru.edu/cse/emac

Macromolecular science and engineering is the study of the synthesis, structure, processing, and properties of polymers. These giant molecules are the basis of synthetic materials including plastics, fibers, rubber, films, paints, membranes, and adhesives. Research is constantly expanding these applications through the development of new high performance polymers, e.g. for engi-
neering composites, electronic, optical, and biomedical uses. In addition, most biological systems are composed of macromolecules—proteins (e.g., silk, wool, tendon), carbohydrates (e.g., cellulose) and nucleic acids (RNA and DNA) can all be classified as polymers and are studied by the same methods that are applied to synthetic polymers.

Production of polymers and their components is central to the chemical industry, and statistics show that over 75 percent of all chemists and chemical engineers in industry are involved with some aspect of polymers. Despite this, formal education in this area is offered by only a few universities in this country, resulting in a continued strong demand for our graduates upon completion of their B.S., M.S., or Ph.D. degrees.

### Bachelor of Science in Engineering Degree

#### Major in Engineering Physics

**Freshman Year**

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<thead>
<tr>
<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>CHEM 111 Principles of Chemistry for Engineers .......... (4-0-4)</td>
</tr>
<tr>
<td>CHEM 113 Principles of Chemistry Laboratory .......... (1-3-2)</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I .......... (4-0-4)</td>
</tr>
<tr>
<td>PHYS 121 General Physics I, Mechanics                    (4-3-4)</td>
</tr>
<tr>
<td>ENGL 150 Expository Writing .................................. (3-0-3)</td>
</tr>
<tr>
<td>PHED 101 Physical Education Activities .................... (0-3-0)</td>
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<td><strong>Total</strong> ........................................................................... (16-9-17)</td>
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<tr>
<td>Spring</td>
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<tr>
<td>MATH 122 Calculus for Science and Engineering IIa ........ (4-0-4)</td>
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<tr>
<td>PHYS 122 General Physics II, Electricity &amp; Magnetismb ...... (4-3-4)</td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming ................. (2-2-3)</td>
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<tr>
<td>ENGR 145 Chemistry of Materials ................................ (4-0-4)</td>
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<tr>
<td>PHED 102 Physical Education Activities .................... (0-3-0)</td>
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<td><strong>Total</strong> ........................................................................... (14-8-15)</td>
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<tr>
<td>Sophomore Year</td>
</tr>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>MATH 223 Calculus for Science &amp; Engineering IIIa .......... (3-0-3)</td>
</tr>
<tr>
<td>PHYS 221 General Physics III – Modern Physics .......... (3-0-3)</td>
</tr>
<tr>
<td>ENGR 200 Statics and Strength of Materials ............... (3-0-3)</td>
</tr>
<tr>
<td>ENGR 210 Circuits &amp; Instrumentation ....................... (3-2-4)</td>
</tr>
<tr>
<td>Humanities/Social Science Elective ......................... (3-0-3)</td>
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<tr>
<td><strong>Total</strong> ........................................................................... (15-2-16)</td>
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<tr>
<td>Spring</td>
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<tr>
<td>MATH 224 Differential Equationsa ................................ (3-0-3)</td>
</tr>
<tr>
<td>PHYS 208 Instrumentation and Signal Analysis Lab .......... (2-4-4)</td>
</tr>
<tr>
<td>PHYS 250 Mathematics, Physics and Computing .............. (3-0-3)</td>
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<tr>
<td>PHYS 310 Classical Mechanics ................................... (3-0-3)</td>
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<tr>
<td>ENGR 225 Thermodynamics, Fluids, Heat &amp; Mass Transfer . (4-0-4)</td>
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<td><strong>Total</strong> ........................................................................... (15-4-17)</td>
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### Junior Year

<table>
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<tr>
<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
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<tr>
<td>PHYS 313 Thermodynamics and Statistical Mechanics .......... (3-0-3)</td>
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<tr>
<td>PHYS 317 Engineering Physics Lab I ............................. (2-4-4)</td>
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<tr>
<td>PHYS 331 Introduction to Quantum Mechanics I .............. (3-0-3)</td>
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<td>Engineering Concentration ......................................... (3-0-3)</td>
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<td>Humanities/Social Science Elective ............................. (3-0-3)</td>
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<tr>
<td><strong>Total</strong> ........................................................................... (14-4-16)</td>
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<tr>
<td>Spring</td>
</tr>
<tr>
<td>PHYS 318 Engineering Physics Lab II ............................ (2-4-4)</td>
</tr>
<tr>
<td>PHYS 324 Electricity and Magnetism I .......................... (3-0-3)</td>
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<td>ENGL 398N Professional Communications ....................... (3-0-3)</td>
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<td>Humanities/Social Science Sequence I ........................... (3-0-3)</td>
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<td>Engineering Concentration ......................................... (3-0-3)</td>
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<tr>
<td><strong>Total</strong> ........................................................................... (14-4-16)</td>
</tr>
<tr>
<td>Senior Year</td>
</tr>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>PHYS 315 Introduction to Solid State Physics ................ (3-0-3)</td>
</tr>
<tr>
<td>PHYS 325 Electricity and Magnetism II ........................ (3-0-3)</td>
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<tr>
<td>PHYS 353 Senior Engineering Physics Project ................ (0-6-3)</td>
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<tr>
<td>Engineering Concentration ......................................... (3-0-3)</td>
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<td>Humanities/Social Science Sequence II ........................ (3-0-3)</td>
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<tr>
<td><strong>Total</strong> ........................................................................... (12-6-15)</td>
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<tr>
<td>Spring</td>
</tr>
<tr>
<td>PHYS 353 Senior Engineering Physics Project ................ (0-6-3)</td>
</tr>
<tr>
<td>Applied Quantum Mechanicsd ...................................... (3-0-3)</td>
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<tr>
<td>Engineering Concentration ......................................... (3-0-3)</td>
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<tr>
<td>Humanities/Social Science Elective ............................. (3-0-3)</td>
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<tr>
<td>Humanities/Social Science Sequence III ....................... (3-0-3)</td>
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<td><strong>Total</strong> ........................................................................... (12-6-15)</td>
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</table>

**Hours required for graduation: 127**

a. Selected students may be invited to take MATH 123, 124, 227, and 228 in place of MATH 121, 122, 223, and 224.

b. Selected students may be invited to take PHYS 123, 124 Physics and Frontiers I, II Honors in place of PHYS 121, 122.

c. Engineering Physics Concentration courses are flexible, but must be in a specific engineering discipline or study area and be approved by an advisor. Possible concentration areas include: Aerospace engineering, Biomedical engineering “hardware,” Biomedical engineering.

d. PHYS 322, EAP 321, EAP 420, EMSE 314, or EMSE

---

**Faculty**

Alexander M. Jamieson, D. Phil. (Oxford University, England)

**Professor and Chair**

- Laser light scattering; rheology and transport of macromolecules in solution and bulk; positron annihilation lifetime studies of free volume in polymers; structure-function relationships of biological macromolecules.

Eric Baer, D. Eng. (The Johns Hopkins University)

**The Herbert Henry Dow Professor of Science and Engineering**

Irreversible microdeformation mechanisms; pressure effects on morphology and mechanical properties; relationships between hierarchical structure and mechanical function; mechanical properties of soft connective tissue; polymer composites and blends; polymerization and crystallization on crystalline surfaces; viscoelastic properties of polymer melts; damage and fracture analysis of polymers and their composites. Structure-property relationships in biological systems.
Monomer and polymer synthesis, structure-property relationships, Associate Professor
Organic chemistry, synthesis, supramolecular chemistry, conducting polymers, reversibly associated living polymers, polymer/surfactant systems, polymer micelles (at thermodynamic equilibrium and micellization kinetics), polyelectrolytes and block copolymers.

Anne Hiltner, Ph.D. (Oregon State University) Professor
Structure-property relationships; irreversible deformation, crack propagation and fracture of polymers, blends and composites; microlayer processing of polymers; structure-function relationships in collagenous tissues; biostability of biomaterials.

Hatsuo Ishida, Ph.D. (Case Western Reserve University) Professor
Processing of polymers and composite materials; structural analysis of surfaces and interfaces; molecular spectroscopy of synthetic polymers.

Jack L. Koenig, Ph.D. (University of Nebraska, Lincoln) The Donnell Institute Professor
Polymer structure-property relationships using infrared, Raman, NMR spectroscopy and spectroscopic imaging techniques.

Jerome B. Lando, Ph.D. (Polytechnic Institute of Brooklyn) Professor
Solid state polymerization; X-ray crystallography of polymers; electrical properties of polymers; ultra-thin polymer films.

Morton Litt, Ph.D. (Polytechnic Institute of Brooklyn) Professor
Kinetics and mechanisms of free radical and ionic polymerization; mechanical properties of polymers; fluorocarbon chemistry; synthesis of novel monomers and polymers; polymer electrical properties; cross-linked liquid crystal polymers.

Ica Manas-Zloczower, D.Sc. (Israel Institute of Technology) Professor
Structure and micromechanics of fine particle clusters; interfacial engineering strategies for advanced materials processing; dispersive mixing mechanisms and modeling; design and mixing optimization studies for polymer processing equipment through flow simulations.

Sergei Nazarenko, Ph.D. (Academy of Sciences, Moscow) Assistant Professor
Diffusion and transport properties of polymeric materials; barrier structures; macromolecular interdiffusion; non-equilibrium behavior of polymer glasses.

Stuart Rowan, Ph.D. (University of Glasgow, UK) Assistant Professor
Organic chemistry, synthesis, supramolecular chemistry, conducting polymers, interlocked macromolecules (polyrotaxanes and polycatenanes), peptide nucleic acids, supramolecular polymerization, reversible ‘dynamic’ chemistry and combinatorial libraries.

David Schiraldi, Ph.D. (University of Oregon) Associate Professor
Monomer and polymer synthesis, structure-property relationships, nanocomposites, polymerization catalysis, combinatorial synthesis and testing of polymers, synthetic fibers, barrier packaging materials.

Christoph Weder, Ph.D. (ETH Zurich, Switzerland) Associate Professor
Design, synthesis, structure-property relationship and application of novel functional polymer systems; advanced optical applications of polymers; anisotropic polymer systems; novel polymers for thin film and fiber applications.

Eimerit Faculty
Charles E. Rogers, Ph.D. (Syracuse University and State University of New York) Emeritus Professor
Transport and mechanical properties of polymers; synthesis and properties of multicomponent systems; environmental effect on polymers; adhesion, adhesives, and coatings.

Robert Simha, Ph.D. (University of Vienna) Emeritus Professor

Secondary Faculty
James M. Anderson, Ph.D. (Oregon State University), M.D. (Case Western Reserve University) Professor of Macromolecular Science, Pathology, and Biomedical Engineering
Development of polymers for medical and dental applications.

Donald Feke, Ph.D. (Princeton University) Professor of Chemical Engineering, and Macromolecular Science
Fine-particle processing; colloidal phenomena; dispersive mixing; acoustic separation methods.

LeRoy Klein, Ph.D. (Boston University), M.D. (Case Western Reserve University) Professor of Orthopaedics, Biochemistry
Collagen physiology.

J. Adin Mann, Jr., Ph.D. (Iowa State University) Professor of Chemical Engineering
Surface phenomena; interfacial dynamics; light scattering; stochastic processes of adsorption and molecular rearrangement at interfaces.

Roger Marchant, Ph.D. (Case Western Reserve University) Professor of Biomedical Engineering
Biopolymers; polymer surface coatings; properties and characterization of polymer surfaces on implants and sensors.

Syed Qutubuddin, Ph.D. (Carnegie-Mellon University) Professor of Chemical Engineering
Colloids; polymers and interfacial phenomena; laser light scattering; enhanced oil recovery.

Charles Rosenblatt, Ph.D., (Harvard University) Professor of Physics
Experimental condensed matter physics; liquid crystal physics.

Kenneth Singer, Ph.D., (University of Pennsylvania) Professor of Physics
Nonlinear optical properties of polymers; contributions of molecular order to the nonlinear optical response in polymers; optical probes of polymer relaxation; formation of and propagation of light in polymer waveguides.

Masood Tabib-Azar (Rensselaer Polytechnic Institute) Associate Professor of Electrical, Systems, Computer Engineering and Science
Bachelor of Science in Engineering Degree
Major in Polymer Science

**Freshman Year**

<table>
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<tr>
<th>Class-Lab-Credit Hours</th>
<th>Fall</th>
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<tr>
<td>Open elective or Humanities/Social Science b</td>
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<tr>
<td>CHEM 111 Principles of Chemistry for Engineers</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(2-2-3)</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
<td>(4-0-4)</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3-0-3)</td>
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<tr>
<td>PHED 101 Physical Education Activities</td>
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**Sophomore Year**

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<tr>
<td>Humanities or Social Science Sequence I</td>
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<tr>
<td>CHEM 223 Organic Chemistry I</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGR 145 Chemistry of Materials</td>
<td>(4-0-4)</td>
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<tr>
<td>MATH 122 Calculus for Science and Engineering II</td>
<td>(4-0-4)</td>
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<tr>
<td>PHYS 121 General Physics I</td>
<td>(4-0-4)</td>
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<tr>
<td>PHED 102 Physical Education Activities</td>
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<tbody>
<tr>
<td>Humanities or Social Science Sequence II</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>CHEM 224 Organic Chemistry II</td>
<td>(3-0-3)</td>
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<tr>
<td>EMAC 276 Polymer Properties and Design</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>MATH 224 Elementary Differential Equations</td>
<td>(3-0-3)</td>
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<tr>
<td>or MATH 234 Introduction to Dynamic Systems</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGR 225 Thermodynamics, Fluid Mechanics, and Heat and Mass Transfer</td>
<td>(4-0-4)</td>
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<td><strong>Total</strong></td>
<td>(16-0-16)</td>
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**Junior Year**

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<thead>
<tr>
<th>Class-Lab-Credit Hours</th>
<th>Fall</th>
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<tbody>
<tr>
<td>Humanities or Social Science Sequence III</td>
<td>(3-0-3)</td>
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<tr>
<td>CHEM 290 Chemistry Laboratory Methods</td>
<td>(4-0-4)</td>
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<tr>
<td>EMAC 351 Physical Chemistry for Engineers I</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGR 200 Statics and Strength of Materials</td>
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<tr>
<td><strong>Total</strong></td>
<td>(16-5-17)</td>
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| Technical elective e | (3-0-3) |

**Senior Year**

<table>
<thead>
<tr>
<th>Class-Lab-Credit Hours</th>
<th>Fall</th>
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<tbody>
<tr>
<td>Humanities or Social Science elective</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGR 210 Introduction to Circuits &amp; Instrumentation</td>
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<td>EMAC 357 Polymer Processing</td>
<td>(3-0-3)</td>
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<td>EMAC 358 Polymer Science &amp; Engineering Project</td>
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| Technical elective e | (3-0-3) |

<table>
<thead>
<tr>
<th>Class-Lab-Credit Hours</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Humanities or Social Science elective</td>
<td>(3-0-3)</td>
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<tr>
<td>EMAC 378 Polymer Production and Technology</td>
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<tr>
<td>EMAC 379 Polymer Processing Laboratory</td>
<td>(2-4-3)</td>
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<tr>
<td><strong>Total</strong></td>
<td>(17-4-18)</td>
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</table>

**Hours required for graduation: 128**

- a. Approved Natural Science electives: PHYS 221 or 223, General Physics III; BIOL 210, Molecular Cell Biology; BIOL 205, Chemical Biology; STAT 312, Basic Statistics for Engr. & Sci.; PHYS 349, Methods of Mathematical Physics; BIOC 307, General Biochemistry.
- b. One of these courses must be a humanities/social science course.
- c. Engineering Core Courses.
- d. Preparation for the polymer science project should commence in the previous semester.
- e. Technical sequence must be approved by department advisor.
Frank N. Kelley, Ph.D. (University of Akron)
Adjunct Professor (University of Akron)
Polymer structure-property relationships; rheology; material characterization; fracture; life prediction
Scott E. Rickert, Ph.D. (Case Western Reserve University)
Adjunct Professor
Conducting polymers; microdevices; polymer electrodes; polymer adsorption
John C. Weaver, Ph.D. (University of Cincinnati)
Internal Adjunct Professor
Coatings science and technology
James L. White, Ph.D. (University of Delaware)
Adjunct Professor (University of Akron)
Polymer melt-solution rheology and fluid mechanics; elastomers; polymer liquid crystals and aromatic polyamides
Theodore Williams, Ph.D. (University of Connecticut)
Adjunct Professor (College of Wooster)
Bioanalytical chemistry with special interest in human eye tissues and teeth

Undergraduate Program

In 1970, the department introduced a program leading to the Bachelor of Science in Engineering degree with a major in polymer science, which is designed to prepare the student both for employment in polymer-based industry and for graduate education in polymer science. The Case School of Engineering is proud that this was the first such undergraduate program in the country to receive accreditation from the Engineering Council for Professional Development. The curriculum combines courses dealing with all aspects of polymer science and engineering with basic courses in chemistry, physics, mathematics, and biology, depending on the needs and interests of the student. The student chooses a sequence of technical electives, in consultation with a faculty advisor, allowing a degree of specialization in one particular area of interest, e.g., polymer materials, chemical engineering, biopolymers, biochemistry, or physics. In addition to required formal laboratory courses, students are encouraged to participate in the research activities of the department, both through part-time employment as student laboratory technicians and through the senior project requirement—a one-or two-semester project that involves the planning and performance of a research project.

Polymer science undergraduates are also strongly encouraged to seek summer employment in industrial laboratories during at least one of their three years with the department. In addition to the general undergraduate curriculum in macromolecular science, the department offers three specialized programs which lead to the B.S. with a macromolecular science major. The cooperative program contains all the course work required for full-time resident students plus one or two six-month cooperative sessions in polymer-based industry. The company is selected by the student in consultation with his or her advisor, depending on the available opportunities. The dual-degree program allows students to work simultaneously on two baccalaureate level degrees within the University. It generally takes five years to complete the course requirements for each department for the degree. The B.S./M.S. program leads to the simultaneous completion of requirements for both the master’s and bachelor’s degrees. Students with a minimum GPA of 3.0 may apply for admission to this program in their junior year.

Mission Statement

To educate students who will excel and lead in the development of polymeric materials and the application of structure-property relationships. The department seeks to prepare students for either professional employment or advanced education, primarily in this or related science or engineering disciplines, but also in professional schools of business, law or medicine. Undergraduate students are offered opportunities for significant research experience, capitalizing on the strength of our graduate program. Specifically, the undergraduate program provides the following educational objectives:

Mastery of Fundamentals
1. Ability to apply knowledge of mathematics, science, and engineering, in general, and synthetic chemistry, polymer processing and structure property relationships of polymeric materials, in particular.
2. Ability to design and conduct experiments (safely and efficiently), to analyze and interpret data, and to critically evaluate hypotheses, by providing experience with synthetic chemistry, polymer processing and measurement techniques.
3. Practical ability to use analytical techniques, computers, information databases and tools for electronic communication.

Creativity
4. Ability to identify, formulate and solve engineering problems that involve materials selection or improvement.
5. Ability to design a polymeric material or process to meet desired needs.

Societal Awareness
6. Broad education necessary to understand the environmental and economic impact of engineering solutions in a global and societal context.
7. Knowledge of contemporary economic, political, scientific and industrial issues.

Leadership Skills
8. Proficiency in oral and written communication, being able to describe clearly either the results of a project or the need for a proposed one.
9. Awareness of the multidisciplinary nature of macromolecular science and engineering, including, synthetic chemistry, polymer fabrication and processing, biomaterials and biomimicry, and mechanical, fluid, electrical, optical and sensing properties of polymers.
10. Ability to function in teams.

Professionalism
11. Exposure to the issues of professional and ethical responsibility.
12. Recognition of the need for, and an ability to engage in lifelong learning.

Graduate Program

Courses leading to the Master of Science and Doctor of Philosophy degrees in macromolecular science are offered within the Case School of Engineering. They are designed to increase the student’s knowledge of macromolecular science and of his own basic area of scientific interest, with application to specific polymer research problems. Research programs derive particular benefit from close cooperation with graduate programs in chemistry, physics, materials science, chemical engineering, biological sciences, and other engineering areas. The interdisciplinary academic structure allows the faculty to fit the individual program to the student’s background and career plans. Basic and advanced courses are offered in polymer synthesis, physical chemistry, physics, biopolymers, and applied polymer science and engineering. A laboratory course in polymer characterization instructs students in the use of modern experimental techniques.
and equipment. Graduate students are also encouraged to take advanced course work in polymer solid state physics, physical chemistry, synthesis, rheology, and polymer processing. The department also offers, in conjunction with the School of Medicine, a six- to seven-year M.D./Ph.D. program for students interested in the application of polymers and plastics to medicine, as well as for students interested in a molecular structural basis of medicine, particularly related to connective tissues, biomechanics, aging, pharmaceuticals, and blood behavior. Initiated in 1977, it is the only program of its kind in the nation.

Facilities

The Kent Hale Smith Science and Engineering Building houses the Department of Macromolecular Science. The building was built in 1993, and specifically designed to meet the specific needs of polymer research. The facility consists of five floors, plus a basement. The laboratories for chemical synthesis are located principally on the top floor, the molecular and materials characterization laboratories on the middle floors, and the major engineering equipment on the ground floor, while the electron microscopes are located in the basement. Electronic classrooms are being installed on the ground floor. Laboratories and instrumentation include the X-ray Laboratory, with diffraction and fluorescence equipment; the Electron Microscopy Laboratory, with transmission and scanning electron microscopes; the Molecular Spectroscopy Laboratory, with a complete range of spectroscopic equipment including FTIR, high resolution solution and solid-state NMR (including imaging, computerized laser Raman spectrophotometers, and a high speed/high sensitivity polymer analysis system; and the Biological Materials Laboratory, with facilities for characterization of certain aspects of structure, size, and shape of biological materials. The Polymer Microdevice Laboratory operates in an ultra-clean environment and uses the Langmuir-Blodgett technique of film deposition. There are also facilities for polymer characterization, optical microscopy, scanning calorimetry, and for testing and evaluating the mechanical properties of materials. The C. Richard Newpher polymer composite processing laboratory includes a high temperature Rheometrics RMS-800 dynamic mechanical spectrometer, a Bomem DA-3 FTIR with FT-Raman capabilities, a pultrusion machine, several RIM machines, a compression molding machine, a Brabender plasticorder, a high speed Instron testing machine, and a vibrating sample magnetometer. The Charles E. Reed ’34 Laboratory is concerned with the mechanical analysis of polymeric materials. The major testing is done by Instron Universal testing instruments including an Instron model 1123 with numerous accessories such as an environmental chamber for high or low temperature experiments. The laboratory also has an Atomic Force Microscope which probes the morphological and mechanical properties of materials at the nanoscale. The EPIC Molecular Modeling Center contains high-end and low-end Silicon Graphics Computers and various software packages for molecular modeling of polymers.

Research

The research activities of the department span the entire scope of macromolecular science and polymer technology.

Synthesis

New types of macromolecules are being made in the department’s synthesis laboratories. The emphasis is on creating polymers with novel functional properties such as photoconductivity, selective permeation, and biocompatibility.

Physical Characterization

This is the broad area of polymer analysis, which seeks to relate the structure of the polymer at the molecular level to the bulk properties that determine its actual or potential applications. This includes characterization of polymers by infrared, Raman, and NMR spectroscopy, thermal and rheological analysis, determination of structure and morphology by x-ray diffraction, electron microscopy, and atomic force microscopy, and investigation of molecular weights and conformation by light scattering.

Mechanical Behavior and Analysis

Polymeric materials are known for their unusual mechanical capabilities, usually exploited as components of structural systems. Analysis includes the study of viscoelastic behavior, yielding and fracture phenomena and a variety of novel irreversible deformation processes.

Processing

A major concern of industry is the efficient and large scale production of polymer materials for commercial applications. Research in this area is focusing on reactive processing, multi-layer processing and polymer mixing, i.e., compounding and blends.

Materials Development and Design

Often, newly conceived products require the development of polymeric materials with certain specific properties or design characteristics. Materials can be tailor-made by designing synthesis and processing conditions to yield the best performance under specified conditions. Examples might be the design of permselective membranes for use in kidney dialysis, polymers that are stable at high temperatures for fire-retardant construction materials, high temperature polymer electrolytes for use in advanced fuel cells, and high-strength nonreactive polymers for use as biological implants.

Biopolymers

Living systems are composed primarily of macromolecules, and research is in progress on several projects of medical relevance. The department has a long-standing interest in the hierarchical structure and properties of the components of connective tissues (e.g., skin, cartilage, and bone). The department is also engaged in the development of new biocompatible polymers for application as biomaterials.

Macromolecular Science and Engineering (EMAC)

Undergraduate Courses

EMAC C100. Co-op Seminar I for Macromolecular Science and Engineering (1)
Professional development activities for students returning from cooperative education assignments. Prereq: COOP 001.

EMAC C200. Co-op Seminar II for Macromolecular Science and Engineering (2)
Professional development activities for students returning from cooperative education assignments. Prereq: COOP 002 and EMAC C100.

EMAC 270. Introduction to Polymer Science and Engineering (3)
EMAC 276. Polymer Properties and Design (3)
Engineering properties of polymers and their evaluation in terms of selection and design procedures. Relation of properties to the chemical and physical structures of polymers and application conditions. Prereq: ENGR 145.

EMAC 303. Structure of Biological Materials (3)
This course on the structure of biological materials is designed to provide students with: (i) a fundamental understanding of the structure of biologic materials including globular and structural proteins, connective tissue and bone; from the molecular to the microscopic levels of structure (approx. 65% of course); (ii) an introduction to the basic principles and applications of instruments for imaging, identification and measurement of biologic materials (approx. 25% of course) and (iii) an introduction to methods of bioengineering, biological materials, and novel biomaterials (approx. 10% of course). Prereq: EMBC 201 and EMBC 202. Cross-listed as EMBC 303.

EMAC 351. Physical Chemistry for Engineering I (3)
Principles of physical chemistry and their application to systems involving physical and chemical transformations. Gases, liquids, solids and solutions; first, second and third laws of thermodynamics; thermochernistry; physical and chemical equilibria. Prereq: ENGR 145 or MATH 223 or PHYS 122 or consent of instructor.

EMAC 352. Physical Chemistry for Engineering II (3)
Continuation of EMAC 351. Phase rule, electrochemistry, kinetics of chemical reactions, surface phenomena, contact catalysis, and colloids. Prereq: EMAC 351.

EMAC 355. Polymer Analysis Laboratory (3)
Experimental techniques in polymer synthesis and characterization. Synthesis by a variety of polymerization mechanisms. Quantitative investigation of polymer structure by spectroscopy, diffraction and microscopy. Molecular weight determination. Physical properties. Prereq: EMAC 270 or MATH 224 or MATH 234.

EMAC 372. Polymer Processing and Testing Laboratory (3)
Basic techniques for the rheological characterization of thermoplastic and thermoset resins; “hands-on” experience with the equipment used in polymer processing methods such as extrusion, injection molding, compression molding; techniques for mechanical characterization and basic principles of statistical quality control. Prereq: EMAC 377.

EMAC 375. Introduction to Fundamentals and Practice of Rheology (3)
Elementary coverage of principles and concepts pertaining to a basic description of rheological (flow) behavior of polymeric and colloidal systems. Rheometry and rheological measurements of viscoelastic fluids. Modern theories of polymer dynamics and suspension rheology. Molecular theories of polymer processing behavior. Prereq: ENGR 225.

EMAC 376. Polymer Engineering (3)
Mechanical properties of polymer materials as related to polymer structure and composition. Visco-elastic behavior, yielding and fracture behavior including irreversible deformation processes. Prereq: EMAC 276 and ENGR 200.

EMAC 377. Polymer Processing (4)
Application of the principles of fluid mechanics, heat transfer and mass transfer to problems in polymer processing; elementary steps in polymer processing (handling of particulate solids, melting, pressurization and pumping, mixing); principles and procedures for extrusion, injection molding, reaction injection molding, secondary shaping. Prereq: ENGR 225.

EMAC 378. Polymer Production and Technology (3)

EMAC 396. Special Topics (1-18)
(Credit as arranged.)

EMAC 397. Special Topics (1-18)
(Credit as arranged.)

EMAC 398. Polymer Science and Engineering Project I (1-9)
(Senior project.) Research under the guidance of staff, culminating in the thesis.

EMAC 399. Polymer Science and Engineering Project II (1-9)
(Senior project.) Research under the guidance of staff, culminating in the thesis.

Graduate Courses

EMAC 400T. Graduate Teaching I (0)
This course will engage the Ph.D. students in teaching experiences that will include non-contact (such as preparation and grading of homeworks and tests) and direct contact (leading recitations and monitoring laboratory work, lectures and office hours) activities. The teaching experience will be conducted under the supervision of the faculty. All Ph.D. students will be expected to perform direct contact teaching during the course sequence. The proposed teaching experiences for EMAC Ph.D. students are outlined below in association with undergraduate classes. The individual assignments will depend on the specialization of the students. The activities include grading, recitation, lab supervision and guest lecturing. Prereq: Ph.D. student in Macromolecular Science.

EMAC 470. Macromolecular Synthesis (3)
Organic chemistry of macromolecules; mechanism of polyreactions; preparation of addition, condensation, and biopolymers; the chemical reactions of polymers. Prereq: EMAC 270. Cross-listed as CHEM 470.

EMAC 471. Polymers in Medicine (3)
Distribution of plastic implants in the body, including history and statistics; chemical and physical characteristics of biomedical polymers, including general implant requirements, reactions of the host to implants, reactions of implants to physiological conditions, physiological and biomechanical basis for soft-tissue implants; plastic materials used in medicine and surgery; frontiers in biomedical polymers (current topics directed to the design and development of new biomedical polymers). Prereq: Consent of instructor. Cross-listed as EMBE 406.

EMAC 472. Physical Chemistry of Macromolecules (3)
Major areas of physical chemistry of macromolecules; theories and experimental methods of polymer solutions, physical methods for determination of chemical structure, configuration. Prereq: EMAC 270.

EMAC 473. Biopolymers (3)
Application of physical techniques (X-ray, electron microscopy, infrared and Raman spectroscopy, circular dichroism, etc.) to the characterization of biopolymers, including polypeptides, polysaccharides, and polynucleotides. Prereq: EMAC 270.

EMAC 474. Macromolecular Physics (3)

EMAC 475. Introduction to Fundamentals and Practice of Rheology (3)
Elementary coverage of principles and concepts pertaining to a basic description of rheological (flow) behavior of polymeric and colloidal systems. Rheometry and rheological measurements of viscoelastic fluids. Modern theories of polymer dynamics and suspension rheology. Molecular theories of polymer processing behavior. Prereq: ENGR 225.

EMAC 476. Polymer Engineering (3)
Mechanical properties of polymer materials as related to polymer structure and composition. Visco-elastic behavior, yielding and fracture behavior including irreversible deformation processes. A term paper is required. Prereq: EMAC 276 and ECIV 110.

EMAC 477. Polymer Processing (3)
Rheological, molecular, structural, engineering, and compounding factors affecting processibility and properties of polymers: principles and procedures for mixing, extrusion, melting, calendering, injection molding, and other primary processing methods. Pertinent mechanisms and theories; the application of theory to practice. Prereq: EMAC 376.

EMAC 479. X-ray Crystallography (3)
Scattering of X-rays by crystalline and semi-crystalline solids, including polymers. Techniques of structure analysis.

EMAC 480. Polymer Morphology (3)
The morphology of semicrystalline and amorphous polymers, fibers, blends, liquid-crystalline polymers, and composites; and the physical and
chemical mechanisms that control morphology. Practical knowledge of optical and electron microscopy: lab experiments and a project are included. Prereq: EMAC 474.

EMAC 482. Fundamentals of Adhesives, Sealants, and Coatings (3)
Film formation, application methods, and related fabrication factors and procedures. Relevant adhesion theories and practices, aspect of rheological treatments, and factors which affect these applications. Properties of constituent polymer materials, pigments, solvents, and other additives.

EMAC 500T. Graduate Teaching II (0)
This course will engage the Ph.D. students in teaching experiences that will include non-contact (such as preparation and grading of homework and tests) and direct contact (leading recitations and monitoring laboratory works, lectures and office hours) activities. The teaching experience will be conducted under the supervision of the faculty. All Ph.D. students will be expected to perform direct contact teaching during the course sequence. The proposed teaching experiences for EMAC Ph.D. students are outlined below in association with graduate classes. The individual assignments will depend on the specialization of the students. The activities include grading, recitation, lab supervision and guest lecturing. Prereq: Ph.D. student in Macromolecular Science.

EMAC 570. Functional and Reactive Polymers: Synthesis and Properties (3)
The design, synthesis, and properties of a number of new and growing areas of polymer science and chemistry. Topics will include (1) Functional polymers e.g., conducting, light emitting, and liquid crystalline polymers. (2) Reactions with polymers e.g., solid-phase synthesis (peptide and DNA synthesis and combinatorial chemistry), polymers reagents. (3) Supramolecular chemistry in polymer systems e.g., molecular imprinting, main chain supramolecular polymers, effect on miscibility, etc. (4) Synthesis and properties of different polymeric architectures: dendrimers, ladder polymers, polyrotaxanes, etc. and (5) New developments in polymer catalysts.

EMAC 600T. Graduate Teaching III (0)
This course will engage the Ph.D. students in teaching experiences that will include non-contact and direct contact activities. The teaching experience will be conducted under the supervision of the faculty. The proposed teaching experiences for EMAC Ph.D. student in this course involve instruction in the operation of major instrumentation and equipment used in the daily research activities. The individual assignments will depend on the specialization of the students. Prereq: Ph.D. student in Macromolecular Science.

EMAC 601. Independent Study (1-18)
(Credit as arranged.)

EMAC 651. Thesis M.S. (1-18)
(Credit as arranged.)

EMAC 654. Selected Topics in Polymer Engineering (2-3)
Timely issues in polymer engineering are presented at the advanced graduate level. Content varies, but may include: mechanisms of irreversible deformation: failure, fatigue and fracture of polymers and their composites; processing structure-property relationships; and hierarchical design of polymeric systems. Prereq: EMAC 376 or EMAC 476.

EMAC 674. Selected Topics (3)
EMAC 677. Colloquium in Macromolecular Science (0)
Lectures by invited speakers on subjects of current interest in polymer science.

EMAC 678. Characterization of Macromolecules (3)
Laboratory experience through synthesis and characterization of polymers. Methods include light scattering, viscosity, infrared, and NMR spectroscopy. Solid samples characterized by x-ray diffraction, electron and optical microscopy, thermal analysis, and physical properties. Prereq: EMAC 470 and EMAC 472.

EMAC 690. Special Topics in Macromolecular Science (1-18)
EMAC 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

EMAC 702. Appointed Dissertation Fellow (9)
Bachelor of Science in Engineering Degree
Major in Materials Science & Engineering

Freshman Year

<table>
<thead>
<tr>
<th>Class/Lab/Credit Hours</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
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<tr>
<td>CHEM 111 Principles of Chemistry for Engineers</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3-0-3)</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>PHED 1xx Physical Education Activities</td>
<td>(0-3-0)</td>
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<tr>
<td>Open Elective or Humanities/Social Science Elective b, g</td>
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<td><strong>Total</strong></td>
<td>(17-3-17)</td>
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<td><strong>Spring</strong></td>
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<tr>
<td>ENGR 145 Chemistry of Materials</td>
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<td>MATH 122 Calculus for Science and Engineering II</td>
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<tr>
<td>PHYS 121 General Physics I - Mechanics a</td>
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<td>PHED 1xx Physical Education Activities</td>
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<td>Humanities/Social Science or Open elective b, g</td>
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<td><strong>Total</strong></td>
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<td><strong>Sophomore Year</strong></td>
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<td><strong>Fall</strong></td>
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<tr>
<td>CHEM 301 Introduction to Physical Chemistry c</td>
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<td>EMSE 102 Materials Science Seminar</td>
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<td>EMSE 201 Introduction to Materials Science &amp; Engr.</td>
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<td>MATH 223 Calculus for Science and Engineering III</td>
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<td>PHYS 122 General Physics II - Electricity &amp; Magnetism</td>
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<td>Humansities/Social Science Elective</td>
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<tr>
<td>ECES 251 Numerical Methods d</td>
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<td>EMSE 202 Phase Diagrams &amp; Phase Transformations</td>
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<tr>
<td>EMSE 270 Materials Laboratory I</td>
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<td>MATH 224 Elementary Differential Equations c</td>
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<td>ENGR 200 Statics and Strength of Materials</td>
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Junior Year

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<tr>
<td>EMSE 280 Materials Laboratory II</td>
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<tr>
<td>ENGR 210 Introduction to Circuits and Instrumentation</td>
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<td>EMSE 203 Applied Thermodynamics</td>
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<td>EMSE 314 Electronic, Magnetic, and Optical Properties of Materials</td>
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<td>Humanities/Social Science Sequence II</td>
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<tr>
<td>EMSE 290 Materials Laboratory III</td>
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<td>ENGL 398N Professional Communication f</td>
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<td>EMSE 303 Mechanical Behavior of Materials</td>
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<tr>
<td>ENGR 225 Thermodynamics, Fluid Mechanics &amp; Heat &amp; Mass Transport</td>
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<td>Humanities/Social Science Sequence III</td>
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<td><strong>Senior Year</strong></td>
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<td><strong>Fall</strong></td>
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<tr>
<td>EMSE 301 Fundamentals of Materials Processing</td>
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<tr>
<td>EMSE 302 Fundamentals of Materials Processing Lab</td>
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<tr>
<td>EMSE 310 Applications of Diffraction Principles</td>
<td>(0-2-1)</td>
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<tr>
<td>EMSE 312 Diffraction Principles</td>
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<tr>
<td>EMSE 398 Senior Project in Materials I</td>
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<tr>
<td>EMSE 313 Engineering Applications of Materials</td>
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Hours required for graduation: 128

a. Selected students may be invited to take PHYS 123-124; General Physics III Honors, in place of PHYS 121-122.

b. One of these must be in the humanities or social sciences.

c. Satisfied the Math, Natural Sciences, or Statistics requirement of the Engineering Core.

d. or EMAE 250 or PHYS 250.

e. or MATH 234.

f. Satisfied the Professional Communications requirement of the Engineering Core.

g. The Engineering Core requires that if the Humanities/Social Sciences sequence is in Social Science, then the Humanities social Sciences electives must be in Humanities; if the sequence is in Humanities, then 2 of the 3 Humanities/social Sciences electives must be in Social Science.
Approved Technical Electives

The following courses are approved technical electives in Materials Science and Engineering. A student is encouraged to discuss with their class advisor a sequence of technical elective courses, which takes into account the biannual nature of some offerings. Students may request approval of other elective courses by submitting a written petition justifying their choices to the department’s Undergraduate Studies Committee.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
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<th>Bi-Annual</th>
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<tr>
<td>ECIV 210</td>
<td>Strength of Materials</td>
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<td>ECIV 410</td>
<td>Advanced Strength of Materials</td>
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<td>ECIV 420</td>
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<td>Circuits, Signals and Systems I</td>
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<tr>
<td>EEAP 246</td>
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<td>EEAP 309</td>
<td>Electromagnetic Fields I</td>
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<td>EMSE 316</td>
<td>Applications of Ceramic Materials</td>
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<td>EMSE 360</td>
<td>Transport Phenomena</td>
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<td>EMSE 401</td>
<td>Transformations in Materials</td>
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<td>EMSE 403</td>
<td>Modern Ceramic Processing</td>
<td>X</td>
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<tr>
<td>EMSE 404</td>
<td>Diffusion Processes in Solids and Liquids</td>
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<td>EMSE 405</td>
<td>Dielectric, Optical, &amp; Magnetic Properties of Materials</td>
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<td>Solidification of Materials</td>
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<td>EMSE 409</td>
<td>Deformation Processing of Metals</td>
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<td>EMSE 410</td>
<td>Numerical Modeling of Materials Forming Processes</td>
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<td>EMSE 411</td>
<td>Environmental Effects on Materials Behavior</td>
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<td>EMSE 417</td>
<td>Properties of Materials at High Temperatures</td>
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<td>Phase Equilibria &amp; Microstructures of Materials</td>
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<td>Fracture of Materials</td>
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<td>Semiconductor Thin Film Science &amp; Technology</td>
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<td>EMSE 427</td>
<td>Dislocations in Solids</td>
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<td>EMSE 429</td>
<td>Crystallography &amp; Crystal Chemistry</td>
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<td>PHYS 331</td>
<td>Introduction to Quantum Mechanics 1</td>
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<td>Introduction to Solid State Physics</td>
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<td>Statistics for Engineering and Science</td>
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<td>or STAT 313</td>
<td>Statistics for Experimenters</td>
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1. Graduates will understand the interrelationships among courses.

2. Graduates will be able to carry out laboratory experiments, analyze data, and interpret the significance of their results, especially with respect to the processing of engineering materials and characterization of their engineering properties.

3. Graduates will be proficient in the oral, written, and electronic communication of their ideas.

4. Graduates will be proficient in the use of computer technology and computer-based information systems.

5. Graduates will be able to function effectively in groups of peers and independently.

6. Graduates will be informed of the impact of engineering on society and of the professional, ethical, safety, and environmental responsibilities that that entails.

7. Graduates will regard professional development and education as processes that should continue hand-in-hand throughout their academic and professional careers.

The undergraduate experience in Materials Science and Engineering at Case Western Reserve is marked by a high degree of hands-on experience and many opportunities for professional development before graduation. Lab courses, senior projects, and plant tours ensure that every student sees the field first-hand in current research and industrial settings.

In addition, many of our undergraduate students participate in co-operative education, summer jobs, and professional societies that expose them to the larger world of materials science beyond the classroom.

Minor in Materials Science and Engineering

In addition to the Bachelor of Science degree program in materials science and engineering, the department also offers a minor in materials science and engineering. This sequence is intended primarily for students majoring in science or engineering, but it is open to any student with a sound background in introductory calculus, chemistry, and physics. This program requires the completion of 5 courses with a minimum of 15 credit hours, of which a maximum of 6 hours can be counted toward the student’s major. All students will be required to take EMSE 201 (3) and four of the following courses:

- EMSE 202, Phase Diagrams and Phase Transformations (3)
- EMSE 203, Applied Thermodynamics (3)
- EMSE 260, Transport Phenomena (4)
- EMSE 301, Fundamentals of Materials Processing (3)
- EMSE 303, Mechanical Behavior of Materials (3)
- EMSE 307, Foundry Metallurgy (3)
- EMSE 313, Engineering Applications of Materials (3)
- EMSE 314, Electrical, Magnetic, and Optical Properties (3)
- EMSE 316, Applications of Ceramics (3)
- EMSE 317, Diffraction Principles and Applications (4)

Prof. Mark DeGuire (506 White; x-4221) is the academic advisor for this program and will assist students with their course selection.

Cooperative Education in Materials Science and Engineering

The Cooperative Education program at Case Western Reserve began in the Materials Science and Engineering Department and the department’s faculty continue to strongly support student participation. Over the past ten years approximately three-quarters of the department’s undergraduates have completed at least one cooperative education assignment. Most students complete the recommended two assignments. A wide range of opportunities...
exist for materials majors including heavy industry, mid-size and small firms, and government and corporate research centers. Many opportunities are local to Northern Ohio, but a wide range of possibilities around the country, and, occasionally, international opportunities arise.

The cooperative education experience is monitored to ensure that students progress in job responsibilities during the course of an assignment. It is common for students to assume positions of responsibility, including employee supervision or decision-making on behalf of the company.

The department offers two academic courses, EMSE C100 and EMSE C200, that may be taken for credit upon return from the first and second experience respectively.

**Five-Year Combined B.S./M.S. Program**

This program offers outstanding undergraduate students the opportunity to obtain an M.S. degree, with a thesis, in one additional year of study beyond the B.S. degree. (Normally, it takes 2 years beyond the B.S. to earn an M.S. degree.) In this program, an undergraduate student can take up to nine credit hours that simultaneously satisfy undergraduate and graduate requirements. Typically, students in this program start their research leading to the M.S. thesis in the fall semester of the senior year. The department endeavors to support such students through the following summer and academic year at the normal stipend for entering graduate students. The B.S. degree is awarded at the completion of the senior year.

Application for admission to the five year B.S./M.S. program is made after completion of five semesters of course work. Minimum requirements are a 3.2 grade point average and the recommendation of the department. Interested students should contact Professor Cawley.

**Graduate Programs**

The department offers programs leading to the Master of Science and Doctor of Philosophy degrees with research specialties in metallurgy, ceramics, electronic materials, composite materials, and materials science. A broad range of studies of the theory, properties, and engineering behavior of materials is encompassed in the academic courses and research within the department, with primary areas of specialization in materials processing, mechanical properties, surface and microstructural characterization, environmental effects, and electronic materials.

**M.S. Degree Requirements**

The M.S. degree in materials science and engineering is awarded through either Plan A (Master’s Thesis) or Plan B (Master’s Comprehensive). Plan A involves a thesis based on individual research and a final oral thesis defense; this plan is appropriate for full-time graduate students. Plan B involves a major project and a comprehensive oral exam; it is typically pursued by part-time graduate students.

Plan A requires successful completion of 6 courses (18 credit hours) and at least 9 credit hours of M.S. research project (EMSE 651). Plan B requires the successful completion of eight courses (24 credit hours) as well as 3 credit hours of a Special Projects course (EMSE 649). The six courses for Plan A and the 8 courses for Plan B may include a maximum of 2 courses from an engineering or science curriculum outside the department. No more than 2 courses at the 3xx level can be included; all other courses must be at a higher level. Transfer of credit from another university is limited to six credit hours of graduate level courses (with grade B or better) taken in excess of degree requirements at the other university. A Program of Study must be submitted by the end of the first semester for Plan A students, and by the end of 2 courses for Plan B students. A cumulative G.P.A. of 2.75 or higher is required.

Plan A students must prepare a written thesis and successfully defend the thesis in a final oral exam. Plan B students must prepare a written report on his/her special project and satisfactorily pass a comprehensive oral exam. The thesis exam for Plan A and the oral exam for Plan B must be conducted by an examining committee consisting of 3 faculty members of the department.

**Ph.D. Degree Requirements**

Immediately upon entering the Materials Science and Engineering Department, the Ph.D. candidate must fill out and submit the first part of the “Ph.D. Student Permanent Record” form; register for 2 or 3 classes during the first semester. If only 2 classes are taken, register for EMSE 701 Dissertation Research (3 credit hours) during the first semester. Note that registration for EMSE 701 is not permitted before the form is turned in.

Candidates for a Ph.D. degree in materials science and engineering must meet the following requirements to prove their competency for doctoral study and to be accepted into the doctoral program:

1. Submit an approved Program of Study form and a Supplementary Information form specifying the Breadth and Basic Science Requirements.
2. Pass a comprehensive written General Exam within 6 months following their being awarded an M.S. degree (12 months for students with an M.S. degree from a different science or engineering discipline).
3. Pass a Thesis Proposal Exam (written and oral) during the semester immediately following the successful completion of the written General Exam. These requirements are explained in detail below. At the completion of these requirements, the student must fill out the second part of the Ph.D. Student Permanent Record form.

Upon successful completion of all requirements and research, the Ph.D. candidate must submit a written dissertation as evidence for his/her ability to conduct independent research at an advanced level. The Ph.D. candidate must pass a final oral exam in defense of the dissertation. The Dissertation Committee must consist of three faculty members of the department and one non-departmental member. The candidate must provide each committee member with a copy of the completed dissertation at least 10 days before the exam, so that the committee members may have an opportunity to read and discuss it in advance.

The student must provide two (2) unbound copies of the final approved version of the thesis for the University, and two (2) bound copies of the thesis, one for the department and one for the student’s faculty advisor.

**(1) Ph.D. Program of Study (Course Requirements)**

A Ph.D. student must take a minimum of 18 credit hours of EMSE 701 and must continue registration each succeeding regular semester (fall and spring) until the dissertation is complete, unless granted a leave of absence. The time limit for the Ph.D. program is 5 years, starting with the first semester of EMSE 701 registration.

The minimum course requirement for a Ph.D. degree is 12 courses (36 credit hours) beyond the B.S. level, out of which at least six courses (18 credit hours) must be taken at Case Western Reserve University. Of these 12 courses, six courses must satisfy the Breadth Requirement and 2 courses must satisfy the Basic Science Requirement for the department as outlined below. In the case of a student entering with an M.S. degree from another discipline, additional courses may be required as decided by the department. A G.P.A. of 3.0 is required for Graduate Assistants.
Breadth Requirement.
A broad knowledge of the field of materials science and engineering includes a minimum level of understanding of the following six areas:
   a. Mechanical Behavior
   b. Structure
   c. Physical Properties
   d. Processing
   e. Thermodynamics and Kinetics
   f. Phase Transformations

The Breadth Requirement for the Ph.D. can be fulfilled by taking a total of 6 courses (18 credit hours); these 6 courses must include at least one course from areas a, b, c, and d and 2 courses from areas e and f combined. The department maintains a list of approved courses for each of these areas.

Basic Science Requirements.
A minimum depth in basic science of two courses (6 credit hours) is required for a Ph.D. degree. This requirement can be fulfilled by taking 2 courses selected from physics, chemistry, mathematics and/or statistics, and/or certain engineering curricula. The department maintains a current list of approved courses for the Basic Science Requirements.

The Program of Study, a list of the courses the student will take to fulfill the Ph.D. requirements, will be discussed and approved at the time of the Thesis Proposal Exam. This form and the associated Supplementary Information form must be approved by the student’s Dissertation Committee (excluding the non-departmental member) and the chair of the department and submitted to the dean of graduate studies within one semester of passing the General Exam.

(2) Ph.D. General Exam
The written General Exam is offered twice a year, typically in January and in June, provided at least three students are registered to take the exam. The Exam is comprehensive and consists of two parts:
1. Thermodynamics and Kinetics; Materials Processing: covering such topics as phase equilibria, phase transformations, diffusion, defect chemistry, synthesis, fabrication, microstructural development, and thermomechanical processing.
2. Structure; Properties, Performance, and Reliability: covering crystallography and symmetry, analytical techniques (diffraction, imaging, and spectroscopy), line defects, surfaces and interfaces, microstructural analysis, mechanical, thermal, chemical (environmental), and electrical, optical, and magnetic properties, individually and in combination.

The emphasis in both parts of this General Exam will be on inorganic materials: metals, ceramics, semiconductors, and composites.

Each part of the exam will last for three hours; the morning session is devoted to part 1 and the afternoon session covers part 2. Each part of the Exam is divided into two sections:

Part 1 (morning)
   Section 1 Thermodynamics and Kinetics
   Section 2 Processing

Part 2 (afternoon)
   Section 3 Structure
   Section 4 Properties, Performance, and Reliability

The exam is closed book. Each section of the exam will contain a minimum of 4 questions. Students must answer 5 questions from part 1 and 5 questions from part 2, with at least 2 questions being answered from each section.

In order to pass the written General Exam, the criteria are as follows—6 out of ten questions in the exam require a 70% passing grade as well as a 75% average for the whole exam. Students who fail the exam (or the Thesis Proposal Exam described below) may try that exam a second time.

(3) Thesis Proposal Exam
The Thesis Proposal Exam tests the more specific knowledge of the Ph.D. candidate concerning the science underlying the proposed research and to his or her intellectual maturity. It is composed of a written and an oral part, both dealing with the candidate’s proposed research project. The written document should be given to each member of the student’s Dissertation Advisory Committee (excluding the non-departmental member) during the semester immediately following the successful completion of the General Exam. It should include a literature search, analysis of the research problem, suggested research procedures, and the general results to be expected. The document should be written by the student and not his/her thesis advisor, and will be examined by the student’s Dissertation Advisory Committee for this purpose.

The oral part of the Thesis Proposal Exam should last approximately two hours and must be given before the student’s Dissertation Advisory Committee within one week of submitting the above written document to the Committee. Both parts of the Thesis Proposal Exam will be graded Pass/Fail.

At the time of this Exam, the student will also have his/her Program of Study examined and approved by the Dissertation Advisory Committee.

Research Areas
Deformation and Fracture
Determination of the relationships between structure and mechanical behavior of traditional and advanced materials—metals, ceramics, intermetallics, composites, and biological materials. State-of-the art facilities are available for testing over a range of strain rates, test temperatures, stress states, and size scales for both monotonic and cyclic conditions.

Materials Processing
Ceramic and metal powder synthesis and processing, computer-aided manufacturing of laminated materials, metals casting, crystal growth, thin film deposition, deformation processing of metals.

Environmental Effects

Surfaces and Interfaces
Free surfaces, grain boundaries, metal/ceramic, polymer/metal composite interfaces. Major facilities for transmission electron microscopy, scanning electron microscopy, and surface spectroscopies.

Electronic, Magnetic and Optical Materials
Electronic materials—silicon, germanium, gallium arsenide, silicon carbide; gallium nitride; thin film dielectric, optical, and magnetic ceramics; synthesis and characterization of multi-component electromagnetic filters, transparent semiconductors, ceramics, such as materials for sensors, catalysts, and fuel cells.

Facilities
Materials Processing
The department’s processing laboratories include facilities which permit materials processing from the liquid state (casting)
as well as in the solid state (powder processing). The department has its own foundry that houses mold making capabilities (green and bonded sand, permanent mold, and investment casting), induction melting furnaces of various capabilities for air melting of up to 1500 pounds of steel, electrical resistance furnaces for melting and casting up to 800 pounds of aluminum, and 500 pounds of magnesium under protective atmosphere, a 500 ton vacuum induction melting unit with a capacity of up to 30 pounds of superalloys, a 350 ton squeeze casting press, and state-of-the-art thermal fatigue testing and characterization equipment. The Crystal Growth Laboratory has facilities for production of high purity electronic single crystals using a variety of furnaces with the additional capability of solidifying under large magnetic fields. In addition, a CVD and MOVCD reactor has been set up to do research on the growth of SiC and GaN on Si, sapphire, and other substrates. Secondary processing and working can be accomplished using a high-speed hot and cold rolling mill, swaging units, and a state-of-the-art hydrostatic extrusion press.

The department has heat treatment capabilities including numerous box, tube, and vacuum furnaces. For the processing of powder metals or ceramics the department possesses a 300,000 pound press, a vacuum hot press (with capabilities of up to 7 ksl and 2300 C), a hot isostatic press (2000 C and 30 ksl), a 60 ksl wet base isostatic press, and glove boxes. Sintering can be performed in a variety of controlled atmospheres while a microcomputer-controlled precision dilometer is available for sintering studies. Several ball mills, shaker mills, and a laboratory model attritor are also available for powder processing. In addition, facilities are available for sol-gel processing, glass melting, diamond machining; a spray dryer is available for powder granulation.

A Deformation Processing Laboratory has recently been commissioned that contains two dual hydraulic MTS presses. The first press is designed to evaluate the stretching and drawing properties of materials in sheet form. Its maximum punch and hold down forces are 150,000 each. Its maximum punch velocity is 11.8 inch/sec. The second press is designed to evaluate the plastic flow behavior of materials in an environment that simulates modern manufacturing processing. The press can deliver up to five consecutive impacts to a material in less than five seconds with a punch velocity as high as 110 inch/sec. The maximum punch force is 110,000 pounds.

A Computational Materials Processing Laboratory has recently been established. The core of the facilities is a Silicon Graphics Origin 2000 which has high speed networking with an array of Octane workstations. A host of software packages are available as tools for the simulation and design of materials processing activities that range from crystal growth to powder consolidation to plastic deformation and also maintains a computer lab expressly for student use, including IBM-compatible and Macintosh computers, laser printers, DEC-net terminals, and a VAX-station 2000 with a large screen high resolution display.

**Mechanical Testing Facility**

The Mechanical Testing Facility permits the determination of mechanical behavior of materials over loading rates ranging from static to impact, with the capability of testing under a variety of stress states under either monotonic or cyclic conditions. A variety of furnaces and environmental chambers are available to enable testing at temperatures ranging from -196 C to 1800 C. The facility is operated under the direction of a faculty member and under the guidance of a full-time engineer. The facility contains one of the few laboratories in the world for high-pressure deformation and processing, enabling experimentation under a variety of stress states and temperatures. The equipment in this state-of-the-art facility includes:

- High Pressure Deformation Apparatus: These units enable tension or compression testing to be conducted under conditions of high hydrostatic pressure. Each apparatus consists of a pressure vessel and diagnostics for measurement of load and strain on deforming specimens, as well as instantaneous pressure in the vessel. Pressures up to 1.0 GPa, loads up to 10kN, and displacements of up to 25 mm are possible. The oil based apparatus is operated at room temperature while a gas (i.e. Ar) based apparatus can be used with an internal furnace.

- Hydrostatic Extrusion Apparatus: Hydrostatic extrusion (e.g. pressure-to-air, pressure-to-pressure) can be conducted at temperatures up to 300 C on manually operated equipment interfaced with a computer data acquisition package. Pressures up to 2.0 GPa are possible, with reduction ratios up to 6 to 1, while various diagnostics provide real time monitoring of extrusion pressure and ram displacement.

- Advanced Forging Simulation Rig: A multi-actuator. MTS machine based on a 330 kip, four post frame, enables sub-scale forging simulations over industrially relevant strain rates. A 110 kip forging actuator is powered by five nitrogen accumulators enabling loading rates up to 120 inches/sec on large specimens. A 220 kip indexing actuator provides precise deformation sequences for either single, or multiple, deformation sequences. Data acquisition rates are sufficient for analysis are available. Testing with heated dies is possible.

- Advanced Metal Forming Rig: A four post frame with separate control of punch actuator speed and blank hold down pressure enables determination of forming limit diagrams. Dynamic control of blank hold down pressure is possible, with maximum punch actuator speeds of 11.8 inches/sec. A variety of die sets are available.

The remainder of the equipment in the Mechanical Testing Facility is summarized below:

- **Servo-hydraulic Machines**: Four MTS Model 810 computer-controlled machines with load capacities of 3 kip, 20 kip, 50 kip, and 50 kip, permit tension, compression, and fatigue studies to be conducted under load-, strain-, or stroke control. Fatigue crack growth may be monitored via a dc potential drop technique as well as via KRAK gages applied to the specimen surfaces. Fatigue studies may be conducted at frequencies up to 30 Hz.

- **Universal Testing Machines**: Three INSTRON screw-driven machines, including two INSTRON Model 1125 units permit tension, compression and torsion testing.

- **Electromechanical Testing Machine**: A computer-controlled INSTRON Model 1361 can be operated under load-, strain-, or stroke control. Stroke rates as slow as 1 micrometer/hour are possible.

- **Fatigue Testing Machines**: Three Sonntag fatigue machines and two R. R. Moore rotating-bending fatigue machines are available for producing fatigue-life (S-N) data. The Sonntag machines may be operated at frequencies up to 60 Hz.

- **Creep Testing Machines**: Three constant load frames with temperature capabilities up to 800 C permit creep testing, while recently modified creep frames permit thermal cycling experiments as well as slow cyclic creep experiments.

- **Impact Testing Machines**: Two Charpy impact machines with capacities ranging from 20 ft-lbs to 240 ft-lbs are available. Accessories include a Dynatup instrumentation package interfaced with an IBM PC, which enables recording of load vs. time traces on bend specimens as well as on tension specimens tested under impact conditions.

- **Instrumented Microhardness Testing**: A Nikon Model QM High-Temperature Microhardness Tester permits indentation studies on specimens tested at temperatures ranging from -196 C to
The first is a Hitachi S-4500, a field emission electron microscope of energy dispersive systems capable of detecting elements of field and realistic three-dimensional imaging at resolutions up to analysis provide valuable specimen investigation with great depth. Scanning Electron Microscopy Laboratory

Two transmission electron microscopes are available that provide virtually all conventional and advanced microscopy techniques required for state-of-the-art materials research and involve an installed capacity worth $3,000,000. The microscopes available are (i) an FEI Tecnai F30 300kV field-emission gun energy-filtering high-resolution analytical scanning transmission electron microscope with an information resolution limit better than 0.14nm, equipped with an EDAX system with a high-energy resolution Si-Li detector for X-ray energy-dispersive spectroscopy (XEDS), a Gatan GIF2002 imaging energy filter including a 2k by 2k slow-scan CCD camera, and a high-angle annular dark-field detector for scanning transmission electron microscopy (STEM), and (ii) a Philips CM20 200kV analytical transmission electron microscope equipped with a Tracor Northern high-purity Ge X-ray energy-dispersive spectroscopy detector, a Gatan parallel electron energy-loss spectrometer (PEELS), and a STEM unit. Conventional TEM techniques, such as bright-field and dark-field imaging, electron diffraction, or weak-beam dark-field imaging (WBDF) are used routinely to analyze line defects (dislocations) and planar defects (interfaces, grain boundaries, stacking faults) in crystalline materials. Advanced TEM techniques include (i) high-resolution TEM, which enables assessing the atomicic structure of crystal defects such as heterophase interfaces, grain boundaries, or dislocations, (ii) convergent-beam electron diffraction, which can be used, for example, to obtain crystallographic information (space group) and to determine orientation relationships between small (even nanoscopic) crystallites, and (iii) energy-filtering TEM, which includes zero-loss filtering for improved image contrast and resolution in conventional imaging and diffraction as well as electron spectroscopic imaging (ESI), a technique that enables rapid elemental mapping with high spatial resolution based on element-characteristic energy losses of the primary electrons in the specimen. Specimen preparation facilities for transmission electron microscopy consist of two dimple-grinders, two electropolishing units, three ultra-microtomes, and two conventional ion-beam mills, and two state-of-the-art precision ion polishing systems (PIPS, by Gatan).

Environmental Stress Laboratories

These facilities include equipment for corrosion, oxidation, and adhesion and wear studies. A wide range of environments can be simulated and controlled. A) Aqueous corrosion: atmospheric, immersion and high pressure/high temperature in autoclaves and B) Oxidation: single and mixed gases over a range of temperatures and pressures. Special items include: electrochemical test equipment, environmental cracking test equipment, vacuum equipment for permeation studies, high sensitivity Cahn electrobalances for thermogravimetric studies and polymer/metal adhesion test fixtures.

Surface Science Laboratories

The Center for Surface Analysis of Materials (CSAM) enjoys state-of-the-art characterization of metal, alloy, ceramic, and polymer surfaces. These tools include a PHI 660 Scanning Auger Microprobe (SAM) for elemental analysis of surfaces and mapping, and PHI 3600 Secondary Ion Mass Spectrometry (SIMS), which provides surface sensitivities for species in the part per billion range. A PHI model 5400 instrument provides X-ray Photoelectron Spectroscopy (XPS or ESCA) capability, which produces information concerning chemical states. The latter two instruments are particularly useful for ceramic and polymer surfaces. With specimen heating, cooling, and depth profiling capabilities directly incorporated in these devices, subsurface regions and interfaces in composite structures, as well as at thin film substrate interfacial regions, can be examined and fully characterized. The ion beam facility for the analysis of materials consists of an NEC 5SDH 1.7 MV tandem pelletron accelerator for the production of 3.4 MeV protons, 5.1 MeV alpha particles, and N ions with energies in excess of 7.0 MeV. Sample analyses take place in a turbo-molecular pumped high vacuum chamber. The chamber is equipped with a computer-controlled 5 axis manipulator and has provisions for maintaining sample temperatures from 77 K to 1000 K. A Si surface barrier detector, NaI(Tl) scintillator, and a liquid nitrogen-cooled Si(Li) detector are used to detect scattered ions, characteristic gamma rays and characteristic X-rays, respectively. This instrumentation can non-destructively provide composition and structure information in the near-surface region of materials using techniques such as Rutherford backscattering spectrometry (RBS), ion channeling, particle-induced X-ray analysis (PIXE), and nuclear reaction analysis (NRA). As with other analytic techniques, sensitivity, sampling depth, and depth resolution are sample dependent. However, sensitivities of 1 atomic percent, accuracies of 5%, and a depth resolution of 20 nm are usually easily achieved. The typical specimen is a solid, vacuum-compatible material with lateral dimensions between 0.5 cm x 0.5 cm and 5 cm x 5 cm. However, PIXE and NRA can also be performed on non-vacuum compatible specimens such as liquids and irreplaceable artifacts of interest to museum curators and archeologists.

Electronic Properties Laboratory

Crystal Growth and Analysis Laboratory

The Crystal Growth and Analysis Laboratory is equipped for research studies and characterization of bulk semiconductor and photonic materials. The growth facilities include a high pressure Czochralski system, low pressure Czochralski system, and a Vertical Bridgman system with magnetic field stabilization. The characterization facilities include capabilities for sample preparation, a Hall effect system, Infra-red microscope, and an Inductively Coupled Plasma-Mass Spectrometer (ICP-MS).
X-Ray Laboratory

The X-ray laboratory contains diffraction equipment for study of the structures of ceramics, metals, polymers, minerals, and single crystals of organic and inorganic compounds. A new Scintag diffractometer system includes a theta/theta wide angle goniometer, a 4.0 kW x-ray generator with copper tube, a third axis stress attachment, a thermoelectrically cooled Peltier germanium detector, a thin film analysis system, a dedicated PC for data acquisition, and a turbomolecular-pumped furnace attachment permitting sample temperatures up to 2000 degrees C.

Materials Science and Engineering (EMSE)

Undergraduate Courses

EMSE C100. Co-Op Seminar I for Materials Science and Engineering (1)
Professional development activities for students returning from cooperative education assignments. Prereq: COOP 001.

EMSE C200. Co-Op Seminar II for Materials Science and Engineering (2)
Professional development activities for students returning from cooperative education assignments. Prereq: COOP 002 and EMSE C100.

EMSE 102. Materials Seminar (1)
Topical lectures by faculty on current areas of materials research serving to complement the concepts introduced in EMSE 201. General discussion of overall curriculum and educational objectives. Prereq or Coreq: EMSE 201.

EMSE 103. Materials in Sports (3)
The relationships between optimizing sports activities and the performance requirements of sports equipment are developed. The inherent properties of materials are shown to be the controlling factors in the design of almost all types of sports equipment. Properties of the major classes of materials used to manufacture sports equipment are examined. Materials discussed include advanced composites, foams, metals, ceramics, and natural composites, e.g., wood and leather. The absorption, storage, and release of energy by equipment during sports activities are shown to relate to the basic structure of the materials from which it is made. Demonstration experiments are conducted periodically throughout the course.

EMSE 201. Introduction to Materials Science and Engineering (3)
Introductory treatment of crystallography, phase equilibria, and materials kinetics. Application of these principles to examples in metals, ceramics, semiconductors, and polymers, illustrating the control of structure through processing to obtain desired mechanical and physical properties. Design content includes examples and problems in materials selection and of design of materials for particular performance requirements. Prereq: ENGR 145 and PHYS 121 and MATH 121.

EMSE 202. Phase Diagrams and Transformations (3)

EMSE 203. Applied Thermodynamics (3)
Basic thermodynamics principles as applied to materials. Application of thermodynamics to material processing and performance including condensed phase and gaseous equilibria, stability diagrams, corrosion and oxidation, electrochemical and vapor phase reactions. Prereq: EMSE 201.

EMSE 270. Materials Laboratory I (2)
Introduction to processing, microstructure and property relationships of metal alloys, ceramics and glass. Solidification of a binary alloy and metallography by optical and scanning electron microscopy. Synthesis of ceramics powders, thermal analysis using TGA and DTA, powder consolidation, sintering and grain growth kinetics. Processing and coloring of glass and glass-ceramics.

EMSE 280. Materials Laboratory II (2)
Synthesis and processing. Experiments designed to demonstrate and evaluate different ways to process different types of materials. Solidification of melts. Crystallogization kinetics, processing using electrochemistry, oxidation and oxidized microstructures. Laboratory teams are selected for all experiments.

EMSE 290. Materials Laboratory III (2)
Experiments designed to characterize and evaluate different microstructural designs produced by variations in processing. Fracture of brittle materials, fractography, thermal shock resistance, hardenability of steels, TTT and CT diagrams, composites, solidification of metals, solution annealing of alloys. Prereq: EMSE 201.

EMSE 301. Fundamentals of Materials Processing (3)
Introduction to materials processing technology with an emphasis on the relation of basic concepts to the processes by which materials are made into engineering components. Includes casting, welding, forging, cold-forming, powder processing of metals and ceramics, and polymer and composite processing. Prereq: EMSE 201 and EMSE 202 and EMSE 203.

EMSE 302. Fundamentals of Materials Processing Laboratory (1)
Demonstration of basic processes of materials fabrication. Includes visits to commercial materials processing plants for tours and demonstrations. Graded pass/fail.

EMSE 303. Mechanical Behavior of Materials (3)

EMSE 307. Foundry Metallurgy (3)
Introduction to solid-liquid phase transformations and their application to foundry and metal casting processes. Includes application of nucleation and growth to microstructural development, application of thermodynamics to molten metal reactions, application of the principles of fluid flow and heat transfer to gating and risering techniques, and introduction to basic foundry and metal casting technology. Prereq: EMSE 202 and EMSE 203 and ENGR 225.

EMSE 310. Applications of Diffraction Principles (1)
A lab sequence in conjunction with EMSE 312, Diffraction Principles, involving experiments on crystallography, optical diffraction, Laue backscattering on single crystals, powder diffraction of unknown compounds, electron diffraction and imaging, and chemical analysis using energy dispersive x-ray spectroscopy. Prereq: EMSE 312 or consent of instructor.

EMSE 312. Diffraction Principles (3)

EMSE 313. Engineering Applications of Materials (3)
Optimum use of materials taking into account not only the basic engineering characteristics and properties of the materials, but also necessary constraints of component design, manufacture (including machining), abuse allowance (safety factors), and cost. Interrelations among parameters based on total system design concepts. Case history studies. Systems of failure analysis. Prereq: EMSE 202 and ENGR 200.

EMSE 314. Electrical, Magnetic, and Optical Properties of Materials (3)

EMSE 316. Applications of Ceramic Materials (3)
Engineering applications of ceramics. Survey of processing techniques. Thermal and mechanical properties; strength, thermal conductivity, thermal expansion, stress corrosion. Electrical properties: electrical conduc-
tivity, dielectric properties, piezo- and ferro-electricity. Glass manufact-
ure and structure-property relationships. Prereq: EMSE 201.

EMSE 360. Transport Phenomena in Materials Science (3)
Review of momentum, mass, and heat transport from a unified point of view. Application of these principles to various phenomena in materials science and engineering with an emphasis on materials processing. Both analytical and numerical methodologies applied in the solution of prob-
lems. Prereq: ENGR 225 and MATH 224 or equivalent.

EMSE 396. Special Project or Thesis (1-18)
Special research projects or undergraduate thesis in selected material ar-
eas.

EMSE 397. Special Project or Thesis (1-18)
Special research projects or undergraduate thesis in selected material ar-
eas.

EMSE 398. Senior Project in Materials I (1)
Independent research project. Projects selected from those suggested by faculty; usually entail original research.

EMSE 399. Senior Project in Materials II (2)
Independent research project. Projects selected from those suggested by faculty; usually entail original research.

Graduate Courses

EMSE 400T. Graduate Teaching I (0)
To provide teaching experience for all Ph.D.-bound graduate students. This will include preparing exams/quizzes, homework, leading recitation sessions, tutoring, providing laboratory assistance, and developing teaching aids that include both web-based and classroom materials. Graduate students will meet with supervising faculty member throughout the se-

EMSE 401. Transformations in Materials (3)
Review of resolution thermodynamics, surfaces and interfaces, recrystalliza-
tion, austenite decomposition, the martensite transformation and heat treatment of metals. Prereq: EMSE 202.

EMSE 403. Modern Ceramic Processing (3)
Fundamental science and technology of modern ceramic powder pro-
cessing and fabrication techniques. Powder synthesis techniques. Physi-
cal chemistry of aqueous and nonaqueous colloidal suspensions of solids. Shape forming techniques: extrusion; injection molding; slip and tape casting; dry, isostatic, and hot isostatic pressing. Prereq: EMSE 316 (or concur).

EMSE 404. Diffusion Processes in Solids and Melts (3)
Development of the laws of diffusion and their applications. Carburi-
tation and decarburization, oxidation processes. Computer modeling of dif-
fusion processing. Prereq: Consent of instructor.

EMSE 405. Dielectric, Optical and Magnetic Properties of Materials (3)
Electrical properties of nonmetals: ionic conductors, dielectrics, ferro-
electrics, and piezo-electrics. Magnetic phenomena and properties of metals and oxides, including superconductors. Mechanisms of optical ab-
sorption in dielectrics. Optoelectronics. Applications in devices such as oxygen sensors, multilayer capacitors, soft and hard magnets, optical fi-
bers, and lasers. Prereq: Consent of instructor.

EMSE 407. Solidification of Materials (3)
Fundamental science of solid-liquid phase transformations and the appli-
cation of these basics to the solidification processing of materials. In-
cludes nucleation and growth, heat and solute transport, rapid solidifica-
tion, and an overview of solidification processing techniques. Emphasis is on the effect of solidification and solidification processing on resulting microstructure. Prereq: EMSE 301.

EMSE 409. Deformation Processing (3)
Flow stress as a function of material and processing parameters; yielding criteria; stress states in elastic-plastic deformation; forming methods: forging, rolling, extrusion, drawing, stretch forming, composite forming. Prereq: EMSE 303.

EMSE 411. Environmental Effects on Materials Behavior (3)
Aqueous corrosion; principles and fundamental concepts; recognition of modes; monitoring and testing; methods to control and prediction. Appli-
cations of engineering problems: design, and economics. Mixed potential theory, principles of protection, hydrogen effects, and behavior in metal sys-
tems.

EMSE 412. Materials Science and Engineering Seminar (0)

EMSE 413. Fundamentals of Materials Engineering and Science (3)
Provides a background in materials for graduate students with under-
graduate majors in other branches of engineering and science: reviews basic bonding relations, structure, and defects in crystals. Lattice dynam-
ics; thermodynamic relations in multi-component systems; microstruc-
tural control in metals and ceramics; mechanical and chemical properties of materials as affected by structure; control of properties by techniques involving structure property relations; basic electrical, magnetic and optical properties.

EMSE 417. Properties of Materials at High Temperatures (3)
nisms. Refractory metals, superalloys, intermetallic compounds, carbon, ceramic materials. Protective coatings.

EMSE 418. Oxidation of Materials (3)
Experimental techniques; thermodynamics of oxidation reactions; de-
facts and diffusion in oxides; oxidation rate laws. Effects of alloying, sur-
face treatment and stress on oxidation. High-temperature corrosion.

EMSE 419. Phase Equilibria and Microstructures of Materials (3)
The multi-component nature of most material systems require under-
standing of phase equilibria and descriptions of microstructure. Attention will be given to phase equilibria in multi-component (ternary and higher) systems, and the stereological description of the microstructure of multiphase systems.

EMSE 420. Powder Processing (3)
Fundamental science and technology of modern metal powder processing and fabrication techniques. Includes powder synthesis, characteriza-
tion, consolidation mechanisms and practices, effects of atmosphere, dif-
sional homogenization processing, and applications of powder metal-
lurgy.

EMSE 421. Fracture of Materials (3)
Micromechanisms of deformation and fracture of engineering materials. Brittle fracture and ductile fracture mechanisms in relation to microstruc-
ture. Strength, toughness, and test techniques. Review of predictive mod-
els. Prereq: ENGR 200 and EMSE 303 or EMSE 427; or consent.

EMSE 426. Semiconductor Thin Film Science and Technology (3)
Fundamental science and technology of modern semiconductors. Thin film technologies for electronic materials. Crystal growth techniques. In-
troduction to device technology. Defect characterization and generation during processing properties of important electronic materials for device applications. Prereq: EMSE 314.

EMSE 427. Dislocations in Solids (3)
Elasticity and dislocation theory; dislocation slip systems; links and dislo-
cation motion; jogs and dislocation interactions, dislocation dissociation and stacking faults; dislocation multiplication, applications to yield phe-
nomena, work hardening and other mechanical properties. Prereq: Con-
sent of instructor.

EMSE 429. Crystallography and Crystal Chemistry (3)
Crystal symmetries, point groups, translocation symmetries, space lat-
tices, crystal classes, space groups, crystal chemistry, crystal structures and physical properties. Prereq: Consent of instructor.
EMSE 500T. Graduate Teaching II (0)
To provide teaching experience for all Ph.D.-bound graduate students. This will include preparing exams/quizzes/homework, leading recitation sessions, tutoring, providing laboratory assistance, and developing teaching aids that include both web-based and classroom materials. Graduate student will meet with supervising faculty member throughout the semester. Grading is pass/fail. Students must receive three passing grades and up to two assignments may be taken concurrently. Prereq: Ph.D. student in Materials Science and Engineering.

EMSE 502. Mechanical Properties of Metals and Composites (3)
Microstructural effects on strength and toughness of advanced metals and composites. Review of dispersion hardening and composite strengthening mechanisms. Toughening of brittle materials via composite approaches such as fiber reinforcement, ductile phases, and combinations of approaches. Prereq: ENGR 200 and EMSE 303 or EMSE 421; or consent.

EMSE 504. Thermodynamics of Solids (3)

EMSE 511. Failure Analysis (3)
Methods and procedures for determining the basic causes of failures in structures and components. Recognition of fractures and excessive deformations in terms of their nature and origin. Development and full characterization of fractures. Legal, ethical, and professional aspects of failures from service. Prereq: EMSE 201 and EMSE 303 and ENGR 200; or consent.

EMSE 512. Advanced Electron Microscopy Techniques (3)
Theory and laboratory experiments to learn advanced techniques in transmission electron microscopy; high resolution transmission electron microscopy (HREM), convergent-beam electron microscopy (CBED), and chemical analysis using energy-dispersive x-ray spectroscopy (EDXS) and electron energy-loss spectroscopy (EELS). Prereq: EMSE 515 and EMSE 516.

EMSE 514. Defects in Semiconductors (3)
Presentation of the main crystallographic defects in semiconductors: point defects (e.g., vacancies, interstitials, substitutional and interstitial impurities, line defects (e.g., dislocation), and planar defects (grain boundaries, stacking faults, heteroepitaxial interfaces). Structural, electrical and optical properties of various defects. Interpretation of the properties from the perspective of semiconductor physics and materials science and correlation of these defects to physical properties of the material. Experimental methods including TEM, EBIC, CL, DLTS, etc. Prereq: EMSE 426.

EMSE 515. Analytical Methods in Materials Science: Lecture (3)
The common advanced analytical methods used in materials science are TEM, SEM, SAM, SIMS, and ESCA. These acronyms will be defined and the theory and application of each will be explained.

EMSE 516. Analytical Methods in Materials Science/Laboratory (3)
A laboratory course designed to achieve proficiency in TEM, SEM, SIMS, SAM, ESCA, and AFM. These acronyms will be defined and the theory and application of each will be explained.

EMSE 600T. Graduate Teaching III (0)
To provide teaching experience for all Ph.D.-bound graduate students. This will include preparing exam/quizzes/homework, leading recitation sessions, tutoring, providing laboratory assistance, and developing teaching aids that include both web-based and classroom materials. Graduate student will meet with supervising faculty member throughout the semester. Grading is pass/fail. Students must receive three passing grades and up to two assignments may be taken concurrently. Prereq: Ph.D. student in Materials Science and Engineering.

EMSE 601. Independent Study (1-18)
EMSE 633. Special Topics (1-18)
EMSE 649. Special Projects (1-18)
EMSE 651. Thesis M.S. (1-18)
Required for Master’s degree. A research problem in metallurgy, ceramics, electronic materials, biomaterials or archeological and art historical materials, culminating in the writing of a thesis.

EMSE 701. Dissertation Ph.D. (1-18)
Required for Ph.D. degree. A research problem in metallurgy, ceramics, electronic materials, biomaterials or archeological and art historical materials, culminating in the writing of a thesis.

EMSE 702. Appointed Dissertation Fellow (9)

Department of Mechanical and Aerospace Engineering

418 Glennan Building (7222)
Phone 216-368-2941; Fax 216-368-6445
Joseph M. Prahl, Chair
e-mail: Prahl@mae.cwru.edu
http://sclwww.scl.cwru.edu/cse/emae/faculty/prahl/

The Department of Mechanical and Aerospace Engineering of the Case School of Engineering offers programs leading to bachelors, masters, and doctoral degrees. It administers the programs leading to the degrees of Bachelor of Science in Engineering with a major in aerospace engineering, Bachelor of Science in Engineering with a major in fluid and thermal engineering sciences and Bachelor of Science in Engineering with a major in mechanical engineering. All three curricula are based on four-year programs of preparation for productive engineering careers or further academic training. All three are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

The mission of the Department of Mechanical and Aerospace Engineering is to challenge students to reach towards positions of leadership in the professions of aerospace engineering, fluid and thermal engineering science, and mechanical engineering. The undergraduate program emphasizes fundamental engineering science, analysis and design to insure that graduates will be strong contributors in their work environment, be prepared for advanced study at top graduate schools and be proficient lifelong learners. The graduate programs emphasize advanced methods of analysis, mathematical modeling, computational and experimental techniques applied to a variety of mechanical and aerospace engineering specialties including applied mechanics, dynamic systems, robotics, biomechanics, fluid mechanics, heat transfer, propulsion and combustion. Leadership skills are developed by infusing the program with current engineering practice, design, and professionalism led by concerned educators and researchers.

The department’s research applies the principles of mechanics, thermodynamics, heat and mass transfer, and engineering design to problems in aeronautics, astronautics, biomechanics and orthopaedic engineering, biomimetics and biological inspired robotics, energy, environment, machinery dynamics, mechanics of materials, and tribology. Many of these activities involve strong collaborations with the departments of biology, electrical engineering and computer science, and orthopaedics of the School of Medicine. The department programs provide

Mastery of Fundamentals

- A strong background in the fundamentals of chemistry, physics and mathematics.
- Methods of mechanical engineering analysis, both numerical and mathematical, applied to mechanics, dynamic systems and control, thermodynamics, fluid mechanics and heat transfer.
- Methods of modern experimental engineering analysis and data acquisition.
Creativity
- Ability to identify, model, and solve mechanical and aerospace engineering design problems.
- Ability to design experiments to resolve mechanical and aerospace engineering issues.
- Ability to perform an individual senior project that demonstrates original research and/or design content.

Societal Awareness
- Issues of environmental impact, efficient use of energy and resources, benefits of recycling.
- An awareness of the multi-disciplinary nature of mechanical and aerospace engineering.
- Impact of economic, product liability and other legal issues on mechanical and aerospace engineering manufacturing and design.

**Bachelor of Science in Engineering Degree Major in Aerospace Engineering**

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Class-Lab-Credit Hours</th>
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<tr>
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<tr>
<td>CHEM 111 Properties and Structure of Matter I .................. (4-0-4)</td>
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<td>MATH 121 Calculus for Science and Engineering I ................ (4-0-4)</td>
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<tr>
<td>PHYS 121 General Physics I b ........................................ (4-0-4)</td>
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<td>ENGR 131 Elementary Computer Programming ......................... (2-2-3)</td>
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<td>PHYS 122 General Physics II b ....................................... (4-0-4)</td>
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<td>ENGR 145 Chemistry of Materials a .................................. (4-0-4)</td>
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<td>ENGL 150 Expository Writing ........................................... (3-0-3)</td>
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<td>Humanities or Social Science Sequence I .......................... (3-0-3)</td>
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<td>EMAE 172 Mechanical Manufacturing c .............................. (3-3-1)</td>
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<td>EMAE 250 Computers in Mechanical Engineering c ................ (2-2-3)</td>
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<td>Humanities or Social Science Sequence II ...................... (3-0-3)</td>
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<td>ENGR 210 Electronic Circuits a .................................... (3-2-4)</td>
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<td>PHYS 221 General Physics III ....................................... (3-0-3)</td>
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<td>MATH 224 Elementary Differential Equations ....................... (3-0-3)</td>
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<td>ENGR 225 Introduction to Fluid &amp; Thermal Engr ........................... (4-0-4)</td>
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<td>EMAE 325 Fluid and Thermal Engineering II ........................ (4-0-4)</td>
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<td>EMAE 282 Mechanical Engineering Lab I ................................ (1-3-2)</td>
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<td>ECIV 310 Strength of Materials c ................................... (3-0-3)</td>
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<td>EMAE 376 Aerostructures ............................................. (3-0-3)</td>
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<td>EMAE 381 Flight and Orbital Mechanics ............................ (3-0-3)</td>
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<td>EMAE 355 Design of Fluid and Thermal Elements ................ (3-0-3)</td>
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**Hours required for graduation: 129**

a. Engineering Core Course
b. Selected students may be invited to take PHYS 123-124, General Physics I, II-Honors (3) in place of PHYS 121-122, General Physics I, II (4).
c. May be taken fall or spring semester.
The bachelor’s candidate must complete an independent design project with an oral and written final report.

The master’s candidate must demonstrate independent research resulting in a thesis or project suitable for publication and/or presentation in peer reviewed journals and/or conferences.

The doctoral candidate must complete a rigorous independent thesis containing original research results appropriate for publication in archival journals and presentation at leading technical conferences.

Faculty

Joseph M. Prahl, Ph.D. (Harvard University), P.E.
Professor, Chair
Fluid dynamics; beat transfer; tribology.

Maurice L. Adams, Ph.D. (University of Pittsburgh)
Professor
Dynamics of rotating machinery; nonlinear dynamics; vibration; tribology; turbomachinery.

J. Iwan D. Alexander, Ph.D. (Washington State University)
Professor and Chief Scientist for Fluids
National Center for Microgravity Research for Fluids and Combustion
Fluid dynamics; beat and mass transfer, low gravity fluid dynamics, interfacial transport capillary surface equilibria and dynamics, two-phase flow in porous media, vibrational convection

R. Balasubramaniam, Ph.D. (Case Western Reserve University)
Research Associate Professor
National Center for Microgravity Research for Fluids and Combustion
Microgravity Fluid Mechanics

Dwight T. Davy, Ph.D. (University of Iowa), P.E.
Professor
Musculo-skeletal biomechanics; applied mechanics.

Isaac Greber, Ph.D. (Massachusetts Institute of Technology)
Professor
Fluid dynamics; molecular dynamics and kinetic theory; biological fluid mechanics; acoustics.

Bachelor of Science in Engineering Degree
Major inFluid and Thermal Engineering Sciences

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<th>Freshman Year</th>
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<td>CHEM 111 Properties and Structure of Matter I .............. (40-4)</td>
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<td>EMAE 282 Mechanical Engineering Lab I .......................... (1-3-2)</td>
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<td>ENGL 150 Expository Writing ...................................... (3-0-3)</td>
<td>EMAE 350 Mechanical Engineering Analysis .................... (4-0-3)</td>
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<td>ENGR 210 Electronic Circuits ..................................... (3-0-4)</td>
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<td>EMAE 359 Aero/Gas Dynamics ..................................... (4-0-3)</td>
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Hours required for graduation: 129

a. Engineering Core Course
b. Selected students may be invited to take PHYS 123-124, General Physics I, II Honors (3) in place of PHYS 121-122, General Physics I, II (4).
c. May be taken fall or spring semester.
Bachelor of Science in Engineering Degree
Major in Mechanical Engineering

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Class-Lab-Credit Hours</th>
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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>CHEM 111 Properties and Structure of Matter I</td>
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<td>ENGL 150 Expository Writing</td>
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<td>PHED 101 Physical Education Activities</td>
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<tr>
<td>MATH 122 Calculus for Science and Engr. II</td>
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<td>PHYS 122 General Physics II b</td>
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<tr>
<td>EMAE 172 Mechanical Manufacturing a</td>
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<tr>
<td>MATH 223 Calculus for Science &amp; Engineering III</td>
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<td>EMAE 181 Dynamics a</td>
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<td>MATH 224 Elementary Differential Equations</td>
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<td><strong>Hours required for graduation:</strong> 129</td>
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</table>

a. Engineering Core Course
b. Selected students may be invited to take PHYS 123-124, General Physics I, II-Honors (3) in place of PHYS 121-122, General Physics I, II (4).
c. May be taken fall or spring semester.
### Approved Technical Electives

EMAE The following list of technical electives has been established for both the Fluid and Thermal Engineering Sciences Program and the Mechanical Engineering Program. The courses must be selected to provide a minimum of two additional design credits for each program. Once the design credit minimum is met, the technical electives can be selected from the list of Approved Technical Electives for students of the Department and must be approved by the student’s adviser to insure a coherent program of courses to meet the student’s professional objectives.

### Design Electives

#### Fluid and Thermal Engineering Science Program
- EMAE 271 Kinematic Analysis & Synthesis
- EMAE 370 Design of Mechanical Elements

#### Mechanical Engineering Program
- EMAE 152 Thermodynamics II
- EMAE 356 Aerospace Design
- EMAE 359 Aero/Gas Dynamics

#### All Programs
- EMAE 372 Relation of Materials to Design
- EMAE 376 Aerostructures
- EMAE 378 Mechanics of Machinery I
- EMAE 387/487 Vibration Problems in Engr.
- EMAE 381 Flight and Orbital Mechanics
- EMAE 382 Propulsion

### Technical Electives

#### Aerospace
- EMAE 356 Aerospace Design
- EMAE 359 Aero/Gas Dynamics
- EMAE 376 Aerostructures
- EMAE 381 Flight and Orbital Mechanics
- EMAE 382 Propulsion

#### Biomechanics
- EBME 201 Physiology-Biophysics I
- EBME 202 Physiology-Biophysics II
- EBME 306 Introduction to Biomedical Materials
- EBME 509 Modeling of Biomedical Systems
- EBME 510 Principles of Biomedical Instrumentation
- EMAE 402 Muscles, Biomechanics and Control of Movement
- EMAE 415 Introduction to Musculo-skeletal Biomechanics

#### Digital Electronics and Control
- EECS 245 Electronic Circuits
- EECS 246 Circuits, Signals & Systems II
- EECS 304 Control Engr. I
- EECS 281 Logic Design and Computer Organization
- EECS 382 Microprocessor-based Design

### Dynamics and Vibration
- EMAE 378/478 Mechanics of Machinery I
- EMAE 387/487 Vibration Problems in Engineering
- EMAE 479 Mechanics of Machinery II
- EMAE 481 Advanced Dynamics I
- EMAE 484 Mechanisms and Motion Synthesis

### Fluid and Thermal Engineering
- EMAE 152 Thermodynamics II
- EMAE 359 Aero/Gas Dynamics
- EMAE 453 Advanced Fluid Dynamics I
- EMAE 460 Theory & Design of Fluid Power Machinery

### Fluid and Thermal Sciences
- EMAE 453 Advanced Fluid Dynamics I
- EMAE 454 Advanced Fluid Dynamics II
- EMAE 455 Advanced Thermodynamics
- EMAE 457 Combustion

### Mathematics and Statistics
- MATH 323 Advanced Calculus
- MATH 324 Introduction to Complex Analysis
- MATH 331 Computational Linear Algebra
- STAT 312 Statistics for Engr & Sci.
- STAT 353 Uncertainty in Engr & Sci.

### Materials
- EMSE 301 Fundamentals of Materials Processing
- EMSE 303 Mechanical Behavior of Materials
- EMSE 307 Foundry Metallurgy
- EMSE 313 Engineering Applications of Materials
- EMAE 473 Mechanical Behavior of Composite Materials
- EMAE 480 Fatigue of Materials

### Mechanical Design
- EMAE 372 Relations of Materials to Design
- EMAE 471 Design Methods
- EMAE 472 Computers, Optimization and Design

### Mechanical Manufacturing
- EMAE 290 Computer Aided Manufacturing
- EMAE 390 Advanced Manufacturing
- EEC 350 Production and Operational Systems
- EEC 360 Manufacturing and Integrated Systems
- OPMT 350 Operations Management
- OPMT 352 Design of Production Systems
- OPRE 201 Introduction to Operations Research I

### Solid Mechanics
- ECIV 220 Structural Analysis I
- ECIV 221 Structural Design I
- EMAE 372 Relation of Materials to Design
- EMAE 376 Aerostructures
- ECIV 410 Advanced Strength of Materials
- EMAE 473 Mechanical Behavior of Composite Material
- EMAE 480 Fatigue of Materials
Aerospace Engineering

Aerospace engineering has grown dramatically with the rapid development of the computer in experiments, design and numerical analysis. The wealth of scientific information developed as a result of aerospace activity forms the foundation for the aerospace engineering major.

Scientific knowledge is being developed each day for programs to develop reusable launch vehicles (RLV), the International Space Station (ISS), High Speed Transport (HST), Human Exploration and Development of Space (HEDS) and micro-electro-mechanical sensors and control systems for advanced flight. New methods of analysis and design for structural, fluid, and thermodynamic applications are required to meet these challenges.

The aerospace engineering major has been developed to address the needs of those students seeking career opportunities in the highly specialized and advancing aerospace industries.

Fluid and Thermal Engineering Sciences

The fluid and thermal engineering sciences are significant not only for modern technology but also for many phenomena related to the association of man with his environment. The importance of this field to aeronautics and astronautics is readily apparent, but it is also of critical importance to many industrial manufacturing processes, power generation and lubrication.

Physicochemical transport phenomena is a subject that has developed at the interface between physics and chemistry, and is concerned with problems raised by the effects of fluid motions on chemical and physicochemical transformations and by the effect of physicochemical factors on the motion of fluids. This subject has considerable significance to microgravity fluids and combustion processes that will be critical to sustaining life for manned space exploration and to many important industrial processes on earth such as materials processing; electrochemical processes; energy storage; pollution; oil recovery; and biological, physiologic, and geological phenomena.

The educational program in fluid and thermal engineering sciences takes cognizance of a broad scope of applications and is fundamental and comprehensive. The interdisciplinary nature of the field is continually stressed, and the subject matter is made relevant to current research and development.

Mechanical Engineering

Civilization, as we know it today, depends on the intelligent and humane use of our energy resources and machines. The mechanical engineer’s function is to apply science and technology to the design, analysis, development, manufacture, and use of machines that convert and transmit energy, and to apply energy to the completion of useful operations. The top ten choices of the millennium committee of the National Academy of Engineering, asked to select the 20 top engineering accomplishments of the 20th century, was abundant with mechanical engineering accomplishments, electrification (large scale power generation and distribution), automobiles, air travel (development of aircraft and propulsion), mechanized agriculture, and refrigeration and air conditioning.
5-Year Programs of Study

The department curriculum offers a five-year cooperative (co-op) education program and five-year combined bachelors-masters programs. Co-op weaves two 7-month industrial internships into the normal four-year program by combining a summer with either a fall or spring semester to form the 7-month industrial experiences. Students apply to participate in the middle of the sophomore year and nominally begin the internship in the spring semester of the junior year. After completing the second internship, students return to campus in the spring or fall to complete the final year of study.

Alternative to the co-op 5 year program, is the 5 year combined bachelors/masters program in which a student can, by double counting 9 credit hours, complete a bachelor of science degree in anyone of the department’s three degree programs as well as a master of science degree in mechanical and aerospace engineering with a thesis by the end of the fifth year. Application to this program is initiated in the spring of the junior year with the department’s graduate student programs office. A minimum grade point of 3.2 is required for consideration for this accelerated program.

Graduate Programs

Master of Science Program

Each M.S. candidate must complete a minimum of 27 hours of graduate-level credits. These credits can be distributed in one of two ways.

Plan A

Students electing Plan A take 18 hours of graduate-level courses and complete at least 9 credit hours of M.S. thesis research.

Plan B

Plan B is directed primarily to part-time students whose technical work in industry or government laboratories is suitable for project courses. Plan B requires completion of 27 credit hours distributed in either of two ways 21 or 24 credit hours (seven or eight courses) of approved graduate course work and 6 or 3 credit hours of project replacing the M.S. thesis.

Master of Engineering Program

The Department of Mechanical and Aerospace Engineering participates in the practice-oriented Master of Engineering program offered by the Case School of Engineering. In this program, students complete a core program consisting of five courses, and select a four-course sequence in an area of interest.

Doctor of Philosophy Program

Students wishing to pursue the doctoral degree in mechanical and aerospace engineering must successfully pass the doctoral qualifying examination consisting of both written and oral components. Qualifying exams are offered on applied mechanics, dynamics and design or fluid and thermal engineering sciences. Students can choose to take it at the beginning of fall or spring semesters. The minimum course requirements for the Ph.D. degree are as follows:

Depth Courses

All programs of study must include 6 graduate level mechanical courses in mechanical engineering or closely related engineering disciplines. Usually these courses follow a logical development of a branch of mechanics, dynamics and design or fluid and thermal engineering science determined in conjunction with the student’s thesis advisor to meet the objectives of the thesis research topic.

Breadth and Basic Science Courses

A minimum of six courses outside the department must be taken. These can be chosen from other engineering departments and the departments of mathematics and natural science. A minimum of two elective courses must be in mathematics.

Thesis research

All doctoral programs must include a minimum of 18 credit hours of thesis research, EMAE 701.

Residence and teaching requirements

All doctoral programs require a minimum of one year of full-time residence in the program of study, three semesters of teaching experience, and must meet the rules of the School of Graduate Studies and the Case School of Engineering.

Facilities

The education and research philosophy of the Department of Mechanical and Aerospace Engineering for both the undergraduate and graduate programs is based on a balanced operation of analytical, experimental, and computational activities. All three of these tools are used in a fundamental approach to the professional activities of research, development, and design. Among the major assets of the department are the experimental facilities maintained and available for the faculty, students, and staff.

The introductory undergraduate courses are taught through the Robert M. Ward ’41 Laboratory, the Reinberger Product and Process Development Laboratory, the Alden Laboratory for Numerically Controlled Machine Instruction and the General Motors Design Studio. The Ward Laboratory is modular in concept and available to the student at regularly scheduled class periods to conduct a variety of prepared experimental assignments. The lab is equipped with a variety of instruments ranging from classic analog devices to modern digital computer devices for the collection of data and the control of processes. Advanced facilities are available for more specialized experimental tasks in the various laboratories dedicated to each specific discipline. Most of these laboratories also house the research activities of the department, so students are exposed to the latest technology in their prospective professional practice. Finally, every undergraduate and graduate degree program involves a requirement, i.e., Project, Thesis or Dissertation, in which the student is exposed to a variety of facilities of the department.

The following is a listing of the major laboratory facilities used for the advanced courses and research of the department.

Biorobotics Laboratory Facilities

The Biorobotics Laboratory (http://biorobots.cwru.edu/) consists of approximately 1080 square feet of laboratory and 460 square feet of office space. The lab includes two CNC machines for fabrication of smaller robot components. The lab’s relationship with CAISR (Center for Automation and Intelligent Systems Research) provides access to a fully equipped machine shop where larger components are fabricated. The laboratory hardware features several biologically inspired hexapod robots including two cockroach-like robots, Robot III and Robot IV. Both are based on the Blaberus cockroach and have 24 actuated revolute joints. They are a 17 times larger than the insect (30 inches long). Robot IV is actuated with pneumatic artificial muscles. A compressed air facility has been installed to operate the robots. In addition, the lab contains structural dynamic testing equipment (sensors, DAQ boards, shakers) and an automated treadmill (5 feet by 6 feet) for
developing walking robots. The Biorobotics Laboratory contains 20 PCs, and a dedicated LAN connected to the campus. Algor Finite Element Analysis software, Mechanical Desktop, and Pro/Engineer are installed for mechanical design and structural analysis. Also, the lab has developed dynamic simulation software for analyzing walking animals and designing walking robots.

Combustion Diagnostics Laboratory

The combustion diagnostics laboratory is directed towards the experimental and computational investigation of combustion and propulsion phenomena to gain insights into efficient and environment-friendly combustion. Research activities are conducted via state-of-the-art non-intrusive laser-based diagnostic techniques, computational with detailed chemistry and transport, and mathematical analysis of flame structure and dynamics, with strong coupling between the individual components. The laboratory is equipped to conduct laser diagnostics measurements, including Spontaneous Raman Spectroscopy, Planar Laser Induced Fluorescence, Raleigh Scattering, Coherent Anti-Stoke Raman Spectroscopy, and Particle Imaging Velocimetry. Current projects include laser diagnostics of reacting and non-reacting flows, aerodynamics and chemical structure of flames, ignition and flame stabilization in supersonic flows, development of reduced chemistry, soot and NOx formation, microgravity combustion, emission reduction in internal combustion engines, and advanced propulsion systems.

Laser Flow Diagnostics Laboratory

A laser diagnostics laboratory is directed toward investigation of complex two-phase flow fields involved in energy-related areas, fluid mechanics of the heart, and slurry flow in pumps and spray characterization. The laboratory is equipped with state of the art Particle Image Velocimetry (PIV) equipment, phase Doppler and laser Doppler anemometers and modern data acquisition and analysis equipment including PCs. The laboratory houses a pulsatile flow loop simulating flow through the heart, a clear centrifugal slurry flow pump loop, and a particle laden jet facility simulating flow in fossil fuel flue gas flow conditions. Current research projects include investigation of flow through heart valves, development of simultaneous particle/droplet size and velocity measurement technique using PIV, development of innovative nozzles for sorbent laden flows for removal of toxins from flue gas, solid-slurry flow through centrifugal pump impellers.

The National Center for Microgravity Research on Fluids and Combustion

The mission of the National Center for Microgravity Research on Fluids and Combustion is to lead a national effort to increase both the number and quality of microgravity researchers. The Center will perform the critical-path research in microgravity fluids and combustion sciences necessary to support the long-term human presence, development and exploration of space as well as to enhance life on Earth by applying the resultant advances in human knowledge and technology acquired through experimentation in the space environment. The Center is dedicated to research in fluid mechanics, heat transfer and combustion in microgravity, such as that found on Shuttle flights, the International Space Station, and long-duration space flight. This activity is directed toward a fundamental understanding of thermocapillary flow, double-diffusive convection, convection in the float-zone crystal growth process, various types of combustion phenomena and spacecraft fire safety.

Mechanics of Materials Experimental Facility

The major instructional as well as research facility for experimental methods in mechanics of materials is the Daniel K. Wright, Jr. Laboratory. Presently, the facility houses a single-stage gas-gun along with tension/compression split Hopkinson bar and torsional Kolsky bar apparatus for carrying out fundamental studies in dynamic deformation and failure of advanced material systems. Hewlett Packard and Tektronix high speed, wide bandwidth digitizing oscilloscopes along with strain-gage conditioners and amplifiers are available for data recording and processing. The facility houses state-of-the-art laser interferometry equipment for measuring spatial and temporal measurements of deformation. High speed Hg-Cd-Te detector arrays are available for making time-resolved multi-point non-contact temperature measurements.

A Schenck Pegasus digital servo-controlled hydraulic testing system with a 20Kip Universal testing load frame equipped with hydraulic grips and instrumentation is available for quasi-static mechanical testing under load or displacement control. A newly developed moiré microscope is available for studying large-scale inelastic deformation processes on micron size scales. CCD camera along with the appropriate hardware/software for image-acquisition, processing and analyzing of full field experimental data from optical interferometers such as moiré microscope, photo-elasticity, and other laser based spatial interferometers are available.

Rotating Machinery Dynamics and Tribology Laboratory

This laboratory focuses on rotating machinery monitoring and diagnostic methods relating chaos content of dynamic nonlinearity and model-based observers’ statistical measures to wear and impending failure modes. A double-spool-shaft rotor dynamics test rig provides independent control over spin speed and frequency of an adjustable magnitude circular rotor vibration orbit for bearing and seal rotor-dynamic characterizations.

Simultaneous radial and axial time-varying loads on any type of bearing can be applied on a second test rig. Real time control of rotor-mass unbalance at two locations on the rotor while it is spinning up to 10,000 rpm, simultaneous with rotor rubbing and shaft crack propagation, can be tested on a third rig. Self-excited instability rotovibrations can be investigated on a fourth test rig.

Musculoskeletal Mechanics and Materials Laboratories

These laboratories are a collaborative effort between the Mechanical and Aerospace Engineering Department of the Case School of Engineering and the Department of Orthopaedics of the School of Medicine. The program has its origins in the pioneering research in musculoskeletal biomechanics of Dr. Victor Frankel and Dr. Albert Burstein, who began their research activities at the University in the 1960’s. Research activities have ranged from basic studies of mechanics of skeletal tissues and skeletal structures, experimental investigation of prosthetic joints and implants, measurement of musculoskeletal motion and forces, and theoretical modeling of mechanics of musculoskeletal systems. Many studies are collaborative, combining the forces of engineering, biology, biochemistry, and surgery. The Biomechanics Test labs include Instron mechanical test machines with simultaneous axial and torsional loading capabilities, a non-contacting video extensometer for evaluation of biological materials and engineering polymers used in joint replacements, acoustic emission hardware and software, and specialized test apparatus for analysis of joint kinematics. An Orthopaedic Implant Retrieval Analysis lab has resources for characterization and analysis of hard tissues and engineering polymers, as well as resources to maintain a growing collection of retrieved total hip and total knee replacements that are available for the study of implant design. There are also a Soft Tissue-testing lab with several standard and special test machines,
an Instrumentation Laboratory, and a Biomechanical Computations and Design lab.

CWRU Low Speed Research Wind Tunnel

The CWRU Low Speed Research Wind Tunnel has completed a major rebuilding effort during which flow quality, instrumentation, operability, flexibility, and noise and vibration levels, have been significantly improved. The tunnel provides very low freestream turbulence levels, making it suitable for highly sensitive boundary-layer stability experiments that require excellent flow quality. The tunnel is completely modular, allowing a variety of different experimental configurations to be realized, greatly extending the tunnel’s functionality.

The tunnel, originally constructed in the late 1940’s, has undergone a rebuilding effort with the construction of a new test section, the replacement of the entire upstream half of the wind tunnel, the rebuild of the drive section, and installation of a new drive motor and motor controller. The new upstream portion provides the incoming flow treatment necessary to produce a low freestream turbulence level. The improved drive section and motor increase the tunnel’s maximum speed while reducing noise and vibration levels. With these improvements, the tunnel now supports research of the highest quality.

Other Experimental Facilities

The department facilities also include several specialized laboratories

• The GM Engines Laboratory is a modern facility for measuring the dynamic performance of internal combustion engines while monitoring behavioral parameters such as pressures, temperatures and exhaust emissions. The test cells can be operated completely by remote control with all data collected by digital computers.

• The Structural Dynamics Laboratory was developed with a grant from NSF and includes facilities for performing vibration and modal testing. This equipment includes laser vibrometers, accelerometers, electrodynamic shakers, computers and data acquisition systems.

• In association with the Department of Electrical Engineering and Computer Science we have agile manufacturing facilities including flexible parts feeders of our design.

• Well-equipped, manned central shops and instrument rooms are available, as well as a controlled-environment room for experiments requiring extreme precision.

Graphical and Computational Facilities

The Computer-Aided Engineering Laboratory (CAEL) includes 18 Dell 500MHz Pentium III computers attached to a Dell dual 500 MHz Pentium III server, running Windows NT 4.0, via local area network running at 100 Mb/s. The CAEL provides access to a number of software packages. Some of these include Pro/Engineer, Release 2000i; Visual Fortran, Release 6.0; AutoCAD, Release 13; Matlab, Release 5.3; and Microsoft Office 2000 Professional. All of the laboratory’s computers are directly linked to the campus network giving students access to a large variety of software on different libraries across campus. The lab is open for student use 7 days a week from 600 a.m. through midnight via card access.

The General Motors Design Studio includes 13 Dell 400MHz Pentium II workstations and 6 Net Power 233MHz Pentium II workstations. These machines are connected via local network to a Dell Dual 333MHz Pentium II server running Windows NT 4.0. The GM Lab is tied directly to the campus network allowing information to be shared with the CAEL. The GM Design Studio is used for instruction on Pro/Engineer CAD/CAM software, and offers a Rapid Prototyping Machine for creating wax models from Pro/Engineer models.

Supercomputing

The department has recently been awarded an 8-node, 32-processor Beowulf-class computing cluster by the Ohio Supercomputer Center. The cluster features libraries, compilers, and debuggers specifically designed for computationally intensive numerical simulations and parallel-code development. Extensive data visualization tools are also available on the cluster. The department also has access to all NSF supercomputing centers, primarily the Pittsburgh and Ohio Supercomputing Centers. Research projects carried on in cooperation with NASA Glenn Research Center can have access to NASA computing facilities.

Research

The research in the department encompasses many areas of modern technology. Among them are:

Aerospace Technology and Transportation

Aerospace mechanics, aircraft aerodynamics (subsonic, supersonic and hypersonic), stability and transition of boundary layers and free shear layers, flow in turbomachinery, molecular dynamics simulation of rarefied gas flow, two phase flow, supersonic combustion and control of internal combustion engines.

Combustion

Flame spread, microgravity combustion, fire research, chemical kinetic models and pollutant formation.

Dynamics of Rotating Machinery

Forced and instability vibration of rotor/bearing/seal systems, nonlinear rotor dynamics, torsional rotor vibration, rotor dynamic characteristics of bearings and seals (computational and experimental approach), control of rotor system dynamics, rub-impact studies on bearings and compressor/turbine blading systems. Advanced rotating machinery monitoring and diagnostics.

Engineering Design

Optimization and computer-aided design, feasibility studies of kinematic mechanisms, kinematics of rolling element-bearing geometries, mechanical control systems, experimental stress analysis, failure analysis, development of biologically inspired methodologies.

Manufacturing

Agile manufacturing work cells developed to facilitate quick change over from assembly of one object to assembly of other objects contains multiple robots, a conveyor system and flexible parts feeders.

Materials

Development of novel experimental techniques to investigate material response at elevated temperatures and high rates of deformation. Constitutive modeling of damage evolution, shear localization and failure of advanced engineering materials. Fabrication of mechanical properties of composite materials; creep, rupture, and fatigue properties of engineering materials at elevated temperatures.

Microgravity Research

Gravitational effects on transport phenomena, fluids and thermal processes in advance life support systems for long duration space travel, interfacial processes, g-jitter effects on microgravity flows, two phase flow in zero and reduced gravity. Combustion phenomena in microgravity, spacecraft fire safety.
Multiphase Flow Research


Orthopaedic Engineering

Kinematics and mechanical joint dynamics of the knee, hip, ankle, and spine; dynamic stability of the human spine; neuromuscular control; mechanics of injuries; gait analysis; design and failure analysis of medical prostheses and material selection; biomechanical measurements, tools and instrumentation; mechanical properties of bone and soft tissue.

Robotics

Biologically inspired and biologically based design and control of legged robots. Dynamics, control and simulation of animals and robots.

Tribology

Time-resolved friction on nano- and microsecond time scale with applications to high speed machining and mechanics of armor penetration. Study of gas lubricated foil bearing systems and magnetic bearing systems with application to oil-free turbomachinery. Retainerless bearings for space applications such as long duration instrument and guidance systems and momentum wheels.

Turbomachinery

Vibration characteristics of seals and bearings and measurement of chaotic motion. Rub impact studies of blade tip/casing interactions, particle-blade/casing interactions in centrifugal pumps.

Mechanical and Aerospace Engineering (EMAE)

Undergraduate Courses

EMAE C100. Co-Op Seminar I for Mechanical Engineering (1)
Professional development activities for students returning from co-operative education assignments. Prereq: COOP 001.

EMAE C200. Co-Op Seminar II for Mechanical Engineering (2)
Professional development activities for students returning from co-operative education assignments. Prereq: COOP 002 and EMAE C100.

EMAE 152. Thermodynamics I (3)
Thermodynamic properties of liquids, vapors and real gases, non-reactive mixtures, psychrometrics and reactive systems; combustion; thermodynamic cycles. Prereq: ENGR 225.

EMAE 170. Introduction to Mechanical Engineering (3)
Introduces beginning engineering student to how things work through an insightful overview of mechanical and aerospace engineering. Focus is on automobiles, airplanes and flight mechanics, turbomachinery and electric power generation, manufacturing methods, heating and air conditioning, rockets and space flight mechanics. Relevance of math, science and engineering fundamentals to well-founded B.S. engineering programs.

EMAE 172. Mechanical Manufacturing (4)
The course is taught in two sections (Graphics and Manufacturing Processes) through a series of lectures, laboratory sessions and weekly engineering workshop classes. The course aim is to provide a solid manufacturing engineering foundation. The course includes: manual and computer-aided drafting and design (CAD), primary and secondary engineering processes, engineering materials and a field trip to a local company. Laboratory sessions will provide hands-on experience using Pro/ENGINEER CAD software.

EMAE 181. Dynamics (3)
Elements of classical dynamics: particle kinematics and dynamics, including concepts of force, mass, acceleration, work, energy, impulse, momentum. Kinetics of systems of particles and of rigid bodies, including concepts of mass center, momentum, mass moment of inertia, dynamic equilibrium. Elementary vibrations. Prereq: MATH 122 and PHYS 121. ENGR 200 recommended.

EMAE 250. Computers in Mechanical Engineering (3)

EMAE 271. Kinematic Analysis and Synthesis (3)
Graphical, analytical, and computer techniques for analyzing displacement, velocities, and accelerations in mechanisms. Analysis and synthesis of linkages, cams, and gears. Laboratory projects include analysis, design, construction, and evaluation of students’ mechanisms. Prereq: EMAE 181.

EMAE 282. Mechanical Engineering Laboratory I (2)
Techniques and devices used for experimental work in mechanical engineering and fluid and thermal science. Lectures on topics in the theory of experimentation. Laboratory includes typical experiments, measurements, analysis, and report writing. Prereq: EMAE 181 and ENGR 225.

EMAE 283. Mechanical Engineering Laboratory II (2)
Application of techniques developed in EMAE 282 to solution of individual semester-long experimental projects, including complete report on results. Prereq: EMAE 282.

EMAE 290. Computer-Aided Manufacturing (3)
A manufacturing engineering course covering a wide range of topics associated with the application of computers to the product design and manufacturing process. Topics include: Computer-aided design (CAD) using Pro/ENGINEER software, design methodology, the design/manufacturing interface, introduction to computer numerical control (CNC), manual part-programming for CNC milling and CNC turning machine tools. Significant time will be spent in both CAD and CNC laboratories. Prereq: EMAE 172.

EMAE 325. Fluid and Thermal Engineering II (4)
The continuation of the development of the fundamental fluid and thermal engineering principles introduced in ENGR 225. Introduction to Fluid and Thermal Engineering. Applications to heat engines and refrigeration, chemical equilibrium, mass transport across semi-permeable membranes, mixtures and air conditioning, developing external and internal flows, boundary layer theory, hydrodynamic lubrication, the role of diffusion and convection in heat and mass transfer, radiative heat transfer and heat exchangers. Prereq: ENGR 225.

EMAE 350. Mechanical Engineering Analysis (3)

EMAE 355. Design of Fluid and Thermal Elements (3)

EMAE 356. Aerospace Design (3)
Interactive and interdisciplinary activities in areas of fluid mechanics, heat transfer, solid mechanics, thermodynamics, and systems analysis approach in design of aerospace vehicles. Projects involve developing (or improving) design of aerospace vehicles of current interest (e.g., hypersonic aircraft) starting from mission requirements to researching developments in relevant areas and using them to obtain conceptual design. Senior standing required.

EMAE 359. Aero/Gas Dynamics (3)
EMAE 360. Engineering Design (3)
The various elements of design: formulation, conceptualization, selection, and evaluation for the initiation of new designs and the modification of existing designs. Various design methodologies including optimization methods, search techniques, constrained gradient methods, penalty functions, statistical design methods, risk analysis, probabilities of failure, and computer applications. Prereq: EMAE 310.

EMAE 370. Design of Mechanical Elements (3)

EMAE 372. Relation of Materials to Design (4)
The design of mechanical and structural elements considering static failure, elastic stability, residual stresses, stress concentration, impact, fatigue, creep and environmental conditions on the mechanical behavior of engineering materials. Rational approaches to materials selection for new and existing designs of structures. Laboratory experiments coordinated with the classroom lectures. Prereq: ECIV 310.

EMAE 376. Aerostructures (3)

EMAE 379. Mechanics of Machinery II (3)
The focus of this course is Rotating Machinery Vibration, and it is comprised of four major components: 1) modeling, 2) analyses, 3) measurement techniques, and 4) physical insights into rotor vibration phenomena. Prereq: EMAE 181.

EMAE 381. Flight and Orbital Mechanics (3)
Aircraft performance: take-off and landing, unaccelerated flight, range and endurance, flight trajectories, static stability and control, simple maneuvers. Orbital mechanics: the solar system, elements of celestial mechanics, orbit transfer under impulsive thrust, continuous thrust, orbit transfer, decay of orbits due to drag, elements of lift-off and re-entry. Prereq: ENGR 225. EMAE 359 suggested.

EMAE 382. Propulsion (3)

EMAE 387. Vibration Problems in Engineering (4)

EMAE 390. Computer-Integrated Manufacturing (3)
The course is taught through a series of lectures, class discussions, group projects, and laboratory sessions. The course aim is to provide a solid understanding of the many aspects of the engineering processes and systems associated with the integration of product design through to manufacture. Laboratory sessions will provide hands-on experience using a number of Pro/ENGINEER modules to become aware of the integration of manufacturing issues. Prereq: EMAE 290.

EMAE 396. Special Topics in Mechanical and Aerospace Engineering I (1-18)
(Credit as arranged.) Prereq: Consent of instructor.

EMAE 397. Special Topics in Mechanical and Aerospace Engineering II (1-18)
(Credit as arranged.) Prereq: Consent of instructor.

EMAE 398. Senior Project I (3)
Individual or team design or experimental project under faculty supervision. Prereq: Senior standing, EMAE 360, and consent of instructor.

EMAE 399. Senior Project II (3)
Continuation of EMAE 398.

Graduate Studies

EMAE 400T. Graduate Teaching I (0)
This course will engage the Ph.D. candidate in a variety of teaching experiences that will include direct contact (for example, teaching recitations and laboratories, guest lectures, office hours) as well non-contact preparation (exams, quizzes, demonstrations) and grading activities. The teaching experiences will be conducted under the supervision of the faculty member(s) responsible for coordinating student teaching activities. All Ph.D. candidates enrolled in this course sequence will be expected to perform direct contact teaching at some point in the sequence. Prereq: Ph.D. student in Mechanical Engineering.

EMAE 401. Mechanics of Continuous Media (3)
Vector and tensor calculus. Stress and traction, finite strain and deformation tensors. Kinematics of continuous media, general conservation and balance laws. Material symmetry groups and observer transformation. Constitutive relations with applications to solid and fluid mechanics problems.

EMAE 402. Muscles, Biomechanics, and Control of Movement (4)

EMAE 403. Aerophysics (3)
The course introduces the physical and chemical topics of basic importance in modern fluid mechanics, plasma dynamics, and combustion sciences: statistical calculations of thermodynamic properties of gases, quantum mechanical analysis of atomic and molecular structure; transport phenomena; propagation, emission, and absorption of radiation; chemical and physical equilibria; adiabatic flame temperatures of complex reacting systems; and reaction kinetics.

EMAE 404. Molecular Gasdynamics (3)
This course first discusses the basic kinetic theory model of a gas, including the essential physical ideas and some of the important fundamental results (equilibrium state, entropy, transport coefficients). The major emphasis of the course is on computer simulation methods, especially molecular dynamics and Monte-Carlo methods. A variety of applications is discussed, including basic fluid flows, low earth orbit flight, gas-surface interaction, and nanoscale devices.

EMAE 415. Introduction to Musculo-skeletal Biomechanics (3)

EMAE 453. Advanced Fluid Dynamics I (3)
Derivation and discussion of the general equations for conservation of mass, momentum, and energy using tensors. Several exact solutions of the incompressible Newtonian viscous equations. Kinematics and dynamics of inviscid, incompressible flow including free streamline theory developed using vector, complex variable, and numerical techniques.

EMAE 454. Advanced Fluid Dynamics II (3)
EMAE 455. Advanced Thermodynamics (3)
Basic ideas of thermodynamics and dominant methods of their development: operational, postulational, and statistical. Entropy and information theory. Irreversible thermodynamics. Applications.

EMAE 457. Combustion (3)
Chemical kinetics and thermodynamics; governing conservation equations for chemically reacting flows; laminar premixed and diffusion flames; turbulent flames; ignition; extinction and flame stabilization; detonation; liquid droplet and solid particle combustion; flame spread, combustion-generated air pollution; applications of combustion processes to engines, rockets, and fire research.

EMAE 458. Propulsion (3)
Energy sources of propulsion. Momentum theorems and performance criteria. Air breathing systems and their components; chemical rockets—liquid and solid propellant; nuclear rockets—solid core, liquid core and gaseous core; rocket heat transfer and heat protection; electric propulsion—electrothermal, electrostatic and plasma thrusters; thermonuclear propulsion. Prereq: Consent of instructor.

EMAE 459. Advanced Heat Transfer (3)
Analysis of engineering heat transfer from first principles including conduction, convection, radiation, and combined heat and mass transfer. Examples of significance and role of analytic solutions, approximate methods (including integral methods) and numerical methods in the solution of heat transfer problems. Prereq: EMAE 453.

EMAE 460. Theory and Design of Fluid Power Machinery (3)
Fluid mechanic and thermal aspects of the design of fluid power machinery such as axial and radial flow turbomachinery, positive displacement devices and their component characterizations. Prereq: Consent of instructor.

EMAE 471. Design Methods (3)
An advanced course on design methodologies. Conceptualization, preliminary design, detail design, and manufacturing. Failure analysis, materials selection, methods of design optimization, and current approaches in computer-aided design. Prereq: EMAE 360.

EMAE 472. Computers, Optimization, and Design (3)

EMAE 473. Mechanical Behavior of Composite Materials (3)
Mechanical properties, static and dynamic characteristics, stress analysis methods, design properties, manufacturing methods, mechanical testing and design considerations. Prereq: ECIV 310.

EMAE 478. Mechanics of Machinery I (3)
(See EMAE 378.)

EMAE 479. Mechanics of Machinery II (3)
A comprehensive treatment of design analysis methods and computational tools for machine components. Emphasis is on vibration and machinery dynamics.

EMAE 480. Fatigue of Materials (3)

EMAE 481. Advanced Dynamics I (3)

EMAE 484. Mechanism and Motion Equations (3)

EMAE 486. Stress Waves in Solids (3)

EMAE 487. Vibration Problems in Engineering (3)

EMAE 489. Robotics I (3)

EMAE 490. World Class Manufacturing (3)
The course is taught through a series of lectures, class discussions, and group projects. The course aim is to provide a solid understanding of the changing technologies and management strategies for companies to maintain competitive advantage in an increasingly global market. Issues such as 'Order Winning Criteria,' 'Lean Manufacturing,' and 'Cellular Manufacturing' will be reviewed and guest speakers will be invited to give an industrial perspective on specific topics of the course. Prereq: EMAE 290, EMAE 390 or permission of instructor.

EMAE 500T. Graduate Teaching II (0)
This course will engage the Ph.D. candidate in a variety of teaching experiences that will include direct contact (for example, teaching, recitations and laboratories, guest lectures, office hours) as well non-contact preparation (exams, quizzes, demonstration) and grading activities. The teaching experience will be conducted under the supervision of the faculty member(s) responsible for coordinating student teaching activities. All Ph.D. candidates enrolled in this course sequence will be expected to perform direct contact teaching at some point in the sequence. Prereq: Ph.D. student in Mechanical Engineering.

EMAE 540. Advanced Dynamics II (3)

EMAE 541. Dynamics of Nonlinear Systems (3)
Nonlinear oscillations; including equations of Duffings, van der Pol, Hill, and Mathieu; and perturbation solution approaches. Bifurcation theory and jump phenomena. Strange attractors, chaos, poineare maps, and related engineering applications.

EMAE 550. Neuromechanics Seminar (0)
(See EBME 550.) Cross-listed as EBME 550.

EMAE 552. Viscous Flow Theory (3)
Compressible boundary layer theory. Blowing and suction effects. Three-dimensional flows; unsteady flows. Introduction to real gas effects. Prereq: EMAE 454.

EMAE 554. Turbulent Fluid Motion (3)

EMAE 556. Variational Methods in Applied Mechanics (3)
Variational and energy principles in dynamics, structures and mechanics of continua. Calculus of variations, principle of virtual work, energy principles and generalization, statics of deformable bodies, dynamics, development of variational principles in fluid mechanics, direct solution methods. Prereq: Consent of instructor.

EMAE 557. Convection Heat Transfer (3)
Energy equation of viscous fluids. Dimensional analysis. Forced convection; heat transfer from non-isothermal and unsteady boundaries, free
convection and combined free and forced convection; stability of free convection flow; thermal instabilities. Real gas effects, combined heat and mass transfer; ablation, condensation, boiling. Prereq: EMAE 453 and EMAE 454.

**EMAE 558. Conduction and Radiation (3)**
Fundamental law, initial and boundary conditions, basic equations for isotropic and anisotropic media, related physical problems, steady and transient temperature distributions in solid structures. Analytical, graphical, numerical, and experimental methods for constant and variable material properties. Prereq: Consent of instructor.

**EMAE 570. Computational Fluid Dynamics (3)**

**EMAE 587. Experimental Stress Analysis (3)**

**EMAE 600T. Graduate Teaching III (0)**
This course will engage the Ph.D. candidate in a variety of teaching experiences that will include direct (for example, teaching recitations and laboratories, guest lectures, office hours) as well non-contact preparation (exams, quizzes, demonstrations) and grading activities. The teaching experience will be conducted under the supervision of the faculty member(s) responsible for coordinating student teaching activities. All Ph.D. candidates enrolled in this course sequence will be expected to perform direct contact teaching at some point in the sequence. Prereq: Ph.D. student in Mechanical Engineering.

**EMAE 601. Independent Study (1-18)**
**EMAE 651. Thesis M.S. (1-18)**
**EMAE 655. Theories of Hydrodynamic Stability (3)**
Stability of parallel flows: general development with application to channel flows and boundary layer flows; magnetohydrodynamic parallel flows; rotating Couette flow; superposed fluids; thermal instability of fluids heated from below; non-linear considerations. Prereq: EMAE 454.

**EMAE 657. Experimental Techniques in Fluid and Thermal Engineering Sciences (3)**
Exposure to experimental problems and techniques provided by the planning, design, execution, and evaluation of an original project. Lectures: review of the measuring techniques for flow, pressure, temperature, etc.; statistical analysis of data; information theory concepts of instrumentation; electrical measurements and sensing devices; and the use of digital computer for data acquisition and reduction. Graduate standing or consent of instructor required.

**EMAE 689. Special Topics (1-18)**
**EMAE 701. Dissertation Ph.D. (1-18)**
**EMAE 702. Appointed Dissertation Fellow (9)**
The College of Arts and Sciences houses educational and research programs in the arts, humanities, social sciences, physical and biological sciences, and mathematics. Formed in 1993, the college traces its origins to a number of predecessor units including Adelbert College, Flora Stone Mather College, Cleveland College, Western Reserve College, and several programs of Case Institute of Technology. It offers undergraduate major and/or minor programs in approximately 57 fields, provides undergraduates with opportunities to follow individually designed programs of study, and to pursue integrated undergraduate and masters-level degree programs in a number of fields. The college is also responsible for a significant portion of the educational experiences of undergraduates in the Case School of Engineering, the Weatherhead School of Management, and the Frances Payne Bolton School of Nursing. The college offers graduate programs in a number of fields in which the University’s size and special expertise allow it to make a distinctive contribution to advanced education and research.

Educational experiences in the college are distinctive for their abundance of curricular offerings in which students interact with the cultural institutions of University Circle. These include the Cleveland Museum of Art, the Cleveland Orchestra, the Cleveland Museum of Natural History, the Cleveland Institute of Music, the Western Reserve Historical Society, the Children’s Museum, the Cleveland Institute of Art, and the Cleveland Playhouse, most of which are in close walking distance.

Undergraduate education is characterized by a set of general educational experiences and in-depth study of one or more major fields. Additional study in a minor field is encouraged. The general educational curriculum is designed to foster communication abilities, critical thinking skills, an appreciation of cultural history, richness and diversity, and an understanding of experimental and theoretical approaches to scientific knowledge and to the understanding of human culture and behavior. Beginning in Fall 2002, some entering freshmen will have the opportunity to participate in the pilot phase of a new general education curriculum, SAGES (Seminar Approach to General Education and Scholarship). This curriculum is organized around a series of four small seminars taken in the freshman and sophomore years (designed to foster the abilities noted above as well as information literacy, quantitative reasoning, and ethical decision-making), a distribution requirement to encourage breadth of knowledge and interests, and a senior capstone experience.

The college is organized into 21 academic departments and many interdisciplinary programs and centers. These include Childhood Studies, International Studies, Evolutionary Biology, History and Philosophy of Science, and Women’s Studies. Undergraduates as well as graduate students are encouraged to engage in independent research in their chosen fields of study, or in related fields within the college, other units of the university, or in nearby medical and cultural institutions. The college offers ample opportunities for students to participate in musical, theater, and dance performances. Academic programs of the College of Arts and Sciences extend into the community in the form of service-learning projects, and student practica and internships in research institutions, businesses, cultural institutions, and governmental agencies.

In addition to formal curricula, the college offers many arts presentations, lecture series, and symposia, both within academic departments and through its Office of Interdisciplinary Programs and Centers.

### Interdisciplinary Centers

#### Baker-Nord Center for the Humanities
Thomas G. Bishop, Director
Timothy K. Beal, Associate Director
[www.cwru.edu/artsci/bakernord/](http://www.cwru.edu/artsci/bakernord/)

The Baker-Nord Center for the Humanities was founded in 1996 by an endowment gift from Eric and Jane Nord. The center facilitates and encourages collaborative work among faculty and students in the humanities and performing arts disciplines. It sponsors, often with other University Circle institutions, conferences, seminars, lectures, research, and special events that enhance the presence and visibility of the humanities at Case Western Reserve.

#### Center for Science and Mathematics Education

The Center for Science and Mathematics Education was established in 1998 to serve as a clearinghouse for the preK-12 education outreach programs in the College and to provide a local base for the national JASON Project, an annual expedition-based science and technology curriculum for middle and high school students. The role of the Center has grown and it now also serves as the administrative home for the Northeast Ohio Regional Science Olympiad and supports more than 75 events, competitions, and professional development courses throughout the University. The Center serves as a single point of access to these and other resources at the University and acts as a catalyst in the development of new programs.

#### College Scholars Program
Jonathan Sadowsky, Director
[www.cwru.edu/artsci/scholars/](http://www.cwru.edu/artsci/scholars/)

The College Scholars Program, instituted in 1997, is a three-year academic enhancement program open to undergraduates interested in forming a community of learners dedicated both to excellence in individual intellectual pursuits and applying classroom learning to larger world concerns. The program emphasizes broad interdisciplinary learning beyond the requirements of professional or disciplinary competence, connection of academic learning to the larger society, and development of a sense of the relationship between service and leadership. The scholars collaborate with faculty in the design, operation, and evaluation of the curriculum. The program takes up the equivalent of one course for each of six semesters.

#### Samuel Rosenthal Center for Judaic Studies
Peter Haas, Director
[www.cwru.edu/artsci/rosenthal/](http://www.cwru.edu/artsci/rosenthal/)

The Samuel Rosenthal Center for Judaic Studies, funded by a gift from the Samuel Rosenthal Foundation, was established in 1996 to broaden the scope of the University’s Jewish Studies curriculum and to strengthen interest in Judaic Studies on campus and throughout the local, national, and international communities. To this end, the center supports a variety of initiatives, including visiting professorships, guest lectures, student scholarships and
American Studies

206 Mather House
Phone 216-368-5413
Renee Sentilles, Director

American studies is an interdisciplinary program governed by an interdepartmental steering committee and taught by an associated faculty from throughout the university. It is available as a secondary undergraduate major that takes an interdisciplinary approach to the study of United States history and culture. This approach combines American studies courses - which emphasize connections among the economic, intellectual, social, and political facets of culture - with offerings from various traditional academic departments. Because of the diversity of choices such a major allows, each student devises an individualized program of study under supervision of the program director.

Graduates majoring in American studies have pursued careers in law, business, social work, journalism, teaching, historic preservation, public health, and government.

American Studies Steering Committee
Renee Sentilles, Ph. D. (The College of William and Mary)
Assistant Professor of History and Program Director

Henry Adams, Ph.D. (Yale University)
Professor of American Art; Curator of American Art, Cleveland Museum of Art
American Art of the 19th century

Thomas Csordas, Ph.D. (Duke University)
Professor
Psychological anthropology; medical anthropology; comparative religion; anthropological theory; language and culture; American Indian culture; University States

Frances E. Lee, Ph.D. (Vanderbilt University)
Assistant Professor
American government, Congress, legislative policy-making

Colin McLarty, Ph.D. (Case Western Reserve University)
Associate Professor and Chair of Department of Philosophy
Logic; philosophy of logic; philosophy of mathematics; philosophy of science; contemporary French philosophy

Undergraduate Programs

Major (30 hours)
American studies comprises the study of American cultures and the study of interdisciplinary methods and models. Students are introduced to and learn the skills of analyzing, conceptualizing, and synthesizing cultural phenomena in more than one discipline. Students are encouraged to seek linkages between disciplines in imaginative ways, making use of the offerings of the entire university. The disciplines listed below traditionally contribute to the study of American cultures, but are not the only ones. The major is a secondary major only and requires students to have declared their first major prior to selecting American Studies as their secondary concentration.

The undergraduate major is required to take AMST 117 (Introduction to American Studies). In addition, students are to choose 27 hours from the courses listed below, making certain that these represent at least two disciplines, though no more than four; or courses may constitute at least two but no more than three areas of concentration. Areas of concentration may consist of courses from more than one department and may center on an issue or theme in American cultures. Students will be advised by the director of American Studies.

Minor (15 hours)
A minor consists of five courses, one of which is AMST 117.

Sequence
AMST 117

Suggested Undergraduate Courses
ANTH 314; ANTH 357; ANTH 389; ARTH 270; ARTH 386; ECON 255; ENGL 356; ENGL 357; ENGL 358; ENGL 359; ENGL 360; ENGL 363H; ENGL 365; ENGL 366; HSTY 125; HSTY 253; HSTY 256; HSTY 257; HSTY 260; HSTY 261; HSTY 262; HSTY 266; PHIL 303; PHIL 390; POSC 308; POSC 310; POSC 315; POSC 321; POSC 327; POSC 343; RLGN 206; RLGN 341; SOCI 302; SOCI 349; SOCI 369; THTR 326; THTR 327

Other departments may offer appropriate courses and students may, with the consent of the director, select offerings not listed.

American Studies (AMST)

Undergraduate Courses

AMST 117. Introduction to American Studies (3)
This course is designed to introduce students to the interdisciplinary field of American Studies while also empowering them to use the tools and perspectives of several disciplines, such as history, literature, art history, and anthropology. This course aims to introduce students to the various disciplines that constitute American Studies while paying special attention to the ways in which these disciplines can work together to illuminate the study of American cultures, past and present. Students will combine different methodologies in the process of completing assignments designed to make use of a variety of University Circle institutions. For the purposes of this course, biography is treated as a constructed genre that comes in a variety of forms, including autobiography, biographical novels, oral histories, and film. The class will discuss how certain biographies have created archetypal American identities, and how gender/race/class/historical context, etc. have affected the writing and reading of biography and restructured notions of identity. Cross-listed as HSTY 117.

AMST 270. American Art and Culture Before 1900 (3)
(See ARTH 270.) Cross-listed as ARTH 270.

AMST 271. American Art and Culture - 20th Century (3)
(See ARTH 271.) Cross-listed as ARTH 271.
AMST 327. American Theater and Playwrights (3) Designed to provide students an overview of the development of theater in the United States and to familiarize them with the work and themes of selected American playwrights. Cross-listed as THTR 327.

AMST 390. Independent Study (1-3)

Graduate Courses

AMST 550. American Studies Research Seminar (3)

AMST 701. Dissertation Ph.D. (1-18) (Credit as arranged.)

Department of Anthropology

238 Mather Memorial Building Phone 216-368-2264; Fax 216-368-5334 Thomas Csordas, Chair

Anthropology, with its broad comparative approach, is in a strategic position to contribute to the identification and resolution of many of the problems that challenge society today. The Department of Anthropology offers programs leading to both undergraduate (Bachelor of Arts) and graduate (Master of Arts, Doctor of Philosophy, and combined Doctor of Medicine-Doctor of Philosophy, and Master of Arts/Doctor of Philosophy in Anthropology-Master of Public Health, and Master of Science in Nursing-Master of Arts) degrees. Students graduating with a B.A. in anthropology normally must continue for the M.A. or Ph.D. degree if they are interested in working as anthropologists.

Faculty

Thomas Csordas, Ph.D. (Duke University) Professor; Armitage Professor of Anthropology and Religion and Chair of Anthropology

Anthropological theory, comparative religion, medical and psychological anthropology, cultural phenomena and embodiment, globalization and societal change, language and culture; Native America and United States.

Cynthia Beall, Ph.D. (Pennsylvania State University) Sarab Idell Pyle Professor; Co-Director, Center for Research on Tibet

Physical anthropology; human growth, development and aging; human ecology; nomads; Andes, Tibet, Himalayas, Mongolia

Rachel R. Chapman, Ph.D. (University of California, Los Angeles) Assistant Professor

Social cultural anthropology; urban health, racial and ethnic disparities in health, reproductive health; gender systems; women’s health; political economy; medical anthropology; medical pluralism; applied international health; Africa; Mozambique; United States.

Atwood D. Gaines, Ph.D. (University of California, Berkeley, M.P.H. (University of California, Berkeley, School of Public Health)) Professor; Professor of Nursing, Frances Payne Bolton School of Nursing; Professor of Psychiatry and Professor of Biomedical Ethics, School of Medicine

Medical and psychiatric anthropology; religion; aging; cultural studies of science; bioethics; social identity; United States, the Mediterranean.

Melynn C. Goldstein, Ph.D. (University of Washington) John Reynolds Harkness Professor; Co-Director, Center for Research on Tibet

Social cultural anthropology; development/population anthropology; cross-cultural aging; cultural ecology, ethnicity and nationalism, anthropology and history; Tibet, China, Mongolia, Himalayas.

Lawrence P. Greksa, Ph.D. (Pennsylvania State University) Professor

Physical anthropology; human biology; growth and development; nutrition; modernization; Polynesia; Andes; Old Order Amish

Charlotte Ikels, Ph.D. (University of Hawaii) Professor

Gerontology; healthcare; urban life; comparative bioethics; Hong Kong, China, United States.

Janis Hunter Jenkins, Ph.D. (University of California, Los Angeles) Professor; Professor Psychiatry, School of Medicine

Medical and psychological anthropology; culture and feminist theory; schizophrenia, depression, trauma; political violence; refugees and immigrants; Latinos; Euro-Americans; Central America, North America, the Caribbean.

Jill E. Koebin, Ph.D. (University of California, Los Angeles) Professor; Associate Dean of Arts and Sciences; Director, Childhood Studies; Co-Director, Schubert Center for Child Development

Cultural and medical anthropology; cross-cultural child rearing and family studies; child abuse and neglect; family violence; neighborhood; United States; Old Order Amish

Janet McGrath, Ph.D. (Northwestern University) Associate Professor; Director of Graduate Programs; Assistant Professor of International Health, School of Medicine

Biological and biomedical anthropology; anthropology of disease; international health; AIDS, urban health; United States, Africa.

James Pfeiffer, Ph.D., M.P.H. (University of California, Los Angeles) Assistant Professor

Medical anthropology; international health; political economy; nutritional anthropology; development studies; applied anthropology; Southern Africa; Central America; Mozambique

Jim Shafer, Ph.D. (University of Wisconsin, Madison) Associate Professor

Archaeology, Middle East; Central Asia; Indus Valley, India

Adjunct Faculty

N’omi Greber, Ph.D. (Case Western Reserve University) Adjunct Associate Professor; Curator of Archaeology, Cleveland Museum of Natural History

Computer and remote sensing applications, early/middle Woodland; eastern United States, archaeology, prehistory of eastern North America, prehistoric social organization, Shoshone ethnohistory.

Bruce Latimer, Ph.D. (Kent State University) Adjunct Assistant Professor; Executive Director, Cleveland Museum of Natural History

Biological anthropology; Plio-Pleistocene hominin evolution; comparative primate anatomy; biomechanics of locomotor system

Ellen S. Lazarus, Ph.D. (Case Western Reserve University) Adjunct Associate Professor, MetroHealth Medical Center

Sociocultural and medical anthropology; maternal and child health, gender, ethnicity and social class, medical ethics and education, and urban anthropology; longitudinal reproductive patterns of childbirth including birth outcomes, family planning and patient assessment of perinatal healthcare.

Jeffrey Longhofer, Ph.D. (University of Kansas) Adjunct Associate Professor

Medical anthropology; mental health, applied anthropology, gender and sexuality, philosophy of social science/theory.

Patricia A. Marshall, Ph.D. (University of Kentucky) Associate Professor; Associate Professor of Biomedical Ethics, Center for Biomedical Ethics

Bioethics, HIV/AIDS

Isabel Parraga, Ph.D. (Case Western Reserve University) Adjunct Assistant Professor; Associate Professor of Nutrition

Nutritional anthropology; international nutrition; nutrition and growth; maternal and child nutrition; schistosomiasis and growth and nutrition; public health nutrition.

Brian Redmond, Ph.D. (Indiana University) Adjunct Associate Professor; Director of Science, Collections and Research; Curator and Head of Archaeology, Cleveland Museum of Natural History

North American prehistory, Eastern Woodland settlement patterns, ceramic analysis, museum archaeology.
Scott Simpson, Ph.D. (Kent State University)
Adjunct Associate Professor; Associate Professor, Department of Anatomy, School of Medicine
Biological Anthropology, Pli–Pleistocene hominid evolution

Undergraduate Program

Major
The undergraduate major requires a minimum of 36 semester hours in anthropology. The undergraduate program provides a cross-cultural perspective on human behavior, culture, and biology. Students study other cultures as well as their own. Students may choose from four major concentrations, or may consult with the department to tailor the major to their individual interests and goals.

The general anthropology concentration includes three subdisciplines of anthropology. The first, sociocultural anthropology, emphasizes relationships among socioeconomic institutions, cultural ecology, health and medicine, religion and symbolism, individual psychological variables, and language. The second, physical and biological anthropology, emphasizes human ecology and adaptability, human growth and development, nutritional adaptation, epidemiology, and human and nonhuman primate evolution. The third, archaeology, deals with the long sequences of independent sociocultural, technological, and ecological evolution that have taken place under diverse conditions.

The health science-oriented anthropology concentration builds upon the department’s expertise in medical anthropology. Students learn about the three subdisciplines discussed above, but with a focus on their relationship to physical and mental health, illness, disease, and medicine.

Archaeology anthropology concentration reconstructs the customs and daily life of people who lived in the past by excavating and analyzing the material remains of the sites of human occupation. At the same time, archaeology seeks to understand the evolution of culture and society by determining how and why changes in human society occurred over the past 5 million years that our species has inhabited the earth.

Physical anthropology concentration deals with the biological nature of humans past and present. The physical anthropologist looks beyond purely biological phenomena to understand how biology, behavior and environment interact.

Paleoanthropology documents the biological history of humans and, in conjunction with archaeology, analyzes those relationships for past humans. Human biology studies physiology, genetics, nutrition and epidemiology in modern human populations throughout the world in order to understand those relationships.

The anthropology scholars’ concentration permits highly qualified and motivated Anthropology majors, with well-defined interests and goals that could be met by an alternative course sequence, to tailor an individual program of study.

General Anthropology Concentration
ANTH 102 and 103
One course dealing with a geographic area (e.g., ANTH 330, 331, 341, 352, 353, 356 or 357)
Approved anthropology electives: 24 semester hours

Health Science-oriented Anthropology Concentration
ANTH 102, 103, and 215
ANTH 319
One course dealing with a geographic area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
At least three courses dealing with health/illness-related topics (e.g., ANTH 301, 304, 306, 309, 318, 351, 359, 365, 369, 371, 376, 393, or 397)
Approved anthropology electives: 12 semester hours

Archaeology Anthropology Concentration
ANTH 102, 103, and 107
ANTH 319
One course dealing with a geographic area (e.g., ANTH 202, 330, 331, 341, 352, 353, 356, or 357)
Three approved archaeology courses: ANTH 202, 321, 324, 330, 331, 333, 399, summer fieldwork
Four approved electives: 12 semester hours

Physical Anthropology Concentration
ANTH 102 and 103
ANTH 319
One course dealing with a geographic area (e.g., 330, 331, 341, 352, 353, 356, or 357)
At least three courses dealing with physical anthropology (e.g., ANTH 295, 301, 302, 369, 393, 397, ANAT 375, 377, 383)
Approved anthropology electives: 15 semester hours

Minor
The department offers four minor emphases in anthropology: a general anthropology emphasis, a health science-oriented anthropology emphasis, an archaeological anthropology emphasis, and a physical anthropology emphasis. All require a minimum of 15 semester hours in anthropology.

General Anthropology Minor
ANTH 102 and 103
One course dealing with a geographic area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
Two approved electives: 6 semester hours

Health Science-Oriented Anthropology Minor
ANTH 102, 103, and 215
One course dealing with a geographic area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
One course dealing with health-related topics (e.g., ANTH 301, 304, 306, 309, 318, 351, 359, 365, 369, 371, 376, 393, or 397)

Archaeology Anthropology Minor
ANTH 102, 103, and 107
One course dealing with a geographical area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
One approved archaeology elective: ANTH 202, 321, 330, 331, 333, 399, summer fieldwork

Physical Anthropology Minor
ANTH 102 and 103
One course dealing with a geographical area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
Two approved physical anthropology electives: ANTH 295, 301, 302, 369, 393, 397, ANAT 375, 377, 383

Engineering Core
A social science sequence for the B.S. based on the Engineering Core requires ANTH 102 or 103 and two other courses of which at least one must be a 300-level course.

Departmental Honors
This program is open to qualified majors in anthropology who have completed 15 hours of anthropology with a 3.25 grade point average and who have a 3.0 grade point overall average. Students should apply for the program in the fall semester of their junior
Requirements for the Master of Arts Degree

The main purpose of the Master of Arts degree program is to prepare students to begin teaching, research, or service careers with a solid background in anthropology. Undergraduate course work in anthropology, while helpful, is not a prerequisite for admission. However, students with no previous training in anthropology are expected to remedy deficiencies prior to taking the M.A. examination.

Requirements for the master’s degree include credit hour requirements, core course requirements, and a six-hour comprehensive written Master of Arts examination. A candidate for the master’s degree is required to complete 27 hours of classwork, including an approved statistics course (3 hours) in which the student has earned a grade of C or better. Not more than 6 credit hours of electives may be taken in 300-level courses (advanced undergraduate courses). All master’s degree candidates are required to attain a minimum cumulative grade point average of 3.0 in the core courses (described below) in order to qualify for the degree. Any student may retake an examination in a required course the next time it is given. The second grade will be the one considered for the student’s overall average.

All master’s degree candidates are required to take a six-hour comprehensive written examination in their field set by the Department Examination Committee. This examination must be taken before the completion of 27 semester hours of graduate work. Written master’s degree examinations can receive one of three grades: High Pass, Pass, or Fail. “High Pass” signifies performance sufficient for both the Master of Arts degree and advancement to the Doctor of Philosophy program, provided other requirements also have been satisfied. “Pass” signifies performance adequate for the master’s degree but insufficient to enter the doctoral program. “Fail” means a performance inadequate for the master’s degree. In the case of grades of Pass and Fail, the written examination may be retaken once.

Requirements for Doctor of Philosophy Degree

The Doctor of Philosophy degree program in anthropology includes specializations in medical anthropology, international health, psychological anthropology, cross-cultural gerontology, urban health, human biology/physical anthropology, and sociocultural anthropology. It requires a minimum of 36 credit hours.

After completing course requirements, a student must take the written Doctor of Philosophy candidacy examination. Within one semester of successfully completing the written Doctor of Philosophy candidacy examination, the student is required to defend a dissertation prospectus with the cooperation of his or her advisor and committee. Before a candidate is permitted to defend the dissertation, he or she must demonstrate a reading knowledge in a foreign language in which there is a scholarly literature relevant to his or her program of studies. A foreign-born student may substitute his or her native language (if it is not English) if it meets the above conditions.

Description of Programs

Medical Anthropology Program

The objective of the Medical Anthropology Program is to train medical anthropologists, physicians, nurses, and other health professionals (1) to recognize and deal with, on both theoretical and practical levels, the complex relations between the biological, social, cultural, psychological, economic, and technoscientific determinants and concomitants of sickness and health; and (2) to analyze and evaluate how health services are organized and delivered. A student who chooses this specialty concentrates on the methods and perspectives of either social-cultural or physical anthropology in his or her studies and research.

Within the Medical Anthropology Program, students may choose to specialize in medical anthropology, cross-cultural gerontology, international health, urban health, or psychological anthropology.

M.A. Requirements

The curriculum covers the range of medical anthropology interests: ethnomedicine, human adaptation and disease, nutrition, international health, urban health, psychiatric anthropology, social demography, and so on. All Master of Arts degree students in medical anthropology must complete 27 hours, including the following core courses: ANTH 462, 480, 481, and 504 as well as an approved statistics course. The remaining 12 credit hours are taken as electives in anthropology or in other departments with the advisor’s approval.

Ph.D. Requirements

All Ph.D. students in medical anthropology are required to complete the Ph.D. requirements. A specific plan of study is developed in consultation with their advisor. It requires a minimum of 36 credit hours.

1. Students must take an approved statistics course (3 credits) and earn a grade of C or better if this requirement has not been fulfilled at the M.A. level.
2. Students must complete two seminars (500 level).
3. Students must take 9 credit hours in electives, as approved by their advisory committee. For those students completing the statistics requirement at the M.A. level, 12 hours of electives are required. Students may not take more than six total credit hours of either ANTH 599 or ANTH 601.
4. Students must take 18 credit hours in dissertation (ANTH 701).
After completing course requirements, a student must take the written Doctor of Philosophy candidacy examination. Within one semester of successfully completing the written Doctor of Philosophy candidacy examination, the student is required to defend a dissertation prospectus with the cooperation of his or her advisor and committee. Before a candidate is permitted to defend the dissertation, he or she must demonstrate a reading knowledge in a foreign language in which there is a scholarly literature relevant to his or her program of studies. A foreign-born student may substitute his or her native language (if it is not English) if it meets the above conditions.

Specializations in Medical Anthropology Program

Cross-Cultural Gerontology

The cross-cultural gerontology specialization within the graduate program in Medical Anthropology focuses on the processes of aging and the problems of the elderly throughout the world in both theoretical and applied perspectives. Particular emphasis is given to understanding the relationship between non-Western and Western experiences in terms of social, cultural, economic, political, and demographic concomitants. All Master of Arts students in cross-cultural gerontology must complete 27 credit hours including the Medical Anthropology Program core courses, an approved statistics course, and 12 credit hours of electives approved by the advisor. At the Ph.D. level, students specializing in cross-cultural aging must develop a program with their advisor to meet all Ph.D. requirements.

International Health

The international health specialization within the graduate program in Medical Anthropology offers students training in international health research as well as evaluation of international health projects. The curriculum includes course work in medical anthropology, epidemiology, and special topics in international health, including child survival, fertility and family planning, and nutritional intervention. Students are qualified to work in international health research, academic, or administrative positions in governmental or private agencies. All Master of Arts students in international health must complete 27 credit hours including the following core courses: ANTH 459, 462, 480, 481, 497, and 504, as well as an approved statistics course. The remaining 6 credit hours are taken as electives in anthropology or other departments with the advisor’s approval. At the Ph.D. level, students specializing in international health must develop a program with their advisor to meet all Ph.D. requirements.

Urban Health Anthropology

The urban health specialization within the graduate program in Medical Anthropology prepares students for careers in anthropology, public health, or allied fields, with a special focus on racial and ethnic disparities in health and underserved populations in urban areas around the world. Under the guidance of faculty with research experience both domestically and internationally, students will learn anthropological theory and methods focusing on health and illness among urban populations.

All Master of Arts students in urban health must complete 27 credit hours including the following core courses: ANTH 462, 480, 481, and 504, as well as an approved statistics course, plus the Urban Health core courses: ANTH 461, 444, and EPBI 490. The remaining 3 credit hours are taken as an elective in anthropology or other departments with the advisor’s approval. At the Ph.D. level, students specializing in urban health anthropology must develop a program with their advisor to meet all Ph.D. requirements.

Psychological Anthropology

The psychological anthropology specialization within the graduate program in Medical Anthropology prepares students for positions in teaching and research institutions. It is also relevant for mental health professionals concerned with research and theoretical issues related to multiethnic patient populations. All Master of Arts students in the psychological anthropology specialization must complete ANTH 462, 471, 480, 481, and 504 as well as an approved statistics course. The remaining 9 credit hours are taken as electives in anthropology or other departments with the advisor’s approval. At the Ph.D. level, students specializing in psychological anthropology must develop a program with their advisor to meet all Ph.D. requirements.

The Cross-Cultural Gerontology Program

In addition to the cross-cultural gerontology specialization in the Medical Anthropology Program, the department offers a distinct Cross-Cultural Gerontology Program. Degree candidates are required to demonstrate mastery of the literature, theories, and methods appropriate to Western and non-Western gerontology, and are encouraged to gain research experience in both Western and non-Western settings. The program emphasizes the integration of qualitative and quantitative methodologies.

M.A. Requirements

Graduates of this program are qualified to work in research or administrative positions in governmental and private agencies, as well as teach at the college and university levels. All Master of Arts students in cross-cultural gerontology must complete 27 credit hours including the following core courses: ANTH 401, 404, 462, and 504. In addition to the four core courses, students must take an approved statistics course. Twelve credit hours are taken as electives in anthropology or in other departments with advisor’s approval.

Ph.D. Requirements

All Ph.D. students in cross-cultural gerontology are required to develop a specific plan of study in consultation with their advisor. It requires a minimum of 36 credit hours:

1. Students must take 18 credit hours in electives as approved by their advisory committee. (For those students who have not completed the M.A. statistics requirement, an approved 3-credit course in statistics is required.)
2. Students must take 18 credit hours in dissertation (ANTH 701).

After completing course requirements, a student must take the written Doctor of Philosophy candidacy examination. Within one semester of successfully completing the written Doctor of Philosophy candidacy examination, the student is required to defend a dissertation prospectus with the cooperation of his or her advisor and committee. Before a candidate is permitted to defend the dissertation, he or she must demonstrate a reading knowledge in a foreign language in which there is a scholarly literature relevant to his or her program of studies. A foreign-born student may substitute his or her native language (if it is not English) if it meets the above conditions.

M.A./Ph.D./M.P.H. Program with the School of Medicine

The joint M.A./Ph.D./M.P.H. program provides students with the opportunity to receive an anthropology graduate degree and a public health degree simultaneously. A combined public health/anthropology degree will be especially valuable to students interested in working in urban health or international health, or within health policy programs. The joint M.A./M.P.H. requires 54 credit hours (21 in Anthropology and 33 in Public Health). The joint Ph.D./M.P.H. requires an additional 18 credit hours in
Anthropology beyond the M.A. level and 18 hours of ANTH 701 (Dissertation Research), for a total of 90 credit hours. Each joint degree student will develop a program of study with their advisors in both Anthropology and Public Health.

**Joint M.S. Nursing/M.A. Anthropology Program**

The joint M.S.N./M.A. program affords students a unique opportunity to combine the cross-cultural expertise of medical anthropology with clinical expertise in nursing. This combination of skills and knowledge will be of particular value in preparing students for careers in international health and in our multi-cultural society. Students must complete a minimum of 19 credits in nursing core courses, 12 to 22 credits in clinical major courses, and a minimum of 18 credits in anthropology courses. The actual number of credits depends upon the nursing major selected. The total M.S.N./M.A. degree requirement is a minimum of 55 hours.

**Joint Doctor of Medicine/Doctor of Philosophy Program**

The objectives of the joint M.D./Ph.D. programs are to train unusually qualified students to conduct research on a broad range of bio-cultural problems, with emphasis on the relationship between medicine, ecology, subsistence variables, population dynamics, and disease epidemiology; and to identify and analyze sociocultural impediments to the successful introduction of effective functioning, and evaluation of programs of health care in diverse contexts.

Applicants should make separate application for admission to the School of Medicine and the Department of Anthropology (through the School of Graduate Studies). Applications to the Department of Anthropology must include MCAT scores, in addition to other information indicated on the graduate school forms.

Application to the School of Medicine is initiated through the American Medical College Application Service in Washington, D.C., but applicants may write to the Admission Office of the School of Medicine for further information about the application procedure. The names of students whose applications have been reviewed favorably by the Department of Anthropology will be forwarded to the Admissions Committee of the School of Medicine with a recommendation that, if accepted by the School of Medicine, these applicants be admitted to the joint-degree program. The Department of Anthropology’s recommendation does not imply automatic admission to that school. The credentials presented by applicants to the program will be considered competitively among all other applicants to the School of Medicine.

**Other Specializations**

Students interested in graduate degrees in social-cultural or physical anthropology should contact the department about requirements.

**Anthropology (ANTH)**

**Undergraduate Courses**

**ANTH 103. Introduction to Human Evolution (3)**
Physical, cultural, and technological evolution of humans. The systematic interrelationships between humans, culture, and environment.

**ANTH 105. Worldwide Variation in Human Biology (3)**
The genetic, ontogenetic, and physiological bases for biological variation within human populations. These variations in the context of adaptation to the natural environment, human-made environment, and continuing environmental change.

**ANTH 107. Archaeology: An Introduction (3)**
Basic archaeological concepts are discussed followed by a review of human cultural and biological evolution from the earliest times through development of state organized societies. Geographical scope is worldwide with special attention given to ecological and cultural relationships affecting human societies through time.

**ANTH 202. Archaeology of Eastern North America (3)**
This course is an introduction to the archaeology and prehistory of the eastern woodlands of North America. Course material will focus on the archaeological record of native societies living east of the Mississippi River from the first arrivals at the end of the Pleistocene up to the coming of Europeans. Specific topics for discussion include late Pleistocene settlement, hunter-gatherer environmental adaptations, the origin of food production, and the development of ranked societies.

**ANTH 212. Popular Culture in the United States (3)**
This course considers the history, character and constituents of popular culture in the U.S. and the various methods by which it is defined and studied. Key elements of popular culture in the United States are considered in their social (ethnic, gender, age) and historical contexts. The course provides an introduction to other more specialized courses in the anthropology of Gender, Popular Music and Science and Medicine. We will consider both themes and images (icons) of Usonian popular culture, their origins and transformations.

**ANTH 215. Health, Culture, and Disease: An Introduction to Medical Anthropology (3)**
This course is an introduction to the field of Medical Anthropology. Medical Anthropology is concerned with the cross-cultural study of culture, health, and illness. During the course of the semester, our survey will include (1) theoretical orientations and key concepts; (2) the cross-cultural diversity of health beliefs and practices (abroad and at home); and (3) contemporary issues and special populations (e.g., AIDS, homelessness, refugees, women’s health, and children at risk).

**ANTH 225. Evolution (3)**
(See PHIL 225.) Cross-listed as PHIL 225.

**ANTH 229. Comparative Primate Behavior (3)**
The behavior of non-human primates (prosimians, monkeys, and apes) and the relevance of these studies for understanding the evolution of human behavior. Biological and ecological influences on behavior. The social aspects of primate life, both human and nonhuman. Prereq: ANTH 102 or ANTH 103 or consent of department.

**ANTH 301. Biological Aging in Humans (3)**
Biological aging phenomena, evidence that various sociocultural and environmental influences may slow or accelerate the aging process, and theories explaining the evolution of the aging process. Prereq: ANTH 103 or consent of department.

**ANTH 302. Darwinian Medicine (3)**
Darwinian medicine deals with evolutionary aspects of modern human disease. It applies the concepts and methods of evolutionary biology to the question of why we are vulnerable to disease. Darwinian (or evolutionary) medicine proposes several general hypotheses about disease causation including disease as evolutionary legacy and design compromise, the result of a novel environment, a consequence of genetic adaptation, the result of infectious organisms’ evolutionary adaptations, and disease symptoms as manifestation of defense mechanisms. It proposes that evolutionary ideas can explain, help to prevent and perhaps help to treat some diseases. This course presents the basic logic of Darwinian medicine and evaluates hypotheses about specific diseases that illustrate each of the hypotheses about disease causation. Prereq: ANTH 103 or ANTH 105 or consent of department.
ANTH 304. Introduction to the Anthropology of Aging (3)
Reviews historical and methodological approaches to the study of aging. Examines theoretical assumptions about aging by comparing studies from Western and non-Western societies that illustrate the differential importance of culture in the experience of aging. Prereq: ANTH 102 or consent of department.

ANTH 306. Anthropology of Childhood and the Family (3)
Child-rearing patterns and the family as an institution, using evidence from Western and non-Western cultures. Human universals and cultural variation, the experience of childhood and recent changes in the American family. Prereq: ANTH 102 or consent of department.

ANTH 309. Family Violence and Child Abuse (3)
The prevalence and causes of intrafamilial violence. Spouse abuse, child abuse, adolescent abuse, sexual abuse, parent abuse, and sibling violence. Major theoretical positions on the occurrence of these behaviors in light of information from both Western and non-Western cultures. Prereq: ANTH 102 or consent of department.

ANTH 313A. Medical Anthropology - Scholars Seminar (3)
This course will combine seminar and hands-on experience in medical settings. Seminar topics will include culture and ethnicity, health care utilization; medical anthropology; and cross-cultural parenting and child development. Concurrent research will be carried out with families being cared for at University Hospital's pediatric clinics. Prereq: ANTH 102, ANTH 215, and application to the department of Anthropology.

ANTH 314. Cultures of the United States (3)
This course considers the rich ethnic diversity of the U.S. from the perspective of social/cultural anthropology. Conquest, immigrations, problems of conflicts and accommodation, and the character of the diverse regional and ethnic cultures are considered as are forms of racism, discrimination, and their consequences. Groups of interest include various Latino and Native peoples, African-American groups, and specific ethnic groups of Pacific, Mediterranean, European, Asian, and Caribbean origin.

ANTH 317. Asian Medical Systems (3)
Examines the philosophical assumptions and therapies of the traditional and contemporary medical systems of India, Tibet, China, and Japan. Particular attention will be given to the folk, popular, and institutional sectors of medical practice as well as to the contemporary relationship between traditional medicine and Western medicine in each of these societies. Prereq: ANTH 102 or consent of department.

ANTH 318. Death and Dying (3)
Examines cultural context of death and dying. Topics include social and psychological consequences of changing patterns of mortality, attitudes towards the taking of life, preparation for death, mortuary rituals, grief and mourning, and nature of relationship between living and dead. Prereq: ANTH 102 or consent of department.

ANTH 319. Introduction to Statistical Analysis in the Social Sciences (3)
Statistical description (central tendency, variation, correlation, etc.) and statistical evaluation (two sample comparisons, regression, analysis of variance, non-parametric statistics). Developing an understanding of statistical inference, particularly on proper usage of statistical methods. Examples from the social sciences. Cannot be used to meet the A&S Humanities and Social Sciences requirement. Not available for credit to students who have completed STAT 201 or PSCL 282.

ANTH 321. Methods in Archaeology (3)
This course reviews the basic methods and techniques used in modern anthropological archaeology. Topics to be discussed include the nature of the archaeological record, research design, techniques of field archaeology, methods of laboratory analysis, museum archaeology, ethnoarchaeology, and cultural interpretation. Prereq: ANTH 107 or consent of department.

ANTH 322. Living Africa (3)
This course is an introduction to the peoples and cultures of Africa. Rather than a traditional, survey approach, this course takes a thematic approach to issues regarding core aspects of African societies such as history, political organization, family and kinship, art and literature, religion, gender, international relations, and economy. Taking a multidisciplinary perspective, the course will draw on diverse sources, from classical ethnographic writings to popular cultural criticism, literature, films, poetry, and news media.

ANTH 323. AIDS: Epidemiology, Biology, and Cultures (3)
This course will examine the biological and cultural impact of AIDS in different societies around the world. Topics include: the origin and evolution of the virus, the evolutionary implications of the epidemic, routes of transmission, a historical comparison of AIDS to other epidemics in human history, current worldwide prevalences of AIDS, and cultural responses to the epidemic. Special emphasis will be placed on the long-term biological and social consequences of the epidemic. Prereq: ANTH 102 or ANTH 103 or ANTH 105 or consent of department.

ANTH 324. Field Methods in Archaeology (6)
This field course is designed to give the student a comprehensive introduction to archaeological field work. All participants will be introduced to the methods of archaeological survey, techniques of hand excavation, artifact identification, and the preparation of field notes and documentation. In large measure this is a "learning through doing" course which is supplemented by formal and informal lectures and discussions about archaeological methods and regional prehistory. The Field School is held as two, three-week sessions of instruction in the field. All participants are required to attend an orientation meeting that is held at the Museum on the first day of each session. The remainder of each session will take place from Monday through Friday at an archaeological site in northeast Ohio. Students are responsible for their own transportation to and from the field site and must bring a sack lunch. All participants will receive a field manual which will provide detailed information on the course and techniques of field work. Prereq: Permission of department.

ANTH 326. Power, Illness, and Inequality: The Political Economy of Health (3)
This course explores the relationship between social inequality and the distribution of health and illness across class, race, gender, sexual orientation, and national boundaries. Class readings drawn from critical anthropological approaches to the study of health emphasize the fundamental importance of power relations and economic constraints in explaining patterns of disease. The course critically examines the nature of Western biomedicine and inequality in the delivery of health services. Special consideration is given to political economic analysis of health issues in the developing world such as AIDS, hunger, reproductive health, and primary health care provision. Prereq: ANTH 102 or ANTH 215 or consent of department.

ANTH 327. Great Lakes Archaeology (3)
This course surveys the archaeology of Native American cultures in the Great Lakes region from ca. 10,000 B.C. to A.D. 1700. The geographic scope of this course is the upper Midwest, southern Ontario, and the St. Lawrence Valley with a focus on the Ohio region. Prereq: ANTH 107 or consent of the department.

ANTH 330. Special Topics in Prehistory (3)
Special topics or geographical areas of archaeological significance (e.g., the origins of food production, the archaeology of the Mediterranean, the archaeology of North America). Prereq: ANTH 102 or ANTH 107 or consent of department.

ANTH 331. Ancient Civilizations of the Near East (3)
The social, economic, and ecological factors involved in the formation of the earliest Asian civilizations. The developmental role of cities, warfare, trade, and irrigation considered with respect to "state" formation in Mesopotamia, Iran, and the Indus Valley. Prereq: ANTH 102 or ANTH 107 or consent of department.

ANTH 333. Roots of Ancient India: Archaeology of South Asia (3)
Examination of the archaeological record of cultural development from earliest times through the Iron Age in India, Pakistan, Sri Lanka, and Bangladesh. Particular attention devoted to how these ancient cultural developments laid the foundations for the early historic civilizations of this region. Prereq: ANTH 102 or ANTH 107 or consent of department.

ANTH 334. Urban Anthropology (3)
This urban anthropology course will focus on contemporary understandings of the institutions of urban, national and transnational life. We will explore the complex ways that urban worlds and social problems are shaped by globalizing capitalism, national, and transnational processes. As well, we will examine how and why various identities, nations, and
transnational institutions are expressed in and by people living in current global urban hierarchies. In particular, we will look at how the urban, national, and transnational dynamically produce and are produced by the everyday cultural practices of people living and struggling in North American urban spaces. Prereq: ANTH 102 or consent of department.

ANTH 337. Comparative Medical Systems (3)
This course considers the world’s major medical systems. Foci include professional and folk medical systems of Asia and South Asia, North and South America, Europe and the Mediterranean, including the Christian and Islamic medical traditions. Attention is paid to medical origins and the relationship of popular to professional medicines. The examination of each medical tradition includes consideration of its psychological medicine and system of medical ethics. Prereq: ANTH 215.

ANTH 340. Culture and Emotion (3)
The cross-cultural consideration of the relationship of culture and emotion. The cultural construction of the experience and expression of emotion. Key substantive issues include: ethnopsychological variations in indigenous conceptualizations and displays of emotion; the socialization of affect; the self and emotion; contextual variations in emotional expression with respect to gender, power relations, patterns of subsistence, and the individual; and the relationship between emotion and illness processes. Prereq: ANTH 102 or consent of department.

ANTH 341. Cultural Area Studies in Anthropology (3)
Prereq: ANTH 102.

ANTH 343. Psychoanalytic Anthropology (3)
Psychoanalytic theory and its application to cross-cultural materials. The cultural context of analytic theory’s development and its applications in social/cultural and medical anthropology; application of cultural criticism to psychoanalytic conceptions and its constructions of the following: social evolution; religious ideology, praxis, patterns and dynamics; altered states of consciousness; individual personality and psychopathology; individual and cultural defense mechanisms; socialization; cognition; emotion; symbolism; and gender. Also considers bases for a culturally relative analytic theory. Prereq: ANTH 102 or consent of department.

ANTH 345. Ethnicity, Gender, and Mental Health (3)
An overview of mental health status and ethnicity. Analysis of ethnicity in relation to culture, social class, gender, sociopolitical conflict and the world refugee crisis. Consideration of populations at special risk for development of specific mental disorders (e.g., schizophrenia, affective disorders, adjustment and stress disorders). Contemporary ethnographic survey of ethnic groups at risk both at home and abroad. Prereq: ANTH 102 or consent of department.

ANTH 348. Sexuality and Gender (3)
This course examines the relationships among gender, sexuality, race, nation, and the body. In particular, it focuses on contemporary ideas and theories in the study of the complex historical and cultural relationships between sexuality and gender. In addition, we examine sexuality and social movements, identity politics, and the so-called “culture wars.” In short, this class will not be a voyeuristic narration of exotic sexual or gender practices; and where we use the “other” it will be solely for the purpose of exploring our own practices and ideologies. Prereq: ANTH 102 or consent of department.

ANTH 351. Topics in International Health (3)
Special topics of interest in International Health. Prereq: ANTH 102 or ANTH 215 or consent of department.

ANTH 352. Japanese Culture and Society (3)
Focuses on contemporary Japanese cultural and social institutions. Topics include child-rearing, personality, values, education, gender roles, the dual economy, and popular culture. Prereq: ANTH 102 or consent of department.

ANTH 353. Chinese Culture and Society (3)
Focuses on Chinese cultural and social institutions during the Maoist and post-Maoist eras. Topics include ideology, economics, politics, religion, family life, and popular culture. Prereq: ANTH 102 or consent of department.

ANTH 356. Mediterranean Culture and Society (3)
Ethnography of the Mediterranean culture area. Topics include geography, topography, climate, rural and urban life styles, economy, social identity (encompassing gender, ethnic, national, provincial, tribal and religious identity), religion, ritual relations, concepts of self, health and healing, politics, worldview and values, family and kinship, aging, death and dying. Past and present methods and problems of anthropological research in the region and the theoretical frameworks that have guided researchers. Prereq: ANTH 102 or consent of department.

ANTH 357. Native American Cultures (3)
Intensive examination of the cultures of selected Native American peoples, including historical, political, religious, social organizational, linguistic, and medical/psychiatric aspects of American Indian life. Prereq: ANTH 102.

ANTH 358. Women's Mental Health (3)
This anthropological course is an examination of the cultural psychology of women in the following domains: (1) women’s social status cross-culturally; (2) specific psychiatric syndromes, such as psychoses, mood and personality disorders as they affect women; and (3) power and resilience. Issues of the cultural validity of psychological theories for women across diverse settings is the subject of critique throughout the seminar. Prereq: ANTH 102 or ANTH 215.

ANTH 359. Introduction to International Health (3)
Critical health problems and needs in developing countries. Prevalence of infectious disease, malnutrition, chronic disease, injury control. Examines strategies for improvement of health in less developed countries. Prereq: ANTH 102.

ANTH 361. Urban Health (3)
This course provides an anthropological perspective on the most important health problems facing urban population around the world. Special attention will be given to an examination of disparities in health among urban residents based on poverty, race/ethnicity, gender, and nationality.

ANTH 362. Contemporary Theory in Anthropology (3)
A critical examination of anthropological thought in England, France and the United States during the second half of the twentieth century. Emphasis will be on the way authors formulate questions that motivate anthropological discourse, on the way central concepts are formulated and applied and on the controversies and debates that result. Readings are drawn from influential texts by prominent contemporary anthropologists. Prereq: ANTH 102 or consent of department.

ANTH 363. Anthropology and Bioethics (3)
The course will review theoretical work on anthropology and values, the discipline of bioethics, its philosophical roots, the body of anthropological work in bioethics, and critically examine a number of current bioethical issues in the United States and internationally. Prereq: ANTH 102 or consent of department.

ANTH 364. Anthropology and Bioethics (3)
The course will review theoretical work on anthropology and values, the discipline of bioethics, its philosophical roots, the body of anthropological work in bioethics, and critically examine a number of current bioethical issues in the United States and internationally. Prereq: ANTH 102 or consent of department.

ANTH 365. Gender and Sex Differences: Cross-cultural Perspective (3)
Gender roles and sex differences throughout the life cycle considered from a cross-cultural perspective. Major approaches to explaining sex roles discussed in light of information from both Western and non-Western cultures. Prereq: ANTH 102 or consent of department.

ANTH 369. The Anthropology of Nutrition (3)
Examines human nutrition and physical performance within the framework of human adaptability theory. The emphasis is on the measurement of energetic intake and expenditure in human populations; the assessment, health consequences, and bio-cultural correlates of malnutrition and obesity; and the uses of energetic data in assessing human population adaptation. Prereq: ANTH 103 or consent of department.

ANTH 371. Culture, Behavior, and Person: Psychological Anthropology (3)
Cross-cultural perspectives on personality, human development, individual variability, cognition, deviant behavior, and the role of the individual in his/her society. Classic and contemporary anthropological writings on Western and non-Western societies. Prereq: ANTH 102 or consent of department.

ANTH 372. Anthropological Approaches to Religion (3)
The development of, and current approaches to, comparative religion from an anthropological perspective. Topics include witchcraft, ritual, myth, healing, religious language and symbolism, religion and gender, religious experience, the nature of the sacred, religion and social change, altered states of consciousness, and evil. Using material from a wide range of world cultures, critical assessment is made of conventional dis-
tinctions such as those between rational/irrational, natural/supernatural, magic/religion, and primitive/civilized. Cross-listed as RLGN 372.

ANTH 375. Human Evolution: The Fossil Evidence (3)
This course will survey the biological and behavioral changes that occurred in the hominin lineage during the past five million years. In addition to a thorough review of the fossil evidence for human evolution, students will develop the theoretical framework in evolutionary biology. Prereq: ANTH 103 and BIOL 110. Cross-listed as ANAT 375.

ANTH 376. Topics in the Anthropology of Health and Medicine (3)
Special topics of interest, such as the biology of human adaptability; the ecology of the human life cycle health delivery systems; transcultural psychiatry; nutrition, health, and disease; paleoepidemiology; and population anthropology. Prereq: ANTH 102 or ANTH 103.

ANTH 377. Human Osteology (4)
This course for upper division undergraduates and graduate students will review the following topics: human skeletal development and identification; and forensic identification (skeletal aging, sex identification and population affiliation). Cross-listed as ANAT 377.

ANTH 380. Independent Study in Laboratory Archaeology I (1-3)
This course provides an introduction to the basic methods and techniques of artifact curation and laboratory analysis in archaeology. Under the supervision of the instructor, each student will develop and carry out a focused project of material analysis and interpretation using the archaeology collections of the Cleveland Museum of Natural History. Each student is required to spend a minimum of two hours per week in the Archaeology laboratory for each credit hour taken. By the end of the course, the student will prepare a short report describing the results of their particular project. Prereq: ANTH 107 and permission of department, and prior permission of Department of Archaeology at the Cleveland Museum of Natural History.

ANTH 381. Independent Study in Laboratory Archaeology II (1-3)
This course provides an introduction to the basic methods and techniques of artifact curation and laboratory analysis in archaeology. Under the supervision of the instructor, each student will develop and carry out a focused project of material analysis and interpretation using the archaeology collections of the Cleveland Museum of Natural History. Each student is required to spend a minimum of two hours per week in the Archaeology laboratory for each credit hour taken. By the end of the course, the student will prepare a short report describing the results of their particular project. Prereq: ANTH 107 and permission of department, and prior permission of Department of Archaeology at the Cleveland Museum of Natural History.

ANTH 383. Evolutionary Anatomy (4)
This course will introduce graduate and advanced undergraduate students to primate comparative anatomy and will examine methods of reconstituting physiology and behavior from fossil remains. Prereq: ANTH 103 and BIOL 110. Cross-listed as ANAT 383.

ANTH 385. Applied Anthropology (3)
Analysis of the use of anthropological theory and data for social development planning and programs. A cross-cultural analysis of the implications of planned change and their ramifications. Prereq: ANTH 102 or ANTH 103 and ANTH 105.

ANTH 388. Globalization, Development, & Underdevelopment: Anthropological Persp. (3)
This course examines both theoretical and practical perspectives on globalization and economic development in the “Third World.” From “Dependency,” “Modernization,” and “World System” theory to post-structuralist critiques of development discourse, the class seeks to provide a framework for understanding current debates on development and globalization. The “neoliberal monologue” that dominates the contemporary development enterprise is critically examined in the context of growing global inequality. Special consideration is given to the roles of international agencies such as the World Bank, International Monetary Fund, United Nations, and non-governmental organizations (NGOs) in the “development industry.” The course also focuses on the contributions of anthropologists to development theory and practice with emphasis on the impact of development on the health of the poor and survival of indigenous cultures. Opportunities for professional anthropologists in the development field are reviewed.

ANTH 389. Crossroads: Transformation of Rural Blues into Urban Rock (3)
A multimedia approach to the development and transformation of an American musical form, the blues. Foci include the social and cultural history of rural and urban blues, rhythm and blues, rock ‘n’ roll, and the later forms of rock, the social context and life histories of modern music’s creators and innovators, the development of vocal and instrumental styles, blues and rock, visual and performance iconography, mile-stones in the development of musical genres and the major roles of racism and discrimination in the development of these forms of popular music. Prereq: ANTH 102.

ANTH 391. Honors Tutorial (3)
Prereq: Acceptance into Honors Program.

ANTH 392. Honors Tutorial (3)
Prereq: Acceptance into Honors Program.

ANTH 393. Human Ecology: Biology of Human Adaptability (3)
The place of human populations in the ecosystem. The importance of biological and behavioral responses of populations ranging from hunters and gatherers to contemporary and industrial societies. The effect of various natural and manmade stresses on man’s adaptation to the environment. Prereq: ANTH 103 or consent of department.

ANTH 394. Seminar in Evolutionary Biology (3)
(See PHIL 394.) Cross-listed as PHIL 394.

ANTH 397. Epidemiology and Evolution of Human Disease (3)
Basic concepts of infectious and degenerative diseases. Description and analysis of the changing distribution and determinants of disease in prehistoric, historic, and contemporary human populations. Prereq: ANTH 103 or consent of department.

ANTH 399. Independent Study (1-6)
Students may propose topics for independent reading and research. Prereq: Consent of department.

Graduate Courses

ANTH 401. Biological Aging in Humans (3)
(See ANTH 301.) Prereq: ANTH 103 or consent of department.

ANTH 402. Darwinian Medicine (3)
(See ANTH 302.) Prereq: ANTH 103 or ANTH 105 or consent of department.

ANTH 404. Introduction to the Anthropology of Aging (3)
(See ANTH 304.) Prereq: ANTH 102 or consent of department.

ANTH 406. Anthropology of Childhood and the Family (3)
(See ANTH 306.) Prereq: ANTH 102 or consent of department.

ANTH 409. Family Violence and Child Abuse (3)
(See ANTH 309.) Prereq: ANTH 102 or consent of department.

ANTH 414. Cultures of the United States (3)
(See ANTH 314.)

ANTH 417. Asian Medical Systems (3)
(See ANTH 317.) Prereq: ANTH 102 or consent of department.

ANTH 418. Death and Dying (3)
(See ANTH 318.) Prereq: ANTH 102 or consent of department.

ANTH 422. Living Africa (3)
(See ANTH 322.)

ANTH 423. AIDS: Epidemiology, Biology, and Culture (3)
(See ANTH 323.) Prereq: ANTH 103 or ANTH 105 or ANTH 102 or consent of department.

ANTH 424. Field Methods in Archaeology (6)
This field course is designed to give the student a comprehensive introduction to archaeological field work. All participants will be introduced to the methods of archaeological survey, techniques of hand excavation, artifact identification, and the preparation of field notes and documentation. In large measure this is a “learning through doing” course which is supplemented by formal and informal lectures and discussions about archaeological methods and regional prehistory. The Field School is held as two, three-week sessions of instruction in the field. All participants are required to attend an orientation meeting that is held at the Museum on the first day of each session. The remainder of each session will take place at the Field School site in the field area.
place from Monday through Friday at an archaeological site in northeast Ohio. Students are responsible for their own transportation to and from the field site and must bring a sack lunch. All participants will receive a field manual which will provide detailed information on the course and techniques of field work. Prereq: Permission of department.

ANTH 426. Power, Illness, and Inequality: The Political Economy of Health (3)
(See ANTH 326.)

ANTH 427. Great Lakes Archaeology (3)
(See ANTH 327.) Prereq: ANTH 107 or consent of department.

ANTH 428. Ethics in Science (3)
This course is a survey of key ethical and value issues in science. Topics to be covered may include: research with human subjects; research with animals; scientific misconduct, including fraud; the role of science in society; opposition to science based on alternative value systems; the historical context of contemporary science; relationships between science and industry, including potential conflicts of interest; the social responsibilities of scientists; science and government; the use of science in public policy, including controversies over smoking and lung cancer, asbestos, and global warming; and the scientist as a "hired gun." Extensive student participation is expected.

ANTH 430. Origins of Civilization (3)
(See ANTH 350.) Prereq: ANTH 102 or consent of department.

ANTH 431. Ancient Civilizations of the Near East (3)
(See ANTH 351.) Prereq: ANTH 102 or ANTH 107 or consent of department.

ANTH 433. Roots of Ancient India: Archaeology of South Asia (3)
(See ANTH 353.) Prereq: ANTH 102 or ANTH 107 or consent of department.

ANTH 434. Urban Anthropology (3)
(See ANTH 354.) Prereq: ANTH 102 or consent of department.

ANTH 437. Comparative Medical Systems (3)
(See ANTH 357.) Prereq: ANTH 215.

ANTH 440. Culture and Emotion (3)
(See ANTH 340.) Prereq: ANTH 102 or consent of department.

ANTH 441. Cultural Area Studies in Anthropology (3)
(See ANTH 341.) Prereq: ANTH 102.

ANTH 443. Psychoanalytic Anthropology (3)
(See ANTH 343.) Prereq: ANTH 102 or consent of department.

ANTH 445. Ethnicity, Gender, and Mental Health (3)
(See ANTH 345.) Prereq: ANTH 102 or consent of department.

ANTH 448. Sexuality and Gender (3)
(See ANTH 348.) Prereq: ANTH 102 or consent of department.

ANTH 451. Topics in International Health (3)
(See ANTH 351.) Prereq: ANTH 102 or ANTH 215.

ANTH 452. Japanese Culture and Society (3)
(See ANTH 352.) Prereq: ANTH 102 or consent of department.

ANTH 453. Chinese Culture and Society (3)
(See ANTH 353.) Prereq: ANTH 102 or consent of department.

ANTH 456. Mediterranean Culture and Society (3)
(See ANTH 356.) Prereq: ANTH 102 or consent of department.

ANTH 457. Native American Cultures (3)
(See ANTH 357.) Prereq: ANTH 102.

ANTH 458. Women’s Mental Health (3)
(See ANTH 358.) Prereq: ANTH 102 or ANTH 215.

ANTH 459. Introduction to International Health (3)
(See ANTH 359.) Prereq: ANTH 102.

ANTH 461. Urban Health (3)
(See ANTH 361.)

ANTH 462. Contemporary Theory in Anthropology (3)
(See ANTH 362.) Prereq: ANTH 102 or consent of department.

ANTH 463. Anthropology and Bioethics (3)
(See ANTH 363.) Prereq: ANTH 102 or consent of department. Cross-listed as BETH 463.
Department of Art History and Art

ART HISTORY
Mather House
Phone 216-368-4118; Fax 216-368-4681
Ellen G. Landau, Chair

ART EDUCATION/ART STUDIO
Art Studio Facility, 2215 Adelbert Road
Phone 216-368-2714; Fax 216-368-2715
Tim Shuckerow, Director of Art Education and Art Studio

Art History and Art

The Department of Art History and Art offers opportunities to study art history, both Western and Non-Western, to participate in a broad range of studio offerings, to pursue state teacher licensure in art education, and to engage in pre-professional museum training. The Bachelor of Arts degree is granted in art history and in pre-architecture (second major only), and the Bachelor of Science degree in art education. In addition, the department offers graduate programs leading to the degrees of Master of Arts in art history, in art history and museum studies, and in art education; and the Doctor of Philosophy in art history, and in art history and museum studies. All art programs are considerably enhanced by close cooperation with and access to the facilities of cultural institutions located in University Circle, in particular the Cleveland Museum of Art and the Cleveland Institute of Art.

The undergraduate and graduate programs in art history are offered as part of the Joint Program in Art History of Case Western Reserve University and the Cleveland Museum of Art. All classes are taught at the museum, and courses are occasionally offered by the museum curators who hold adjunct appointments in the department. Students taking advanced-level courses use the museum's extensive research library, and all students have an opportunity to study original works of art in the museum's superb collections. Students majoring in art history have a wide variety of career opportunities. Graduates with a strong background in art are employed as teachers; as museum professionals (both curatorial and administrative); as art librarians and archivists; as journalists or as sales representatives in commercial art galleries, auction houses, and bookstores; as art conservators and restorers; as art educators. Graduates are employed as teachers; as museum professionals (both curatorial and administrative); as art librarians and archivists; as journalists or as sales representatives in commercial art galleries, auction houses, and bookstores; as art conservators and restorers; as art specialists in the diplomatic service and at all levels of government; and in industry, film, and television. Some of these specialties require additional study and professional preparation beyond the bachelor's degree.

Art Education

The Art Education program’s mission is “to prepare committed, knowledgeable, and creative professional art educators who will develop into leaders, teachers, and talented artists in the field of art education”.

The undergraduate and graduate degree programs in art education are given jointly with the Cleveland Institute of Art. Art education majors have the advantage of pursuing their academic studies in a university environment and their studio studies at a professional art school which educates artists and designers. Students participate in educational field experiences conducted in many of greater Cleveland’s urban, suburban and rural school systems, its hospitals, museums and cultural institutions. Graduates of the University’s art education programs have pursued careers as...
teachers, supervisors and consultants in public and private schools, colleges, art schools and museums; as administrators of galleries and art organizations; as art therapists in hospitals and community centers; as designers of educational programs for industry; and as practicing artists.

A second major and a minor sequence in pre-architecture are offered for those students expecting to continue architectural studies at the graduate level (or who simply wish to pursue an area of interest).

The university offers a variety of introductory and intermediate art studio courses taught by experienced artists/teachers in a newly renovated art building to students interested in developing and nurturing their artistic and creative talents.

Qualified undergraduates majoring in art history or art education may also participate in the Integrated Graduate Studies Program (see separate listing in this bulletin).

Faculty

Art History and Art

Ellen G. Landau, Ph.D. (University of Delaware)
Professor and Chair

20th century American and European art; Critical Theory and Gender Studies

Henry Adams, Ph.D. (Yale University)
Professor & Curator of American Painting, Cleveland Museum of Art

American art

David Carrier, Ph.D. (Columbia University)

Champney Family Professor

Methodology of Art History, Contemporary Art and Art Criticism

Jenifer Neils, Ph.D. (Princeton University)

Ruth Coulter Heede Professor

Ancient art and classical archaeology

Edward J. Olszewski, Ph.D. (University of Minnesota)

Professor

Italian Renaissance and Baroque art

Constantine Petridis, Ph.D. (Ghent University)

Assistant Professor & Assistant Curator, Cleveland Museum of Art

African Art

Catherine B. Scallen, Ph.D. (Princeton University)

Associate Professor and Undergraduate Advisor

Northern Renaissance and Baroque art and historiography

Harvard University

Adjunct Faculty

Curators of the Cleveland Museum of Art

Michael Bennett, Ph.D. (Harvard University)

Ancient Art

Susan Bergh, Ph.D. (Columbia University)

Art of the Ancient Americas

Michael Cunningham, Ph.D. (University of Chicago)

Japanese and Korean art

Stephen Fliegel, M.A. (University of Sheffield)

Medieval art

William Robinson, Ph.D. (Case Western Reserve University)

Modern art

J. Stanton Thomas, Ph.D. (Case Western Reserve University)

Medieval and Northern Renaissance art

Marjorie Williams, M.A. (University of Michigan)

Asian art

Art Education

Tim Shuckerow, M.A. (Case Western Reserve University)

Director of Art Education and Art Studio

Supervisor of Art Education

Amelia Joynes M.Ed. (Cleveland State University)

Supervisor of Art Education Secondary Student Teaching

Sandra Noble, M.A. (Cleveland State University)

Supervisor of Art Education Elementary Student Teaching and Clinical/Field-Based Experience

Undergraduate Programs

Majors

Art History

The curriculum in art history is designed to give students a broad grounding in painting, sculpture, architecture and the decorative arts, with a strong emphasis on understanding the cultural context in which they were produced. Students also develop a technical and critical vocabulary as well as sound writing skills to analyze works of art.

The major in art history, which leads to the Bachelor of Arts degree, requires 36 hours of course work in art history, including:

ARTh 101, Art History I (3)

ARTh 102, Art History II (3)

ARTh 396, Majors Seminar (3)

At least 6 credit hours must be taken at the 200 level. At least 15 credit hours must be taken at the 300 level. One approved art studio course is also required. Foreign language study (French, German, or Italian) is highly recommended.

Pre-Architecture

The pre-architecture major leads to the Bachelor of Arts degree. However, it may be chosen only as a second major. The double major is required so that the perspectives provided by this interdisciplinary program may be complemented by a concentrated disciplinary experience. The pre-architecture program introduces the student to the forms, history, and functions of architecture as well as the studio skills relevant to its practice. The program is designed to provide a background for undergraduate students who plan to continue architectural studies at the graduate level, as well as for those interested in the study of architecture as part of a liberal or technical education.

To declare a pre-architecture major, students should have declared a first major and have sophomore or junior standing. Up to 6 credits in general education requirements and elective courses taken by students for their first major may be applied to their pre-architecture major.

The major consists of a minimum of 30 credit hours, 15 of which are in required courses and the remainder of which are approved elective courses. Detailed information about approved electives is available in the departmental office.

The required courses are:

ARTS 302, 303, Architecture and City Design I, II (3, 3)

ARTH 101, Art History I (3)

ARTH 102, Art History II (3)

ARTS 106, Creative Drawing I (3)

Fifteen hours of electives must be selected from the following groups:

A. 6 hours from selected art history courses.

B. 6 hours from:

ARTS 101, 201, Design and Color I, II (3,3)

ARTS 206, Creative Drawing II (3)

ARTS 220, Photography Studio I (3)

THTR 223, 224, Stagecraft I, II (3,3)

C. For students whose interests lie in aesthetics and the history of architecture, 3 hours in sociology, American studies, anthropology, history of science and technology, civil engineering, or geology. Students are encouraged to include as many of the courses listed below as possible in their schedules:

MATH 125, 126, Mathematics I, II (4,4)

PHYS 115, 116, Introduction to Physics (4,4) and Laboratory (4,4)
PHYS 121, General Physics-Mechanics (4)  
PHYS 122, General Physics II-Electricity and Magnetism (4) and Laboratory

Art Education

The program in art education, which leads to the Bachelor of Science degree, requires a total of 123 credits and is designed to educate professional teachers of art for the public and private schools who are also competent, creative artists. The program meets all requirements of the Ohio Board of Education to qualify its University-recommended students for PreK-12 Art Specialist Licensure to teach art in the public schools of Ohio and over 40 reciprocating states.

This program is conducted jointly by Case Western Reserve University and the Cleveland Institute of Art. Admission requires application to Case Western Reserve and submission of an art portfolio to the Cleveland Institute of Art. Credentials must be acceptable to both institutions. Academic work is taken at Case Western Reserve University and studio courses at the Cleveland Institute of Art, as follows:

Academic Courses at Case Western Reserve University

- *ENGL 150 ................................................................. 3
- PHED (two semesters-Lifetime Sports Activities) .................. 0
- *GER: Mathematics ..................................................... 3
- *GER: Natural Sciences .................................................. 3
- *GER: Natural Science or Science and Society ..................... 3
- *Art History 101, 102 .................................................... 6
- *GER: History, Philosophy, Religion .................................. 6
- *PSCL 101, EDUC 304 .................................................. 6
- *EDUC 301 ................................................................. 3
- ARTH electives (one must be at 300 level) ......................... 6
- ENGL elective (300 level) ................................................. 3
- *GER: Global and Cultural Diversity .................................. 3
- One open elective (300 level) ........................................... 3

*indicates courses fulfilling Arts and Sciences General Education

Requirements

Art Studio at Cleveland Institute of Art

Total of 51 hours of studio possible, taken at the Cleveland Institute of Art

- Computer Basics 101, 201 ................................................. 3
- Design 107, 108, 209 ..................................................... 9
- Drawing 117, 118, 217 .................................................... 9
- Painting 121, 122, 210 .................................................... 9
- Sculpture 227 .............................................................. 3
- 5 studio electives at 3 hours each .................................. 15
- CIA open elective ....................................................... 3

Retention and Advanced Standing

(Undergraduate Level)

Students in art education who expect to meet Ohio’s licensure requirements must apply for advanced standing by the end of their first semester junior year. To apply, students must submit to the art education faculty information about grade point average, written personal goals, three faculty recommendations, self-analysis of program progress up to the point of evaluation, and have an interview with the program director. Art education faculty may (1) accept a student for advanced standing; (2) accept a student with reservation, with a remedial plan; or (3) reject a student and recommend a career change.

To enter student teaching, a 2.5 cumulative University grade point average is required, a 3.0 cumulative G.P.A. average in professional education courses, and a total of 500 contact hours of clinical field-based experience acquired in a variety of settings as required by the State of Ohio. Fingerprinting for a criminal background check by the Ohio Bureau of Criminal Identification is required. For students who have not lived in Ohio consecutively for the past five years, a background check through the Federal Bureau of Investigation is also required.

To be recommended by the university’s director of teacher licensure for State Teacher Licensure, a 3.0 cumulative G.P.A. must be maintained in all professional education courses. An overall G.P.A. of 2.5 must be maintained. The Ohio Department of Education requires passing scores on the Praxis II Principles of Learning and Teaching and Art Content Knowledge exams in addition to the requirements stated above.

Completion of the Bachelor of Science degree exists separately from the assurance that State of Ohio Visual Art Teacher Licensure will be awarded.

Additional information on this program is available in the office of the director of art education.

Minors

Four minors are available in art: one in art history, and three through the art studio program:

Art History

Requires 18 hours of art history including:
- ARTH 101, Art History I (3)
- ARTH 102, Art History II (3)
At least three credit hours must be taken at the 200 level.

Art Studio

Requires 18 hours in art studio including:
- ARTS 101, Design and Color (3)
- ARTS 106, Creative Drawing (3)
Four additional studio courses, two of which must be in the same area (i.e., drawing, painting, design, photography, or ceramics).

Photography

Requires 18 hours including:
- ARTS 220, Photograpy Studio I (3)
- ARTS 320, Photography Studio II (3)
- ARTS 322, Photography: Color Studio (3)
- ARTS 325, Creative Photography (3) or ARTS 365D, Black and White Photography Studio
- ARTS 365E, Color Studio (3) or ARTS 365K, Creative Photography
An elective, either ARTS 399, Independent Study in Art Studio (3) or ARTH102, Art History II (3)

Pre-Architecture

Requires 18 hours including:
- ARTS 302, 303, Architecture and City Design I, II (3, 3)
- ARTH 101, Art History I (3)
- ARTH 102, Art History II (3)
- ARTS 106, Creative Drawing (3)
One approved elective.

Sequences

Sequences for students in the Engineering Core are available in art history and in art studio, in photography, and in pre-architecture. Sequences must include three art history courses, two of which should be at the 100 or 200 level, and selected in consultation with the departmental advisor. Art history sequences may
include one three-hour course in art studio. A pre-architecture sequence is offered by art studio, drawn from ARTS 106, 302, 303; ARTH 101, 102.

Departmental Honors
Majors who wish to earn the Bachelor of Arts degree with Honors in Art History must make written application to the department chair no later than the fall semester of their senior year. Departmental honors are awarded upon fulfillment of the following requirements: a grade point average of at least 3.5 in the major and an honors thesis (ARTH 399) that receives a grade of A.

Integrated Graduate Studies
Qualified undergraduates majoring in art history or art education also may participate in the Integrated Graduate Studies Program. Interested students should note the general requirements and the admission procedure in this bulletin and may consult the department for further information.

Graduate Programs

Master of Arts in Art History
The master's program in art history is designed to provide the student with a broad knowledge of the major art historical periods, the scholarly and bibliographical resources, and the methodologies of art history. It also offers an opportunity to investigate art historical problems in some depth. In addition to the regular graduate school application form, applicants to the graduate program in art history are required to submit GRE scores and copies of two term papers which they consider to represent their best work. Applicants for the M.A. should have a BA major or minor concentration in art history or a related humanities field and a minimum G.P.A. of 3.0.

The master's degree in art history is conducted exclusively under Plan B as described under the School of Graduate Studies in this bulletin. All other requirements of the M.A. program must be fulfilled:

ARTH 490, Visual Arts and Museums (3)
ARTH 495, Methodology of Art History (3)
Eight graduate courses, including one each from four of the following five areas, three of which must be seminars at the 500-level (24):
1. Non-Western
2. Ancient
3. Medieval
4. Renaissance/Baroque
5. Modern and American
A reading knowledge of one foreign language (French, German, or Italian).
Successful performance on the M.A. comprehensive examination.
3 credit hours of Qualifying Paper (ARTH 489)

Total: 30 hours.

Master of Arts in Art History and Museum Studies
The master's program in art history and museum studies includes the same broad requirements and objectives of the master's program in art history, with additional study of art museum procedures and two supervised museum internships.

The requirements include:

ARTH 495, Methodology of Art History (3)
ARTH 490, Visual Arts and Museums (3)
ARTH 491A&B, Visual Arts and Museums: Internship (1/3)

Seven graduate courses, including one each from four of the following five areas, three of which must be graduate seminars at the 500 level (21):
1. Non-Western
2. Ancient
3. Medieval
4. Renaissance/Baroque
5. Modern and American

Total 31 hours

Master of Arts in Art Education
The Master of Arts in Art Education is offered in two plans: Plan I for those who are already teacher licensed and who desire advanced studio- and art-related studies; Plan II for those holding the Bachelor of Fine Arts or equivalent degree who desire teaching licensure as visual art specialists. Both programs are offered jointly by Case Western Reserve University and the Cleveland Institute of Art.

The admission procedure includes a formal application, three letters of recommendation, and a college transcript, which are to be submitted to the Art Education office. The Cleveland Institute of Art admission procedure requires a portfolio of art work. Approval by both the University and the Cleveland Institute of Art is required for admission. Information and application forms are available through the office of Graduate Admission at Case Western Reserve University and through the department.

Students in this program may follow either of two plans.

Plan I: 36 semester hours of course credit:
18 hours in studio to be taken at the Cleveland Institute of Art at the 300 level or above; and 18 hours in academic courses to be taken at Case Western Reserve University at the 400 level or above, to be selected in consultation with the Director of Art Education; or
30 semester hours of course credit: 18 hours in studio to be taken at the Cleveland Institute of Art at the 300 level or above and 12 hours in academic courses to be taken at Case Western Reserve University at the 400 level or above, to be selected in consultation with the Director of Art Education; AND a thesis based on individual research not less than 6 semester hours of registration.

Plan II: 36 semester hours of course credit:
(Teacher Licensure Track for holders of the Bachelor of Fine Arts degree or equivalent studio background)
EDUC 401, Introduction to Education (3)
EDUC 404, Educational Psychology (3)
ARTS 385, Clinical Field-Based Experience I (1)
ARTS 385, Clinical Field-Based Experience II (1)
ARTS 387, Clinical Field-Based Experience III (1)
ARTS 400, Current Issues in Art Education (3)
ARTS 493, Art Content, Pedagogy, Methodology, and Assessment (3)
ARTS 466 A&B, Student Teaching in Art for Pre-K – 6th Grade and 7th – 12th Grade (4 each)
ARTS 465, Seminar for Art Teachers (4)
ARTS 602, Study in Art Education (3)
Studio electives at the Cleveland Institute of Art at the 300-level or above (6)

Retention and Advanced Standing
(Graduate Level)
Students in art education who expect to meet state teacher licensure requirements must apply for advanced standing prior to the semester in which they register for student teaching. To apply, students must submit to the art education faculty information about grade point average, personal goals, and self-analysis of
performance in the program up to the point of evaluation. Art education faculty may (1) accept a student for advanced standing; (2) accept a student with reservation, with a remedial plan; or (3) reject a student and recommend a career change.

A 3.0 cumulative grade point average is required to enter student teaching as well as a total of 300 contact hours of clinical field-based experience as required by the State of Ohio.

A 3.0 grade point average must be maintained in all professional education courses and an overall G.P.A. of 3.0 is required to be recommended by the university’s Director of Teacher Licensure for State Teacher Licensure.

Completion of the Master of Arts degree exists separately from the assurance that State of Ohio Visual Art Teacher Certification will be awarded. The State of Ohio requires a passing score on the National Teacher Examination, fingerprinting with a criminal background check by the Ohio Bureau of Criminal Identification, in addition to the requirements stated above. All M.A. degree candidates are required to present a documented thesis exhibition in the program’s gallery of their art work prior to graduation.

**Doctor of Philosophy in Art History**

The doctorate in Art History is designed to allow advanced graduate students the opportunity to specialize in designated areas. Admission to the program requires an M.A. in art history or its equivalent, including a reading knowledge of one approved foreign language (French, German, or Italian). A qualifying examination or the equivalent is also required for admission at the doctoral level.

Applicants are required to submit GRE scores and two papers written during their matriculation for a master’s degree or a thesis if completed by the time of application.

University requirements for the Ph.D. include a minimum of 36 hours of course credits, but the department may require additional course work as preparation for the general examination or for the dissertation. The minimum credits are to be distributed as follows: ARTH 495, Methodologies of Art History (3); two graduate seminars at the 500 level or above (6); three additional courses at the 400 level or above (9); and a minimum of 18 hours of ARTH 701, Ph.D. Dissertation.

Doctoral students must demonstrate an ability to read two approved languages (other than English) useful in art historical research. German is normally required as one of the two languages for students concentrating in Western art. Both languages must be approved by the department at the time of admission or during the first semester of doctoral study.

Ph.D. students are required to pass a written and oral general examination before being advanced to candidacy. Within two weeks after the written examination, the faculty examining committee will administer the oral examination. A final evaluation will be based on the student’s performance in both the written and oral sections of the general examination.

**Doctor of Philosophy in Art History and Museum Studies**

The Ph.D. program in art history and museum studies is offered to a limited number of candidates. The program combines the academic requirements of a Ph.D. with practical museum training and is designed to provide experience in connoisseurship, conservation, and art education, as well as a planned program of academic course work and independent research. Admission to the program is made on the basis of academic record, experience, recommendations, and personal interviews. A master’s degree in art history or its equivalent is required for admission as well as GRE scores and a reading knowledge of one foreign language. A Ph.D. qualifying examination or the equivalent is also required for admission.

Students in the Museum Studies Program are required to take a minimum of 38 hours of graduate study as follows: ARTH 610, Cleveland Museum of Art Internship (2); two graduate seminars at the 500 level or above (6); four elective courses at the 400 level or above (12); and a minimum of 18 hours of ARTH 701, Ph.D. Dissertation.

During the two-semester internship, the student will be assigned to one or more departments in the Cleveland Museum of Art for supervised study and practice that will be evaluated by a member of the Joint Faculty in Art History. The dissertation subject may be related to some aspect of art museum research; it may take the form of a special collection or exhibition catalogue, but it must satisfy the scholarly standards of the department and the University. Any student who has not taken ARTH 495, Methodologies of Art History or the equivalent, will be required to do so as part of the 12 hours of elective courses. Students also must satisfy all other requirements for the Ph.D. degree in art history.

**Art History (ARTH)**

**Undergraduate Courses**

**ARTH 101. Art History I: Pyramids to Pagodas (3)**
The first half of a two-semester survey of world art highlighting the major monuments of the ancient Mediterranean, medieval Europe, MesoAmerica, Africa, and Asia. Special emphasis on visual analysis, and socio-cultural contexts, and objects in the Cleveland Museum of Art.

**ARTH 102. Art History II: Michelangelo to Mapplethorpe (3)**
The second half of a two-semester survey of world art highlighting the major monuments of Renaissance and Baroque Europe, America, and Asia. Special emphasis on visual analysis historical and sociocultural contexts and objects in the Cleveland Museum of Art. (ARTH 101 and 102 may be combined, or either can be taken in conjunction with any other 100 or 200 level Art History class to complete a sequence in the Arts portion of the Humanities section of the General Education Requirements in the College of Arts and Sciences or can be used as part of a three course Humanities sequence in the Engineering Core curriculum.)

**ARTH 103. Works of Art, Images, and Artifacts (3)**
This course is designed to introduce students to the history of art and to the cultural resources of University Circle. It is comprised of slide lectures, videos, presentations by invited curators, and visits to the museums surrounding the University. By examining a variety of objects from many times and places and raising issues that cut across categories, it encourages discussion and helps to develop a critical understanding of visual and material culture.

**ARTH 203. The Arts of Asia (3)**
A survey of Japanese and Chinese art from the Bronze Age to the 18th century, with particular emphasis on objects in the Cleveland Museum of Art. The relationship of art works to Buddhism and Hinduism is explored along with cultural rituals, ceremonies, and traditions.

**ARTH 226. Introduction to Greek and Roman Art (3)**
Classical art from the 8th century B.C. to the fourth century A.D.; the major developments in the architecture, sculpture, and painting of ancient Greece, Etruria, and Rome. Cross-listed as CLSC 226.

**ARTH 227. Ancient Cities and Sanctuaries (3)**
A selection of cities and sanctuaries from the ancient Near East, Egypt, the Aegean, Greece, Etruria, and Rome: their political and religious institutions and the relationship to contemporary art forms. Cross-listed as CLSC 227.

**ARTH 240. Introduction to Medieval Art (3)**
Architecture, sculpture, painting, manuscript illumination, mosaics, and metal work from Early Christian period through later Middle Ages.
ARTh 250. Art in the Age of Discovery (3)
A survey of developments in Renaissance art and architecture in northern Europe and Italy during a new age of science, discovery and exploration, 1400-1600.

ARTh 260. Art in the Age of Grandeur (3)
A survey of European art in the seventeenth and eighteenth centuries, an era of rising nationalism, political aggrandizement, religious expansion and extravagant art patronage.

ARTh 270. American Art and Culture Before 1900 (3)
Survey of the development of American art from colonial times to the present which explores how art has expressed both American values and American anxieties. Painting is emphasized, but the course also considers architecture, the decorative arts, film, literature, and music. Cross-listed as AMST 270.

ARTh 271. American Art and Culture: The Twentieth Century (3)
Survey of the development of American art from 1900 to the present (and the future) which will explore how art has expressed both American values and American anxieties. Painting will be emphasized, but the course will also consider architecture, the decorative arts, film, literature, and music. Cross-listed as AMST 270.

ARTh 280. Modern Art and Modern Science (3)
An examination of the development of painting, sculpture, and architecture from the 19th to the mid 20th century. Special attention is given to the emergence of “modernism” and the influence of science on such movements as Impressionism and Cubism.

ARTh 284. History of Photography (3)
A survey of the history of photography from its inception in 1839 to the present. Emphasis is on the complex relationship between technological innovations and picture-making; the artistic, documentary, and personal uses of photography; and the relationship of photography to other art forms.

ARTh 290. Introduction to the Art of Sub-Saharan Africa (3)
Exploration of the diverse forms and multiple contexts of the visual arts of sub-Saharan Africa. Attention focused on the sculpture of different peoples of West and Central Africa. Ancient arts in terracotta and bronze of Nigeria, Mali, and Chad and rock art of Saharan, Southern, and Eastern Africa will also be explored. Topics such as the styles, aesthetics, meanings, and functions of African art and the training, techniques, and status of the African artist will be discussed.

ARTh 300. Childhood through Art (3)
This course will explore the imagery of children in art from its beginnings in ancient Egyptian sculpture up to the present with photographs by Mapplethorpe and Sally Mann. In order to develop a critical awareness of how children are portrayed and how the viewer is manipulated, students will study specific works of art in the Cleveland Museum of Art as well as examples from contemporary visual culture. Cross-listed as CHST 300.

ARTh 302. Buddhist Art in Asia (3)
The development of Buddhist art from its origins in India along the silk route to China and along the maritime routes to Japan and southeast Asia.

ARTh 303. History of Far Eastern Art (3)
A survey of traditional arts of Asia east of the Indus river, designed to emphasize the creative contributions of the artist with particular attention to the international relations of: the Bronze Age, Buddhist art, Hindu art and the later arts of China, Korea, and Japan. National and regional contributions to the developed styles of South Asia and the Far East will be stressed.

ARTh 305. The Art of India (3)
A survey of Indian art from the Indus valley civilization to the Islamic conquest of India. Stylistic developments of the three-dimensional arts examined through cave sites and other extant materials.

ARTh 306. History of Indian Sculpture (3)
The stylistic development of both Buddhist and Hindu schools of Indian sculpture from the prehistoric period to the 12th century. Sculptural images are studied in terms of Indian mythology and literature.

ARTh 328. Greek Sculpture (3)
Greek sculpture from the Archaic period through the Hellenistic; style, the development of specific types, and the uses of architectural sculpture. Cross-listed as CLSc 328.

ARTh 332. Art and Archaeology of Ancient Italy (3)
The arts of the Italian peninsula from the 8th century B.C. to the 4th century A.D., with emphasis on recent archaeological discoveries. Lectures deal with architecture, sculpture, painting, and the decorative arts; supplemented by gallery tours at the Cleveland Museum of Art. Cross-listed as CLSc 332.

ARTh 333. Greek and Roman Painting (3)
Greek vase painting, Etruscan tomb painting and Roman wall painting. The development of monumental painting in antiquity. Cross-listed as CLSc 333.

ARTh 334. Art and Classical Archaeology of Greece (3)
A survey of the art and architecture of Greece from the beginning of the Bronze Age (3000 B.C.) to the Roman conquest (100 B.C.) with emphasis on recent archaeological discoveries. Lectures deal with architecture, sculpture, painting and the decorative arts, supplemented by gallery tours at the Cleveland Museum of Art. Cross-listed as CLSc 334.

ARTh 340. Issues in Non-Western Art (3)
Various topics in non-western art. Lectures, discussions, and reports.

ARTh 350. Topics in Medieval Art (3)
Various topics in Medieval Art. Lectures, discussions, and reports.

ARTh 351. Late Gothic Art in Italy (3)
Sculpture of the Pisani; early trends in Pisa, Siena, and Florence: Cimabue and Giotto; Duccio, Simone Martini, and the Lorenzetti; painting in Florence and Siena after the Black Death.

ARTh 352. Italian Art of the 15th Century (3)
The early 15th century in Florence: civic humanism, the sculpture of Ghiberti and Donatello, the painting of Masaccio; the International Style in painting, the art of Uccello, Piero della Francesca, Mantegna, and Botticelli; Carpaccio and the Bellini in Venice.

ARTh 353. Sixteenth Century Italian Art (3)
The development of the High Renaissance and Mannerist styles in Italy and late 16th century trends: painting and sculpture.

ARTh 356. Italian Renaissance and Baroque Sculpture (3)
Italian sculpture from the early 12th century to the later 18th century. The Pisani, Ghiberti, Donatello, Michelangelo, the Mannerists and Bernini.

ARTh 361. Dutch and Flemish 17th Century Painting (3)
The golden age of Dutch and Flemish art with study of major masters (Rubens, Hals, Rembrandt, and Vermeer) and developments in subject matter: landscape, still-life, and genre themes.

ARTh 362. Issues in Renaissance Art (3)
Various topics in Renaissance art. Lectures, discussions and reports.

ARTh 365. Issues in Baroque Art (3)
Various topics in baroque art. Lectures, discussions and reports.

ARTh 367. 17th and 18th Century French Art (3)
A survey of the arts of painting, sculpture and architecture in France from 1600 to 1780. Attention will be given to stylistic developments and to social and political contexts, patronage and art theory.

ARTh 374. Impressionism to Symbolism (3)
Major developments in European painting and sculpture during the latter half of the nineteenth century. Post-impressionism, Cubism, and the arts and crafts movement considered in their socio-cultural contexts. Works of Degas, Manet, Monet, Klimt, Bocklin, Gauguin, etc.

ARTh 379. Issues in 19th Century Art (3)
Various topics in 19th century art, with class lectures, discussions and reports. Consult department for current topic.

ARTh 380. Abstract Expressionism and Its Aftermath (3)
An examination of the development and influences of Abstract Expressionism, including the impact on the Beat Generation and Post Art.

ARTh 381. Neoclassicism to Realism (3)
The main developments of European art chiefly painting and sculpture from post-impressionism to the present; the nature of abstract art and the
interrelationships between the visual arts and new developments in literature, philosophy, and science.

ARTh 382. Visions of Utopia: 20th Century European Art (3)
Major movements in early 20th century European painting and sculpture with utopian goals. Focus on the interrelationships between the visual arts and new developments in literature, philosophy, and sciences.

ARTh 383. Gender Issues in Feminist Art (3)
An in-depth thematic approach to issues affecting works of art by and about women. Focus on the late 20th century. Emphasis on a specifically modern use of feminine myths, subjects and modes of production, and feminist criticism.

ARTh 385. American Avant-Garde: 1900 - 1925 (3)
An examination of the development of avant-garde styles in New York during the early twentieth century. In-depth discussion of the Post-structure, Stieglitz’s “291” gallery, the Armory Show, Marcel Duchamp’s move to America, and the formation and demise of the New York Dada movement.

ARTh 392. Issues in 20th Century Art (3)
Various topics in 20th century art, with class lectures, discussions and reports.

ARTh 393. Contemporary Art: Critical Directions (3)
An examination of the directions taken by avant-garde American art and criticism in the aftermath of Abstract Expressionism. Includes the rise and fall of modernism in the 1960s and 70s, as well as an investigation of Post-modern trends and theories.

ARTh 396. Majors Seminar (3)
A group discussion course designed to focus on methodology and the relationship between art and contemporary society. Required of majors. Offered in alternate years.

ARTh 397. History of Prints and Printmaking (3)
Development of techniques and style and the social function of prints. The great masters: Durer, Rembrandt, Goya, and others. Based on the extensive collections of the Cleveland Museum of Art.

ARTh 398. Independent Study in Art History (1-3)
Individual research and reports on special topics.

ARTh 399. Honors Thesis (3)
Intensive study of a topic or problem leading to the preparation of an honors thesis.

Graduate Courses

ARTh 400. Childhood through Art (3)
(See ARTH 300.)

ARTh 402. Buddhist Art in Asia (3)
(See ARTH 302.)

ARTh 403. History of Far Eastern Art (3)
(See ARTH 303.)

ARTh 405. The Art of India (3)
(See ARTH 305.)

ARTh 406. History of Indian Sculpture (3)
(See ARTH 306.)

ARTh 428. Greek Sculpture (3)
(See ARTH 328.)

ARTh 432. Art and Archaeology of Ancient Italy (3)
(See ARTH 332.)

ARTh 433. Greek and Roman Painting (3)
(See ARTH 333.)

ARTh 434. Art and Classical Archaeology of Greece (3)
(See ARTH 334.)

ARTh 440. Issues in Non-Western Art (3)
(See ARTH 340.)

ARTh 450. Topics in Medieval Art (3)
(See ARTH 350.)

ARTh 451. Late Gothic Art in Italy (3)
(See ARTH 351.)

ARTh 452. Italian Art of the 15th Century (3)
(See ARTH 352.)

ARTh 453. Sixteenth Century Italian Art (3)
(See ARTH 353.)

ARTh 456. Italian Renaissance and Baroque Sculpture (3)
(See ARTH 356.)

ARTh 461. Dutch and Flemish 17th Century Painting (3)
(See ARTH 361.)

ARTh 462. Issues in Renaissance Art (3)
(See ARTH 362.)

ARTh 465. Issues in Baroque Art (3)
(See ARTH 365.)

ARTh 467. 17th and 18th Century French Art (3)
(See ARTH 367.)

ARTh 474. Impressionism to Symbolism (3)
(See ARTH 374.)

ARTh 479. Issues in 19th Century Art (3)
(See ARTH 379.)

ARTh 480. Abstract Expressionism and Its Aftermath (3)
(See ARTH 380.)

ARTh 481. Neoclassicism to Realism (3)
(See ARTH 381.)

ARTh 482. Visions of Utopia: 20th Century European Art (3)
(See ARTH 382.)

ARTh 483. Gender Issues in Feminist Art (3)
(See ARTH 383.)

ARTh 485. American Avant-Garde: 1900 - 1925 (3)
(See ARTH 385.)

ARTh 489. M.A. Qualifying Paper (3)
Individual research and intensive study of a specific topic in art history which culminates in a written M.A. Qualifying Paper. Prereq: 26 credit hours of Art History.

ARTh 490. Visual Arts and Museums (3)
Students who successfully complete this course may be considered for admission into ARTH 491A, a supervised internship in an art museum or gallery situation.

ARTh 491A. Visual Arts and Museums: Internship (1)
Prereq: ARTH 490.

ARTh 491B. Visual Arts and Museums: Internship (3)
Second semester of Internship; includes final project devised in consultation with Director of Museum Studies. Prereq: ARTH 490 and ARTH 491A.

ARTh 492. Issues in 20th Century Art (3)
(See ARTH 392.)

ARTh 493. Contemporary Art: Critical Directions (3)
(See ARTH 393.)

ARTh 494A. Ancient Art (1-3)
Directed reading. Consent of professor and department chair required before registering.

ARTh 494C. Medieval Art (1-3)
Directed reading. Consent of professor and department chair required before registering.

ARTh 494D. Renaissance and Baroque Art (1-3)
Directed reading. Consent of professor and department chair required before registering.

ARTh 494E. American Art (1-3)
Directed reading. Consent of professor and department chair required before registering.

ARTh 494F. Modern Art (1-3)
Directed reading. Consent of professor and department chair required before registering.

ARTh 495. Methodologies of Art History (3)
The study of art history as a discipline in its practical and theoretical aspects. Consideration given to research methods, style and historical con-
text, and a critical examination of selected major art historical texts with a view to understanding traditional as well as recent approaches. Special attention is given to art historical writing, employing selected original works in the Cleveland Museum of Art. Required of first-year graduate students in the Ph.D. and Master’s programs.

ARTH 497. History of Prints and Printmaking (3)
(See ARTH 397.)

ARTH 512. Seminar in Ancient Art (3)

ARTH 518B. Seminar in Asian Art (3)

ARTH 540. Seminar in Non-Western Art (3)
Topics may include: African Art and The West, Africa: Symbolism and Ritual, The Classic Period in Mesoamerica, Andean Textiles.

ARTH 545B. Seminar in Medieval Art (3)

ARTH 550. Seminar: Issues in Western European Art (3)

ARTH 551. Seminar in Renaissance Art (3)

ARTH 552. Seminar in Baroque Art (3)

ARTH 565. Seminar in American Art (3)

ARTH 570. Seminar: 19th Century Art (3)

ARTH 575. Critical Theory Seminar (3)
In-depth study of controversial revisionist writings which demonstrate the strong impact of structuralist, poststructuralist, semiotic, Marxist, psychoanalytic, film, and gender theories on recent art historical discourse. Discussion of a wide range of current theoretical positions applied to visual and critical analysis of 19th and 20th century art works. Prereq: ARTH 495.

ARTH 576. Seminar in Modern Art (3)

ARTH 601. Research in Art History (1-18)
(Credit as arranged.)

ARTH 610. Cleveland Museum of Art Intern (1)
Prereq: ARTH 490.

ARTH 651. Thesis M.A. (1-18)

ARTH 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

ARTH 702. Appointed Dissertation Fellow (9)

Art Education/Art Studio (ARTS)

Undergraduate Courses

ARTS 101. Design and Color I (3)
Organizational and structural problems as a basis for the development of style. Studies in line, texture, shape, space, value, color, and two dimensional composition through studio problems.

ARTS 106. Creative Drawing I (3)
Development of graphic fluency in black and white through direct observation of nature and the model. Drawing as a means of enlarging visual sensitivity using a wide range of media and subject matter. Work from model.

ARTS 201. Design and Color II (3)

ARTS 206. Creative Drawing II (3)
Continuation of ARTS 106. Advanced work in graphic representation. Development of visual acuity and a personal drawing style while working in color. Work from the model. Prereq: ARTS 106.

ARTS 210. Enameling and Jewelry I (3)
Techniques in the application of vitreous enamel on copper and of constructed metal jewelry. Technical skill and suitability of design as applied to the medium.

ARTS 212. Weaving, Fibers, and Textiles I (3)
Basic techniques of weaving, macrame, and textile printing. Use of natural and synthetic fibers. Introduction to batik, quilting, and block printing on fabric.

ARTS 214. Ceramics I (3)
The techniques of hand building. Development of sensitivity to design and form. Basic work in stoneware, earthenware, and glazing.

ARTS 216. Painting I (3)
The creative, conceptual, visual, and technical aspects of painting. Style ranging from naturalism to abstraction. Work in acrylic and mixed media.

ARTS 220. Photography Studio I (3)
Camera, film, and darkroom techniques. Development of basic perceptive and photographic skills. Darkroom and photographic field and lab work. 35mm camera required.

ARTS 295. Introduction to Art Education (3)
General history and theories of art education. Development of personal philosophy as basis for teaching art. Topics in professional standards, creativity, aesthetic theory, and art criticism.

ARTS 300. Current Issues in Art Education (3)
Contemporary issues in Art Education; understanding art goals and standards of National Art Education Association and the Ohio State Department of Education for teachers, students and administrators. Special topics: art and technology, multiculturalism, and special populations. Prereq: ARTS 295.

ARTS 302. Architecture and City Design I (3)
The social, spatial, and aesthetic elements in architecture; the components of the building: the window, door, roof, enclosing walls, and character of interior and exterior space. Problems related to small, intimate scale and residential structures. Lectures, field trips, studio experiences. Recommended ARTS 101 or ARTS 106 courses prior to enrollment.

ARTS 303. Architecture and City Design II (3)
The social, spatial, and aesthetic elements of the urban setting of architecture, the organizational components of the city, the path, the node, the edge, and the grid. Problems related to large-scale and public buildings and their relationship to the encompassing visual world. Lectures, field trips, studio experiences. Recommended ARTS 101 or ARTS 106 courses prior to enrollment.

ARTS 310. Enameling and Jewelry II (3)

ARTS 312. Weaving, Fibers, and Textile II (3)
Continuation of ARTS 212. Development of a selected area of weaving or textiles: loom weaving tapestry, three dimensional work, batik, or fabric printing. Exploration of an area through design and execution of a series of projects. Prereq: ARTS 212.

ARTS 314. Ceramics II (3)
Continuation of ARTS 214. Problematic approach to technical aspects of ceramics: extensive experience in wheel throwing, experimentation with glaze and clay body formulation. Prereq: ARTS 214.

ARTS 316. Painting II (3)

ARTS 320. Photography Studio II (3)
Continuation of ARTS 220. Advanced theory and black and white techniques, historic processes and theory. Development of personal aesthetic encouraged. Field work. 35mm camera required. Prereq: ARTS 220.

ARTS 322. Photography: Color Studio (3)
Personal expression through use of color photography. Introduction to color printing and processing techniques. History of the medium. Field and lab work. 35mm camera required. Prereq: ARTS 220.

ARTS 325. Creative Photography (3)
Creative photography through photographing and responding to photographs. The question of self-expression and photographic medium explored in the pursuit of understanding images. Prereq: ARTS 220 and ARTS 320 or ARTS 322.

ARTS 365A. Painting (3)
Advanced painting problems determined in consultation with instructor. Prereq: ARTS 216 and ARTS 316.
ARTS 365B. Design and Color (3)
Advanced design problem determined in consultation with instructor. Prereq: ARTS 101 and ARTS 201.

ARTS 365C. Enameling and Jewelry (3)
Advanced enameling and jewelry problems determined in consultation with instructor. Prereq: ARTS 210 and ARTS 310.

ARTS 365D. B&W Photography Studio (3)
Advanced black and white problems determined in consultation with instructor. Prereq: ARTS 220 and ARTS 320.

ARTS 365E. Color Studio (3)
Advanced color studio problems determined in consultation with instructor. Prereq: ARTS 220 and ARTS 320.

ARTS 365F. Creative Drawing (3)
Advanced multimedia drawing. Prereq: ARTS 106 and ARTS 206.

ARTS 365G. Ceramics (3)
Advanced ceramics problems determined in consultation with instructor. Prereq: ARTS 214 and ARTS 314.

ARTS 365H. Weaving, Fibers, and Textiles (3)
Advance textile problems determined in consultation with instructor. Prereq: ARTS 212 and ARTS 312.

ARTS 365K. Creative Photography (3)
Incorporates computer technologies and multimedia processes with photography. Prereq: ARTS 220 and ARTS 320 and ARTS 322.

ARTS 366A. Student Teaching in Art: Pre-K - 6th Grade (4)

ARTS 366B. Student Teaching in Art: 7th - 12th Grade (4)

ARTS 385. Clinical/Field Based Experience I (1)
Art education students observe and assist art teachers in classes in a variety of public and private educational environments such as local schools, Cleveland Museum of Art, and Cleveland Children’s Museum. Students study, identify, and analyze differences in art curriculum taught at the various art programs that they observe. Written reports using departmental observation guidelines are required. Prereq: ARTS 295 or consent of Art Education director.

ARTS 386. Clinical/Field Based Experience II (1)
Art education students become sensitized to serving needs of “special” populations. Observation of educational strategies for teaching learning disabled and/or physically disabled students. Written reports using departmental observation guidelines required. Prereq: ARTS 295 or consent of Art Education director.

ARTS 387. Clinical/Field Based Experience III (1)
Art education students observe and assist in art programs for artistically gifted students working in specialized art areas (drawing, painting, sculpture, printmaking, art history). Written reports using departmental observation guidelines are required. Prereq: ARTS 295.

ARTS 393. Art Content, Pedagogy, Methodology, and Assessment (3)
Growth and development of image making from Pre-K through young adult. Principles and practices of art instruction in grades Pre-K through 12th grade. Issues in art education. Curriculum construction, implementation and assessment of art lessons that address content areas of art production, art history, art appreciation, and art criticism. Clinical field experiences required. Prereq: ARTS 295.

ARTS 399. Independent Study in Art Studio (1-3)
Prereq: Permit required from Director of Art Studio.

Graduate Courses

ARTS 400. Current Issues in Art Education (3)
(See ARTS 300.) Research paper required for graduate students.

ARTS 402. Architecture and City Design I (3)
(See ARTS 302.)

ARTS 403. Architecture and City Design II (3)
(See ARTS 303.)

ARTS 465. Seminar for Art Teachers (4)
(See ARTS 303.)

ARTS 466A. Student Teaching in Art: Pre-K - 6th Grade (4)
(See ARTS 366A.) Prereq: ARTS 385, ARTS 386, ARTS 387, ARTS 400, ARTS 493, and ARTS 602. Coreq: ARTS 465 and ARTS 466B.

ARTS 466B. Student Teaching in Art: 7th - 12th Grade (4)
(See ARTS 366B.) Prereq: ARTS 385, ARTS 386, ARTS 387, ARTS 400, ARTS 493, and ARTS 602. Coreq: ARTS 465 and ARTS 466A.

ARTS 493. Art Content, Pedagogy, Methodology, and Assessment (3)
(See ARTS 393.) Prereq: ARTS 602.

ARTS 494. Teaching Art (3)
Research contrasting theories of art education in relationship to a variety of educational settings in elementary and secondary schools. Developing innovative, interdisciplinary, comprehensive curriculum models for a specific organization. For licensed art teachers only. Prereq: Permit required from Director of Art Education.

ARTS 497. Summer Workshop in Art Education (3)
A current art education issue is covered in depth.

ARTS 602. Independent Study in Art Education (3)
General history and theories of art education. Development of personal philosophy as basis for teaching art. Topics in professional standards, creativity, aesthetic theory, and art criticism. Students must also produce an art education research paper. Clinical/Field experiences are required.

ARTS 605. Final Creative Thesis (1-3)
Students receive individual guidance for an approved self-designed project from program faculty members. A public exhibition or presentation is required. Prereq: Permit required from Director of Art Education.

Artificial Intelligence

508 Olin
Phone 216-368-2839
George W. Ernst, Director
E-mail: ernst@eecs.cwru.edu

Program Faculty

George W. Ernst, Ph.D. (Carnegie Institute of Technology)
Professor of Electrical Engineering and Computer Science

Randall D. Beer, Ph. D. (Case Western Reserve University)
Professor of Electrical and Computer Science

Michael S. Branicky, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor of Electrical Engineering and Computer Science

Hillel J. Chiel, Ph.D. (Massachusetts Institute of Technology)
Professor of Biology

Grover C. Gilmore, Ph.D. (Johns Hopkins University)
Professor of Psychology

Robert L. Greene, Ph.D. (Yale University)
Professor of Psychology

Gilles Klopman, Ph.D. (University of Brussels, Belgium)
Professor of Chemistry

Behnam Malakooti, Ph.D. (Purdue University)
Professor of Electrical Engineering and Computer Science

Francis L. Merat, Ph.D. (Case Western Reserve University)
Associate Professor of Electrical Engineering and Computer Science
Undergraduate Program

The program in artificial intelligence offers an undergraduate minor. The core of the minor introduces students to the techniques of artificial intelligence programming and the basic theoretical concepts of artificial intelligence, knowledge representation, and automated reasoning. Within the minor, a student may choose a track pertaining to science and engineering or a track pertaining to artificial intelligence and cognition. Students who take the science and engineering track will have the opportunity to build significant intelligent systems. They will acquire a solid understanding of methods for knowledge representation and automated reasoning. The science and engineering track provides an opportunity for a student to acquire knowledge that is useful in areas such as management and engineering.

The artificial intelligence and cognition track will give students the opportunity to explore the relationships between computational processes and the study of mind and language. Studies of the relationships between these areas have led to developments in robotics, mathematical neuroscience, visual processing systems, parallel processing systems, mathematical and experimental psychology, and linguistics.

A minor consists of five courses. Every student who takes the minor in artificial intelligence must take the two courses, ENGR 131 (Elementary Computer Programming) and EECS 391 (Introduction to Artificial Intelligence). Students who take the artificial intelligence minor must also take one of two minor tracks:

The Technology Track requires 3 of the following courses:
- BIOL 373 Introduction to Neurobiology
- BIOL 374 Neurobiology of Behavior
- BIOL 477 Dynamics of Adaptive Behavior (cross listed as EECS 477)
- BIOL 478 Computational Neuroscience (cross listed as EECS 478)
- BIOL 479 Seminar in Computational Neuroscience (cross listed as EECS 479)
- EECS 350 Industrial and Production Systems Engineering
- EECS 352 Engineering Economics and Decision Analysis
- EECS 360 Manufacturing, Operations and Automated Systems
- EECS 375 Autonomous Robotics (cross listed as BIOL 375)
- EECS 411 Logic Programming
- EECS 475 Autonomous Robotics (cross listed as BIOL 475)
- EECS 484 Computational Intelligence I: Basic Principles
- EECS 487 Computational Intelligence II: Applications
- EECS 489 Robotics I
- EECS 491 Intelligent Systems I
- EECS 531 Computer Vision for Industrial Applications
- EECS 589 Robotics II
- EECS 591 Intelligent Systems II
- PHIL 201 Introduction to Logic
- PHIL 306 Mathematical Logic

The Cognitive Science Track requires 3 of the following courses:
- BIOL 373 Introduction to Neurobiology
- BIOL 374 Neurobiology of Behavior
- BIOL 477 Dynamics of Adaptive Behavior (cross listed as EECS 477)
- BIOL 478 Computational Neuroscience (cross listed as EECS 478)
- BIOL 479 Seminar in Computational Neuroscience (cross listed as EECS 479)
- ENGL 301 Linguistic Analysis of Modern English
- PHIL 201 Introduction to Logic
- PHIL 306 Mathematical Logic

The Technology Track requires 3 of the following courses:
- BIOL 373 Introduction to Neurobiology
- BIOL 374 Neurobiology of Behavior
- BIOL 477 Dynamics of Adaptive Behavior (cross listed as EECS 477)
- BIOL 478 Computational Neuroscience (cross listed as EECS 478)
- BIOL 479 Seminar in Computational Neuroscience (cross listed as EECS 479)
- EECS 350 Industrial and Production Systems Engineering
- EECS 352 Engineering Economics and Decision Analysis
- EECS 360 Manufacturing, Operations and Automated Systems
- EECS 375 Autonomous Robotics (cross listed as BIOL 375)
- EECS 411 Logic Programming
- EECS 475 Autonomous Robotics (cross listed as BIOL 475)
- EECS 484 Computational Intelligence I: Basic Principles
- EECS 487 Computational Intelligence II: Applications
- EECS 489 Robotics I
- EECS 491 Intelligent Systems I
- EECS 531 Computer Vision for Industrial Applications
- EECS 589 Robotics II
- EECS 591 Intelligent Systems II
- PHIL 201 Introduction to Logic
- PHIL 306 Mathematical Logic

Asian Studies

106 Mather House
Phone 216-368-2623
Elisabeth Köll, Director (exk21@po.cwru.edu)

Advisory Committee

Elisabeth Köll, Ph.D. (Oxford University)
Associate Professor, History
Director, Asian Studies Program
Modern China, Chinese business
William E. Deal, Ph.D. (Harvard University)
Severance Associate Professor of the History of Religion and Chair
Buddhism, Japanese and Chinese religions, ethics, methodology of
religion, religion and culture
Linda C. Ehrlich, Ph.D. (University of Hawaii/East-West Center)
Associate Professor, Japanese and Comparative Literature
Cinema and art, emphasis on Asian (Japanese) cinema; traditional
Asian theater; Japanese poetry, literature and film; cinema of
Spain
Margaret M. Fitzgerald, M.A. (Ohio State University)
Lecturer, Department of Modern Languages and Literatures
Japanese language and culture
Melvyn C. Goldstein, Ph.D. (University of Washington)
John Reynolds Harkness Professor of Anthropology and Chair
Director, Center for Research on Tibet
Social anthropology; cross-cultural aging; cultural ecology; development; Tibet, China, Mongolia, Himalayas
Takao Hagiwara, Ph.D. (University of British Columbia)
Associate Professor, Japanese and Comparative Literature
Japanese literature, especially modern prose and poetry; classical
and modern Japanese literature; pre-modern Japanese
sensibilities and (post)modernism
Charlotte Ikels, Ph.D. (University of Hawaii)
Professor, Anthropology
Urban life, aging, intergenerational relations, health care, comparative biomedical ethics; China, Hong Kong, U.S.

Undergraduate Programs

Asian Studies has become an increasingly important area of study in North American colleges and universities. This is due in part to a growing acknowledgment that Asian cultures are of significance both regionally and globally. The Asian Studies Program offers students the opportunity to explore these cultures from a multidisciplinary perspective so that they are able to understand the social, cultural, political, and other forces that shape and have shaped these nations.

The Asian Studies Program brings together faculty with research and teaching interests in the histories and cultures of Asia, and provides students with a curriculum that offers several different approaches to the study of Asia. The Asian Studies Program is interdisciplinary, drawing faculty and courses from such departments as Anthropology, Art History and Art, Economics, Modern Languages and Literatures, History, Philosophy, Political Science, and Religion. A current list of approved courses is available from a Program advisor. Several Asian Studies courses contribute to the
The requirements for an Asian Studies sequence are satisfied with the completion of ASIA 133 or ASIA 134 and six additional semester hours of Asia-related courses chosen in consultation with a Program advisor.

9 semester hours total
• ASIA 133 or ASIA 134 (cross-listed as: HSTY 133 or HSTY 134)
• 6 additional hours (Asia-related) selected in consultation with a Program advisor

Asian Studies Honors
Asian Studies Honors is a semester-long program for Asian Studies majors, normally taken during the senior year, involving the research and writing of an Honors Thesis. Honors Program requirements include the completion of ASIA 133 and ASIA 134, at least two semesters of study of an Asian language and two further content courses in Asian Studies, and maintenance of GPAs of at least 3.0 overall and 3.2 in Asian Studies courses. A participating student enrolls in Asia 398: Honors Thesis, and writes a thesis under the direction of a faculty member designated as the thesis director, in association with a second reader, who must be a member of the Asian Studies Program. A third reader, who need not be a member of the Asian Studies Program, is optional. Each student must maintain regular contact with the supervising faculty member in the various stages of the research and writing of the thesis. Detailed guidelines and deadlines for the course are available from the director of the Asian Studies Program.

Asian Studies (ASIA)

Undergraduate Courses

ASIA 110. Introduction to East Asian Culture and Society (3)
This course is an introduction to Chinese and Japanese culture and society from both contemporary and historical perspectives. Students will examine political, social, religious, artistic, literary, and other phenomena which have shaped these two East Asian nations. This course is both an introduction to China and Japan for non-majors, and a foundation for Asian Studies majors and minors pursuing further course work on East Asia.

ASIA 133. Introduction to Chinese History and Civilization (3)
(See HSTY 133.) Cross-listed as HSTY 133.

ASIA 134. Introduction to Japanese History and Civilization (3)
(See HSTY 134.) Cross-listed as HSTY 134.

ASIA 230. Asian Cinema and Drama (3)
(See CMPL 230.) Cross-listed as CMPL 230.

ASIA 284. Daily Life in Imperial China (3)
(See HSTY 284.) Cross-listed as HSTY 284.

ASIA 398. Honors Thesis (1–4)
Intensive study of a topic or problem under the direction of a faculty member, resulting in the preparation of an honors thesis. Prereq: Permission of program director.

ASIA 399. Independent Study (1-3)
Tutorial in Asian studies.
Department of Astronomy

422 A.W. Smith Building
Phone 216-368-3728; Fax 216-368-5406
R. Earle Luck, Chair
wsohs@grendel.astr.cwru.edu

Facilities

The Department of Astronomy operates the Kitt Peak Station near Tucson, Arizona, home of the Burrell Schmidt telescope. This telescope is used for deep surveys and imaging with large format CCDs. The 0.9m reflector located at the Nassau Station near Chardon, Ohio is remote control capable and equipped for both direct imaging and spectroscopy. A 9.5-inch refractor permanently mounted on the roof of the campus offices of the Department of Astronomy is available for use by students. The department also maintains a research and instruction computer laboratory.

Faculty

R. Earle Luck, Ph.D. (University of Texas, Austin)
Worcester R. and Cornelia B. Warner Professor and Chair
Director of the Warner and Swasey Observatory

J. Christopher Mihos, Ph.D. (University of Michigan)
Associate Professor
Heather L. Morrison, Ph.D. (Australian National University)
Associate Professor

Secondary Faculty

Lawrence M. Krauss, Ph.D. (Massachusetts Institute of Technology)
Ambrose Swasey Professor and Chair, Department of Physics

John E. Ruhl, Ph.D. (Princeton University)
Professor of Physics

Glenn Starkman, Ph.D. (Stanford University)
Associate Professor, Department of Physics

Undergraduate Programs

Two degrees in astronomy are offered, the Bachelor of Science degree and the Bachelor of Arts degree. The primary difference between the two degrees is that the B.A. degree allows somewhat more flexibility in choice of courses. Both the B.A. and B.S. degrees provide excellent preparation for graduate studies. There are also two minor programs in astronomy.

A broad and substantial background in physics and mathematics with introductory exposure to astronomy is emphasized in the astronomy curriculum. A faculty actively engaged in research provides first-rate instruction and opportunity for undergraduate involvement in research.

A bachelorís degree in astronomy is designed to prepare for graduate study in astronomy, but the holder of this undergraduate degree who seeks employment can fill the same jobs as physics and computer science majors.

Graduate Programs

The department offers graduate programs leading to the degrees of Master of Science and Doctor of Philosophy in astronomy. Current research provides opportunities in optical observational astronomy and theoretical studies of galaxy interaction and formation. Prospective graduate students must submit scores on the Graduate Record Examination including the advanced physics test. Further information on the departmentís graduate programs, and details concerning financial aid, are available through the departmental office.

Astronomy (ASTR)

Undergraduate Courses

ASTR 201. The Sun and its Planets (3)
An overview of the solar system; the planets and other objects that orbit about the sun and the sun itself as the dominant mass and the most important source of energy in the solar system. Concepts and the development of our knowledge will be emphasized. Not available for credit to astronomy majors.

ASTR 202. Stars, Galaxies, and the Universe (3)
Stellar structure, energy sources, and evolution, including red giants, white dwarfs, supernovae, pulsars, and black holes. Stellar populations in the Milky Way and external galaxies. The universe and its evolution. Not available to astronomy majors.

ASTR 203. Archaeoastronomy: Calendars, Barrows, and Megaliths (3)
To acquaint the student with the regular cycles of the Sun, Moon, planets, and stars. To show how ancient civilizations (and some not so ancient) have used those cycles to formulate calendars which are evidenced primarily by artifacts and ruins scattered over the entire Earth.

ASTR 204. Einstein's Universe (3)
This course is intended to introduce the non-scientist to the concepts of modern cosmology—the structure and evolution of the universe. No mathematical background beyond simple algebra is needed.

ASTR 205. The Scale of the Universe (3)
The solar system, stars, and galaxies. Our place in the Universe. Cosmology and the evolution of the Universe. The use of physical laws to study the Universe. The scientific method—predictions and tests of scientific theory.

ASTR 221. Stars and Planets (3)

ASTR 222. Galaxies and Cosmology (3)

ASTR 306. Astronomical Techniques (3)
Emphasis will be on acquisition of direct imaging and/or spectroscopic data at the 0.9 meter telescope and its subsequent reduction. Principles of optics applied to astronomical telescopes and instrumentation. Modern detector technology. Computational techniques will also be explored through projects emphasizing modeling of data, dynamical simulations of star clusters emphasizing modeling of data, dynamical simulations of star clusters and galaxies, or astronomical database mining. Prereq: ASTR 221 and ASTR 222.

ASTR 309. Senior Seminar I (1)
Selected topics in astronomy not covered ordinarily in courses. Presentation of talks by the students.

ASTR 310. Senior Seminar II (1)
Selected topics in astronomy not covered ordinarily in courses. Presentation of talks by students.

ASTR 311. Stellar Physics (3)

ASTR 323. The Local Universe (3)

ASTR 328. Cosmology and the Structure of the Universe (3)
Distances to galaxies. The content of the distant universe. Large scale structure and galaxy clusters. Physical cosmology. Structure and galaxy
## Bachelor of Arts Degree Major in Astronomy

### Freshman Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>(Credit Hours)</th>
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<tbody>
<tr>
<td>MATH 121 Calculus for Science &amp; Engineering I</td>
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<tr>
<td>or MATH 125 Calculus I</td>
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<tr>
<td>PHYS 121 General Physics I: Mechanics</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
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<td>PHED 101 Physical Education Activities</td>
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<td>Arts &amp; Humanities I</td>
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<tr>
<td>or MATH 124 Calculus II</td>
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<tr>
<td>PHYS 122 General Physics II: Electricity and Magnetism</td>
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### Sophomore Year

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<td>ASTR 221 Stars and Planets</td>
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<td>PHYS 221 General Physics III: Modern Physics</td>
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<td>ENGR 131 Elementary Computer Programming</td>
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<td>Arts &amp; Humanities III</td>
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<tr>
<td>ASTR 222 Galaxies and Cosmology</td>
<td>(3)</td>
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<tr>
<td>MATH 224 Elementary Differential Equations</td>
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<td>or MATH 228 Differential Equations</td>
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<tr>
<td>PHYS 250 Mathematical Physics &amp; Computing</td>
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<td>PHYS 310 Classical Mechanics</td>
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### Junior Year

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<tr>
<td>ASTR 306 Astronomical Techniques</td>
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<td>ASTR 309 Seminar I</td>
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<td>PHYS 331 Quantum Mechanics</td>
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<td>Social Science III</td>
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<td>ASTR 310 Senior Seminar II</td>
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<td>Science &amp; Society</td>
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<td>Cultural Diversity</td>
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### Senior Year

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<tr>
<td>ASTR 316 Introduction to Nuclear and Particle Physics</td>
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<td>PHYS 325 E&amp;M II</td>
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<tr>
<td>PHYS 332 QM II</td>
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</tbody>
</table>

### Minors in Astronomy

For non-physical science majors: ASTR 221, 222; PHYS 115, 116, and 1 of the following: (ASTR 306, 311, 323, 328).

For physical science majors: ASTR 221, 222, and 3 of the following: (ASTR 306, 311, 323, 328).

### Approved Technical Electives - B. A. In Astronomy

(This is not an exhaustive list)

- CHEM 107 Properties and Structure of Matter I
- CHEM 108 Properties and Structure of Matter II
- PHYS 204 Advanced Instrumentation Lab
- PHYS 316 Introduction to Nuclear and Particle Physics
- PHYS 325 E&M II
- PHYS 332 QM II

### Graduate Courses

**ASTR 409. Nucleosynthesis and Chemical Evolution (3)**
Formation of the elements by stellar nucleosynthesis, especially within supernovae. The subsequent dispersal of this material into the interstellar medium and its incorporation into stars. The observable elemental content of stars and the relation of that content to the history and dynamics of the Galaxy. Prereq: Consent of department.

**ASTR 411. Stellar Physics (3)**
(See ASTR 311.)
Bachelor of Science in Astronomy Degree

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>(Class-Lab-Credit Hours)</th>
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<td><strong>Spring</strong></td>
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<td>&amp; Magnetism ......................................................... (4-0-4)</td>
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<td><strong>Sophomore Year</strong></td>
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<td>PHYS 221 General Physics III: Modern Physics .......... (3-0-3)</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming ................... (3-0-3)</td>
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<td><strong>Total:</strong> .................................................................... 14-3-14</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>ASTR 222 Galaxies and Cosmology ................................. (3-0-3)</td>
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</tr>
<tr>
<td>MATH 224 Elementary Differential Equations .................. (3-0-3) or</td>
<td></td>
</tr>
<tr>
<td>MATH 228 Differential Equations ................................ (3-0-3)</td>
<td></td>
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<tr>
<td>PHYS 204 Advanced Instrumentation Lab .......................... (1-4-4)</td>
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<tr>
<td>PHYS 250 Mathematical Physics &amp; Computing ................... (3-0-3)</td>
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<tr>
<td>PHYS 310 Classical Mechanics ..................................... (3-0-3)</td>
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<tr>
<td><strong>Total:</strong> .................................................................... 13-4-16</td>
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<tr>
<td><strong>Total Hours Required for Graduation:</strong> 125</td>
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</table>

Nine hours of Mathematics and Natural Science (Physics) double counted toward General Education Requirement.

Astronomy Hours: 20
Physics Hours: 43
Math/Stat Hours 17
Technical Electives Hours 12

Technical Electives are additional courses in astronomy, chemistry, mathematics, statistics, physics, or geology which satisfy interests of the student but also fall within the science/mathematics objectives of the major. For a list of approved technical electives see advisor.

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>(Class-Lab-Credit Hours)</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>ASTR 311 Stellar Physics .......................................... (3-0-3)</td>
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<tr>
<td>PHYS 313 Thermodynamics &amp; Statistical Mechanics .......... (3-0-3)</td>
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<tr>
<td>STAT 312 Statistics for Science and Engineering .......... (3-0-3)</td>
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<td>Technical Elective ................................................... (3-0-3)</td>
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<tr>
<td>Arts &amp; Humanities III ............................................... (3-0-3)</td>
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<tr>
<td><strong>Total:</strong> .................................................................... 15-0-15</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>ASTR 328 Cosmology and the Structure ......................... (3-0-3)</td>
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<tr>
<td>of the Universe ....................................................... (3-0-3)</td>
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<td>PHYS 326 Electricity &amp; Magnetism II ............................ (3-0-3)</td>
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<td>PHYS 325 Physical Optics ............................................ (3-0-3)</td>
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<td>Science &amp; Society ..................................................... (3-0-3)</td>
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<td><strong>Total:</strong> .................................................................... 15-0-15</td>
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<tr>
<td><strong>Senior Year</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Fall</strong></td>
<td></td>
</tr>
<tr>
<td>ASTR 306 Astronomical Techniques .................................. (3-0-3)</td>
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<tr>
<td>ASTR 309 Senior Seminar I .......................................... (1-0-1)</td>
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<td>PHYS 325 Electricity &amp; Magnetism II ............................ (3-0-3)</td>
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<td>PHYS 331 Quantum Mechanics I ...................................... (3-0-3)</td>
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<tr>
<td>Social Science III ..................................................... (3-0-3)</td>
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<tr>
<td>Cultural Diversity ...................................................... (3-0-3)</td>
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<td><strong>Total:</strong> .................................................................... 16-0-16</td>
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</tr>
<tr>
<td><strong>Spring</strong></td>
<td></td>
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<tr>
<td>ASTR 310 Senior Seminar II ........................................ (1-0-1)</td>
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<tr>
<td>ASTR 323 The Local Universe ....................................... (3-0-3)</td>
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<tr>
<td>PHYS 332 Quantum Mechanics II ..................................... (3-0-3)</td>
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<td><strong>Total:</strong> .................................................................... 16-0-16</td>
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</table>

Approved Technical Electives - B. S. In Astronomy
(This is not an exhaustive list)
- GEOC 345 Planetary Materials
- MATH 201 Introduction to Linear Algebra
- MATH 345 Introduction to Applied Mathematics
- PHYS 316 Introduction to Nuclear and Particle Physics
- PHYS 349 Methods of Mathematical Physics I
- PHYS 350 Methods of Mathematical Physics II

Minors in Astronomy

For non-physical science majors: ASTR 221, 222; PHYS 115, 116; and 1 of the following: ASTR 306, 311, 323, or 328.

For physical science majors: ASTR 221, 222, and 3 of the following ASTR 306, 311, 323, or 328.

a. Selected students may be invited to take PHYS 123, 124, 223 in place of 121, 122, 221.

b. Courses taught every other year only.
Astronomy

ASTR 423. The Local Universe (3)
(See ASTR 323.)

ASTR 427. Dynamical Astronomy (3)

ASTR 428. Cosmology and the Structure of the Universe (3)
(See ASTR 328.) Cross-listed as PHYS 428.

ASTR 497. Special Topics in Astronomy (1-3)
Prereq: Consent of department.

ASTR 601. Research (1-3)
Original research under the guidance of the staff.

ASTR 651. Thesis M.S. (1-18)
(Credit as arranged.)

ASTR 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

ASTR 702. Appointed Dissertation Fellow (9)

ASTR 820. Hands-On Astronomy For Secondary School Teachers (2)
This course is designed to train secondary school teachers in the use of Hands-On Astronomy curriculum, star clusters, and resources. Programs included are the Hands-On Universe Project of Lawrence Berkeley National Laboratory and the Hands-On Astrophysics Project of the American Association of Variable Star Observers. Resources to be demonstrated and trained for include the network of Hands-On Universe telescopes and specifically, the University’s 0.9 meter Robotic Telescope.

Department of Biochemistry

School of Medicine
Phone 216-368-3344; Fax 216-368-3419
Michael Weiss, Chair

The Department of Biochemistry offers undergraduate programs leading to the Bachelor of Arts or Bachelor of Science in Biochemistry and graduate programs leading to the Master of Science, Doctor of Philosophy, the combined Bachelor of Arts-Doctor of Philosophy and combined Doctor of Medicine-Doctor of Philosophy.

In addition, many interdisciplinary and interdepartmental programs are available with other departments in the School of Medicine and in Case Western Reserve University that provide other possible avenues of study for those interested in pursuing a career in biochemistry. Research interests within the department include a broad spectrum of modern biochemical topics. Departmental facilities include major special equipment and well-equipped laboratories needed for research in modern biochemistry. Additional information about either the undergraduate or graduate programs can be obtained by contacting the departmental office.

Faculty
(See School of Medicine.)

Undergraduate Programs

The two undergraduate major programs are based on the Arts & Sciences General Education Requirements, but they differ in their requirements of fundamental mathematical and physical sciences. Either degree is excellent for students planning to undertake graduate work in biochemistry or in related areas of the biomedical sciences. Both the B.A. and the B.S. programs, shown on the following pages, permit students to follow many options after graduation. Graduates are well prepared to pursue further studies in the biological sciences, for a career in medicine, for employment in the chemical or pharmaceutical industry, or as research assistants in academic research laboratories. The B.A., has a reduced emphasis on the quantitative aspects of science and the availability of a considerable amount of elective time permits a student to concentrate on biochemistry even more intensively than the curriculum requires, or to pursue other subjects in science or the liberal arts. The B.S. degree is for the student who has a particularly strong interest in the quantitative physical sciences. A small number of additional courses will qualify biochemistry students for a double major in chemistry and for associate or full membership in the American Chemical Society.

Undergraduate research is strongly encouraged for all biochemistry majors. As many as nine hours of Research in Biochemistry (BIOC 391) may be credited toward the requirements for graduation.

Major
(leading to the Bachelor of Arts degree)

Students enroll in the curriculum for the Bachelor of Arts degree in biochemistry, and are required to complete the following courses: BIOC 307, 308, 312 or 334, 371, 372, and approved Technical Electives in Biochemistry, 2 courses (6 cr), BIOL 214, 215, 326; CHEM 105, 106 (or CHEM 111 + ENGR 145), 113, 223, 224 (or 323,324), 233, 234, 301; MATH 125, 126 (or 121, 122); PHYS 115, 116 (or 121,122), including laboratory.

Major
(leading to the Bachelor of Science degree)

Students enroll in the curriculum for the Bachelor of Science degree in Biochemistry, and are required to complete the following courses: BIOC 307, 308, 312, 334, 371, 372 and approved Technical Electives in Biochemistry, 2 courses (6 cr), BIOL 214, 215, 326; CHEM 105, 106 (or CHEM 111 + ENGR 145), 113, 223, 224 (or 323,324), 301, 302 (or 335, 336); 321, 322 (or 233, 234, and 304); ECES 131; MATH 121, 122, 223, 224 (or 125, 124, 227, 228); PHYS 121, 122 (or 125, 124), including laboratory, 221 (or 223); Statistics/Data Analysis Elective(PHYS 250, ECES 251, STAT 312, 313, or equivalent)

Honors Program

Biochemistry majors who have excellent academic records may be admitted to the department’s Undergraduate Honors Program. To graduate with departmental honors in biochemistry, a student must satisfy the following requirements:
1. A combined grade point average of at least 3.300 in biochemistry, biology, and chemistry, and an overall grade point average of 3.000
2. A minimum of 6 credit hours of undergraduate research (BIOC 391) in one laboratory
3. A research report approved by the Undergraduate Education Committee of the department on the basis of the quality of the research, the written report, and an oral presentation. An acceptable report:
   a. Should follow a standard journal format
   b. Should demonstrate the student’s understanding of the research area, experimental techniques, goals and implications of the project
   c. Should show that the student has advanced his/her knowledge of the applicable techniques and the underlying scientific concepts.

The research advisor is asked to write a letter recommending the student for honors.
Minor

Students may obtain credit for a minor in biochemistry by completing one year of freshman chemistry (including laboratory), one year of organic chemistry (including laboratory), two semesters of approved biology courses, and three semesters of didactic courses in biochemistry. A recommended sequence of courses would include:

- CHEM 105, 106 (or CHEM 111 + ENGR 145)
- CHEM 113 laboratory
- CHEM 223, 224 (or 323, 324), 233, 234
- BIOL 110, 210
- BIOC 307, 308, and either 312 or 334.

The sequences may be followed after consultation with the Department of Biochemistry and with the other departments involved.

Bachelor of Arts Degree
Major in Biochemistry

Freshman Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MATH 125 Mathematics I ................................. (4)</td>
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<tr>
<td>CHEM 105 Principles of Chemistry I ........................ (3)</td>
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<td>CHEM 111 .................................................. (4)</td>
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<tr>
<td>PHED 100 Physical Education Activities ................... (0)</td>
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</tr>
<tr>
<td>GER Course .................................................. (3)</td>
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<tr>
<td>Elective ....................................................... (3)</td>
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<tr>
<th>Spring</th>
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<tbody>
<tr>
<td>MATH 126 Mathematics II ................................. (4)</td>
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</tr>
<tr>
<td>CHEM 106 Principles of Chemistry II ...................... (3)</td>
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<tr>
<td>ENGR 145 .................................................. (4)</td>
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<tr>
<td>CHEM 113 Principles of Chemistry Laboratory ............. (2)</td>
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<tr>
<td>ENGL 150 Expository Writing .............................. (3)</td>
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<td>PHED 100 Physical Education Activities ................... (0)</td>
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<td>GER Course .................................................. (3)</td>
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Sophomore Year

<table>
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<tr>
<th>Fall</th>
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<tbody>
<tr>
<td>CHEM 223 Introductory Organic Chemistry I .................. (3)*</td>
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<td>CHEM 233 Organic Chemistry Laboratory ...................... (2)</td>
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</tr>
<tr>
<td>PHYS 115 Introductory Physics I ............................... (4)</td>
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<tr>
<td>GER Course .................................................. (3)</td>
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<table>
<thead>
<tr>
<th>Spring</th>
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<tbody>
<tr>
<td>CHEM 224 Introductory Organic Chemistry II .................. (3)*</td>
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<td>CHEM 234 Organic Chemistry Laboratory ...................... (2)</td>
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<tr>
<td>PHYS 116 Introductory Physics II ............................... (4)</td>
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<td>BIOL 214 .................................................. (4)</td>
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Junior Year

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<tbody>
<tr>
<td>CHEM 301 Physical Chemistry I ............................... (3)</td>
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<tr>
<td>BIOC 307 General Biochemistry .............................. (4)</td>
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<tr>
<td>BIOL 215 .................................................. (4)*</td>
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<table>
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<tr>
<th>Spring</th>
<th>Credit Hours</th>
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<tr>
<td>BIOC 308 Molecular Biology: Genes &amp; Genetic Engineering ............................................. (4)</td>
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<tr>
<td>Approved Biochemistry elective ............................ (3)*</td>
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<td>GER Course .................................................. (3)</td>
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<tr>
<td>Electives ..................................................... (6)</td>
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Senior Year

<table>
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<th>Fall</th>
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<tr>
<td>BIOC 371 Undergraduate Seminar ................................ (1)</td>
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<tr>
<td>BIOL 326 .................................................. (3)</td>
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<tr>
<td>Approved Biochemistry Elective ............................ (3)*</td>
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<tr>
<td>Electives ..................................................... (11)</td>
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</table>

<table>
<thead>
<tr>
<th>Spring</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>BIOC 372 Undergraduate Seminar ................................ (1)</td>
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<tr>
<td>Approved Biochemistry Elective ............................ (3)*</td>
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<td>Electives ..................................................... (11)</td>
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</table>

Total Hours Required for Graduation: 120

a. Selected students may be invited to take CHEM 323, 324.
b. One of the approved electives in Biochemistry must be either BIOC 312 or 334.

NOTE: Up to nine credit hours of undergraduate research, BIOC 391, may be counted as electives toward graduation. Students should consult their academic advisors about the elective parts of the curriculum.
Bachelor of Science Degree Major in Biochemistry

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>(Class-Lab-Credit Hours)</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>CHEM 105 Principles of Chemistry I ............................................... (3-0-3)</td>
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<td>CHEM 111 ......................................................................................... (4-0-4)</td>
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<tr>
<td>ECES 131 Elementary Computer Programming ........................................ (2-2-3)</td>
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<td>MATH 121 Calculus for Science and Engineering I .................................. (4-0-4)</td>
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<tr>
<td>ENGL 150 Expository Writing ............................................................ (3-0-3)</td>
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<td>PHED 100 Physical Education Activities ............................................. (0-3-0)</td>
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<td>GER Course ......................................................................................... (3-0-3)</td>
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<tr>
<td><strong>Total</strong> ......................................................................................... (15-5-16) or (16-5-17)</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>CHEM 106 Principles of Chemistry II .................................................. (3-0-3)</td>
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<td>ENGR 145 ......................................................................................... (4-0-4)</td>
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<td>CHEM 113 Principles of Chemistry Laboratory ....................................... (1-3-2)</td>
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<td>MATH 122 Calculus for Science and Engineering II ................................... (4-0-4)</td>
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<td>PHYS 121 General Physics I, Mechanics .............................................. (3-1-4)</td>
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<tr>
<td><strong>Sophomore Year</strong></td>
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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>BIOC 110 Principles of Biology ........................................................ (3-0-3)</td>
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<td>CHEM 223 Introductory Organic Chemistry I ....................................... (3-0-3)</td>
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<td>CHEM 321 Laboratory Methods and Techniques I ..................................... (1-6-3)</td>
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<td>MATH 223 Calculus for Science and Engineering III ................................ (3-0-3)</td>
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<td>PHYS 122 General Physics II, Electricity and Magnetism ........................ (3-1-4)</td>
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<td><strong>Spring</strong></td>
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<tr>
<td>CHEM 224 Introductory Organic Chemistry II ....................................... (3-0-3)</td>
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<td>CHEM 322 Laboratory Methods and Techniques II ................................... (1-6-3)</td>
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NOTE: Up to nine credit hours of undergraduate research, BIOC 391, may be counted as electives toward graduation. Students should consult their academic advisors about the elective parts of the curriculum.

<table>
<thead>
<tr>
<th>Junior Year</th>
<th>(Class-Lab-Credit Hours)</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>BIOC 307 General Biochemistry ..................................................... (4-0-4)</td>
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<tr>
<td>BIOL 215 ......................................................................................... (4-0-4)</td>
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<tr>
<td>BIOL 211 Cell Biology Laboratory ................................................. (0-4-2)</td>
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<td>CHEM 301 Physical Chemistry I ...................................................... (3-0-3)</td>
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<td>GER Course ......................................................................................... (3-0-3)</td>
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<td>GER Course ......................................................................................... (3-0-3)</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>BIOC 308 Molecular Biology: Genes and Genetic Engineering ................. (4-0-4)</td>
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<tr>
<td>PHYS 221 ......................................................................................... (3-0-3)</td>
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<td>CHEM 302 Physical Chemistry II ...................................................... (3-0-3)</td>
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<td>Elective ............................................................................................ (3-0-3)</td>
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<td><strong>Total</strong> ......................................................................................... (16-0-16)</td>
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<tr>
<td><strong>Senior Year</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>BIOC 334 Structural Biology of Proteins, Enzymes, and Nucleic Acids .......... (3-0-3)</td>
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<td>BIOC 371 Undergraduate Seminar ..................................................... (1-0-1)</td>
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<td>BIOL 326 ......................................................................................... (3-0-3)</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>BIOC 372 Undergraduate Seminar ..................................................... (1-0-1)</td>
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<tr>
<td>Statistics/Data Analysis Elective (PHYS 250, ECES 251, STAT 312, 313, or equivalent) .... (3-0-3)</td>
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<td>GER Course ......................................................................................... (3-0-3)</td>
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<td>Electives ........................................................................................... (6-0-6)</td>
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</table>

Total Hours Required for Graduation: 129c

a. Selected students may be invited to take PHYS 123, 124, Physics and Frontiers, I, II (Honors), in place of PHYS 121, 122.
b. Selected students may be invited to take CHEM 325, 324, Organic Chemistry, in place of CHEM 223 and 224.
c. Students may elect to take CHEM 223, 224 and 304 (7) instead of CHEM 312, 322 (6). In this case the total number of credit hours required for graduation will be 130.
Career Opportunities

The undergraduate programs in biology provide excellent preparation for graduate or professional school programs and for careers in industry and governmental agencies. Students are well prepared for medical, dental, or veterinary schools, or to enter the many specialized graduate programs in the biological sciences. Increasingly, career opportunities are opening up in the developing fields of biotechnology both in industry and government. Elective sequences of courses in areas of biotechnology within the B.A. and B.S. degrees in biology are an excellent preparation for such careers.

Faculty

Joseph F. Koonce, Ph.D. (University of Wisconsin, Madison)
Professor and Chair, Professor of Electrical Engineering and Computer Science

Aquatic ecology; systems ecology

Morris Burke, Ph.D. (University of New South Wales, Australia)
Professor, Professor of Physiology and Biophysics
Muscle physiology, protein chemistry

Arnold I. Caplan, Ph.D. (Johns Hopkins University)
Professor, Professor of Physiology and Biophysics, Professor of General Medical Sciences (Oncology), Director - Skeletal Research Center
Developmental biology and biochemistry; molecular and cellular aspects of muscle, cartilage, and bone development

Hillel J. Chiel, Ph.D. (Massachusetts Institute of Technology)
Professor, Associate Professor of Neurosciences
Neurobiology and animal behavior; cellular dynamics of neuronal computation

Christopher A. Cullis, Ph.D. (University of East Anglia, United Kingdom)
Professor, Francis Hobart Herrick Professor of Biology
Plant molecular biology and genetics; modifications of the information content of plant cells

Paul B. Drewa, Ph.D. (Louisiana State University)
Assistant Professor
Ecology; effects of fire and other disturbances on plant populations and community structure

Stephen E. Haynesworth, Ph.D. (Case Western Reserve University)
Associate Professor, Assistant Professor of Orthopaedics, Assistant Professor of General Medical Sciences (Oncology); Associate Dean, College of Arts & Sciences
Developmental and aging biology

Jennifer O. Liang, Ph.D. (Washington University)
Assistant Professor
Molecular biology and genetics; the role of signaling molecules in vertebrate embryonic development

Roy E. Ritzmann, Ph.D. (University of Virginia)
Professor, Professor of Neurosciences
Neurobiology and behavior; physiology

Martin J. Rosenberg, Ph.D. (State University of New York, Stony Brook)
Senior Instructor and Executive Officer
Herpetology; vertebrate biology; human anatomy and physiology

Charles E. Rozek, Ph.D. (Wayne State University)
Associate Professor
Molecular genetics; developmental biology

Norman B. Rushforth, Ph.D. (Cornell University)
Professor, Professor of Adolescent Health, Associate Professor of Epidemiology and Biostatistics
Epidemiology; animal behavior; population biology

Christopher D. Town, Ph.D. (University of London, England)
Associate Professor
Developmental genetics; cell and molecular biology

Joanne Westin, Ph.D. (Cornell University)
Senior Instructor, Premedical Advisor (Office of Undergraduate Studies)
Neurobiology and behavior; physiology

Mark A. Willis, Ph.D. (University of California, Riverside)
Associate Professor
Neurobiology and behavior; sensorimotor control of insect flight; animal behavior

Debra E. Wood, Ph.D. (Georgia State University)
Assistant Professor
Neurobiology; neural and mechanical correlates of motor pattern generation; animal behavior

James E. Zull, Ph.D. (University of Wisconsin, Madison)
Professor, Professor of Biochemistry, Director, University Center for Innovation in Teaching and Education (UCITE)
Human learning, brain function in education

Secondary Faculty

Randall D. Beer, Ph.D. (Case Western Reserve University)
Professor, Professor of Computer Engineering and Science Computational neurosciences

Peter L. McCall, Ph.D. (Yale University)
Professor, Professor of Geological Sciences Paleoecology

Adjunct Faculty

Richard F. Drushel, Ph.D. (Case Western Reserve University)
Adjunct Assistant Professor
Kinematic Modeling and Neural Control

Ana B. Locci, Ph.D. (Case Western Reserve University)
Adjunct Assistant Professor
Aquatic ecology and population biology

Sandra Rode, M.S. (University of Arizona)
Adjunct Instructor
Cleveland Botanical Garden Ecology and Evolutionary Biology; Development of Secondary Education Programs

Bettie Sogor, Ph.D. (Case Western Reserve University)
Adjunct Assistant Professor
Edison Biotechnology Center Organic Chemistry; Development of Secondary Education Programs

Undergraduate Programs

Students interested in life sciences can take a major or minor in biology.

Major Programs

Major programs share a core of courses and provide options for specialization in a variety of areas including biotechnology and genetic engineering, molecular and cellular biology, genetics, immunology, chemical biology, physiology and biophysics, neurobiology and animal behavior, developmental biology, population biology, ecology, and environmental science. Indi-
individual research projects form a significant part of the curriculum for many undergraduates and are required for students in the B.S. program. Advanced biology majors may register, with permission, for graduate-level courses in the Biology Department and within the School of Medicine.

The department offers programs leading to the B.S. and the B.A. Thirty hours of biology are required for the B.A. and 39 hours for the B.S. Students for both the B.A. and B.S. degrees must complete the General Education Requirements (GER) of the College of Arts and Sciences. They may begin their biology program in the freshman year.

**B.A. Program in Biology**

The B.A. degree in biology features a three-semester core of lecture courses beginning with BIOL 214, Genes and Evolution, and continuing with BIOL 215, Cells and Proteins and BIOL 216, Organisms and Ecosystems; each of these courses incorporates a series of correlated laboratories and discussion sessions. The remaining hours include laboratory and elective courses. The laboratory requirement consists of two additional laboratory courses (4-6 hours; excluding BIOL 346, 388, and 390). The elective requirement must include one elective from two of the following major areas: cell & molecular biology, organismal biology, or population biology/ecology. At least 15 hours of the selected electives and laboratories must be at the 300 level or higher. Students are required to complete two years of chemistry-

**Bachelor of Arts Degree**

**Major in Biology – Suggested Sequence of Courses**

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3)</td>
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<tr>
<td>MATH 125 Mathematics I</td>
<td>(4)</td>
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<tr>
<td>CHEM 105 Principles of Chemistry I</td>
<td>(3)</td>
</tr>
<tr>
<td>CHEM 113 Principles of Chemistry Laboratory</td>
<td>(2)</td>
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<tr>
<td>GER Course</td>
<td>(3)</td>
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<tr>
<td>PHED 101 Physical Education Activities</td>
<td>(0)</td>
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<tr>
<td><strong>Spring</strong></td>
<td></td>
</tr>
<tr>
<td>BIOL 214 Genes and Evolution</td>
<td>(4)</td>
</tr>
<tr>
<td>CHEM 106 Principles of Chemistry II</td>
<td>(3)</td>
</tr>
<tr>
<td>MATH 126 Mathematics II</td>
<td>(4)</td>
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<tr>
<td>GER Course</td>
<td>(3)</td>
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<tr>
<td>PHED 102 Physical Education Activities</td>
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<tr>
<th>Sophomore Year</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
</tr>
<tr>
<td>BIOL 215 Cells and Proteins</td>
<td>(4)</td>
</tr>
<tr>
<td>CHEM 223 Introductory Organic Chemistry I</td>
<td>(3)</td>
</tr>
<tr>
<td>CHEM 233 Organic Chemistry Laboratory I</td>
<td>(2)</td>
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<tr>
<td>GER Course</td>
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<td>GER Course</td>
<td>(3)</td>
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<tr>
<td><strong>Spring</strong></td>
<td></td>
</tr>
<tr>
<td>BIOL 216 Organisms and Ecosystems</td>
<td>(4)</td>
</tr>
<tr>
<td>Approved BIOL elective</td>
<td>(5)</td>
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<tr>
<td>Approved BIOL elective</td>
<td>(5)</td>
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<tr>
<td>GER Course</td>
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<td>GER Course</td>
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<tr>
<th>Junior Year</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
</tr>
<tr>
<td>Approved BIOL elective</td>
<td>(3)</td>
</tr>
<tr>
<td>BIOL laboratory</td>
<td>(2)</td>
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<tr>
<td>PHYS 115 Introductory Physics I</td>
<td>(4)</td>
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<tr>
<td>GER Course</td>
<td>(3)</td>
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<tr>
<td>Elective or course in selected minor field</td>
<td>(3)</td>
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<tr>
<td><strong>Spring</strong></td>
<td></td>
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<tr>
<td>Approved BIOL elective</td>
<td>(3)</td>
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<tr>
<td>BIOL laboratory</td>
<td>(2)</td>
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<tr>
<td>PHYS 116 Introductory Physics II</td>
<td>(4)</td>
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<tr>
<td>GER Course</td>
<td>(3)</td>
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<tr>
<td>Elective or course in selected minor field</td>
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<tr>
<th>Senior Year</th>
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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>Approved BIOL elective</td>
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<tr>
<td>Electives or courses in selected minor field</td>
<td>(12)</td>
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<tr>
<td><strong>Spring</strong></td>
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</tr>
<tr>
<td>Approved BIOL elective</td>
<td>(3)</td>
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<tr>
<td>Electives or courses in selected minor field</td>
<td>(12)</td>
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</table>
ecology. In addition, students must complete a course in genetics (BIOL 301, Biotechnology Laboratory: Genes and Genetic Engineering or BIOL 326, Genetics); a quantitative biology laboratory (BIOL 300, Dynamics of Biological Systems, or BIOL 304, Laboratory in Quantitative Methods for Chemical Biology, or BIOL 315, Quantitative Biology Laboratory); one additional laboratory course (except BIOL 346) and one upper-level advanced lecture course (300- or 400-level). B.S. students must undertake an undergraduate research project, completing BIOL 388, Undergraduate Research; BIOL 390, Advanced Undergraduate Research (continuation of BIOL 388 project); and BIOL 395, Undergraduate Research Discussions. At least 11 hours of the selected electives and lab must be at the 300 level or higher. Additional requirements for the B.S. degree consist of: Mathematics: one year of calculus - MATH 125 & 126 (or 121 & 122, but former preferred); MATH 201, Linear Algebra or MATH 225, Discrete & Continuous Models or an approved statistics course; Computer Science: ENGR 131, Computer Programming (or other approved computer programming course); Chemistry: Principles of Chemistry I & II and laboratory (CHEM 105, 106, & 113); Organic Chemistry I & II and laboratory (CHEM 223, 224, & 233; or 323, 324, & 233); Physical Chemistry I (CHEM 301); and Physics: Introductory Physics I & II (PHYS 115 & 116).

All biology majors are required to meet with their departmental advisor at least once each semester to discuss their academic program and receive their registration PINs, and must have their drop-add cards signed by their advisors. In addition to formal courses, departmental seminars in recent advances in biology are held every Thursday afternoon at 4:15 p.m.

Concentrations in Areas of the Biological Sciences

Students are encouraged to utilize their elective courses in the biology major to take advantage of concentrations in various specialized areas in the biological sciences. These concentrations have been developed between the Biology Department, the basic science departments of the School of Medicine, and other departments. Currently, concentrations have been developed in the following areas: biotechnology and genetic engineering; computational biology; developmental biology; genetics; molecular & cell biology; neurobiology and animal behavior; population biology, ecology and environmental science.

Integrated Graduate Studies Program in Biology

The Biology Department participates in the Integrated Graduate Studies Programs for both B.A./M.S. and B.S./M.S. degrees. These

<table>
<thead>
<tr>
<th>Bachelor of Science in Biology Degree</th>
<th>Suggested Sequence of Courses</th>
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<tbody>
<tr>
<td><strong>Freshman Year</strong></td>
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<td>GER Course</td>
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<tr>
<td>PHED 101 Physical Education Activities</td>
<td>(0)</td>
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<td><strong>Spring</strong></td>
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<tr>
<td>BIOL 214 Genes and Evolution</td>
<td>(4)</td>
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<td>MATH 126 Mathematics II</td>
<td>(4)</td>
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<tr>
<td>CHEM 106 Principles of Chemistry II</td>
<td>(3)</td>
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<tr>
<td>GER Course</td>
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<tr>
<td>Elective</td>
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<tr>
<td>PHED 102 Physical Education Activities</td>
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<tr>
<td><strong>Sophomore Year</strong></td>
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<tr>
<td>Fall</td>
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<tr>
<td>BIOL 215 Cells and Proteins</td>
<td>(4)</td>
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<tr>
<td>CHEM 223 (or 323) Introductory Organic Chem I</td>
<td>(3)</td>
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<tr>
<td>CHEM 233 Organic Chemistry Laboratory</td>
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<td>PHYS 115 Introductory Physics I</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>BIOL 216 Organisms and Ecosystems</td>
<td>(4)</td>
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<tr>
<td>GER Course</td>
<td>(3)</td>
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<tr>
<td>CHEM 224 (or 324) Introductory Organic Chem II</td>
<td>(3)</td>
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<tr>
<td>PHYS 116 Introductory Physics II</td>
<td>(4)</td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(3)</td>
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<tr>
<td><strong>Junior Year</strong></td>
<td><strong>Credit Hours</strong></td>
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<tr>
<td>Fall</td>
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<tr>
<td>CHEM 301 Introductory Physical Chemistry I</td>
<td>(3)</td>
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<tr>
<td>BIOL 301 Biotechnology Laboratory OR</td>
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<td>BIOL 326 Genetics</td>
<td>(3)</td>
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<td>MATH 225 Discrete &amp; Continuous Models OR</td>
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<td>MATH 201 Linear Algebra OR</td>
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<tr>
<td>An approved statistics course</td>
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<td>BIOL Elective</td>
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<td>Elective</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>BIOL 300 Dynamics of Biological Systems OR</td>
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<tr>
<td>BIOL 304 Laboratory in Quantitative Methods for Chemical Biology OR</td>
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<tr>
<td>BIOL 315 Quantitative Biology Lab</td>
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<td>GER Course</td>
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<td>Elective</td>
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<tr>
<td><strong>Senior Year</strong></td>
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<tr>
<td>Fall</td>
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<tr>
<td>BIOL 388 Undergraduate Research</td>
<td>(3)</td>
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<tr>
<td>BIOL laboratory</td>
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<td>GER Course</td>
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<td>BIOL Elective</td>
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<td>Elective</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>BIOL 390 Undergraduate Research</td>
<td>(3)</td>
</tr>
<tr>
<td>BIOL 395 Undergraduate Research Discussions</td>
<td>(1)</td>
</tr>
<tr>
<td>BIOL Electives</td>
<td>(6)</td>
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<tr>
<td>Elective</td>
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<td>Elective</td>
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programs are intended for gifted and highly-motivated students for the B.A. degree whose objective is a degree at the master’s or doctoral level. By more closely integrating undergraduate and graduate studies, qualified students begin a program of graduate study in their senior year leading to the simultaneous completion of requirements for both the master’s and bachelor’s degrees, each within its specified framework. Students desiring to pursue this dual degree program will normally apply during the sophomore year by contacting the department office.

Minor in Biology
A minor in biology is available to students. The minor requires a minimum of 16 credit hours in biology consisting of any two of the three core courses (BIOL 214, 215, 216) plus electives to total 16 hours of biology courses. Suitable minor sequences are available for students majoring in the humanities and arts, social and behavioral sciences, health sciences, mathematics, chemistry, physics, astronomy, and geological sciences.

Honors Program in Biology
To receive a bachelor’s degree with honors in biology, the student must meet the following criteria:
1. Maintain a 3.2 grade-point average, with a 3.5 in the major
2. Write a senior honors thesis with the approval of the faculty supervisor
3. Submit the thesis for review by an ad hoc Honors Committee
4. Successfully defend the thesis at an oral examination

Co-op Program in Biology
The Co-op (Cooperative Education) program offers full-time undergraduate students in good academic standing the opportunity to engage in full-time, paid employment consistent with their major fields of study. Typically students participate in the co-op program for one or two seven-month periods, such as summer-fall and/or spring-summer, beginning after their sophomore or junior year. Although participation in this program extends the time required to achieve a bachelor’s degree, students often benefit from higher starting salaries and greater lifetime earnings that can result from the experience acquired in co-op assignments. Co-op employment opportunities may exist at local companies engaged in biotechnology research, pharmaceuticals, or other areas involving the life sciences. Students interested in this program should contact the department office.

Graduate Programs

Master of Science
The Department of Biology offers both thesis and non-thesis Master of Science degree programs. Both programs require a minimum of 30 semester hours of courses at the 300 level or higher. A minimum of 18 semester hours of formal course work is required for the thesis degree, and a minimum of 24 semester hours of formal course work is required for the non-thesis degree. The remaining credits may be research credits (BIOL 601 and 651). Further information is available in the Biology Department Office.

Doctor of Philosophy
Students who are planning to enter the doctoral program in biology should obtain information from the department office. The Doctor of Philosophy degree in biology is granted upon the completion of original research under the guidance of a faculty member in the Department of Biology.

Research
The mission of the Department of Biology at Case Western Reserve University is to promote research programs of national and international prominence and to provide strong undergraduate and graduate educational programs that emphasize integrative approaches to biological problems. Faculty research interests involve three theme areas: Neurobiology and Neuromechanical Systems, Development and Tissue Engineering, and Great Lakes Studies. Collectively, these concentrations provide opportunities for training in Developmental Biology, Genetics and Biotechnology, Biochemistry, Neuropsychology, and Robotics, Neurophysiology and Behavior, Ecology, Environmental Biology, and Evolutionary Biology. These programs provide educational and research programs that support preparation for careers in health sciences and research in biological sciences and add preparation in professional development for careers that involve skills in computational biology.

Some of the research being conducted within each theme area includes:
- Neurobiology and Neuromechanical Systems: Electrophysiological studies of invertebrate animals; neural control of movement, pattern generation and integration of sensory information; cellular dynamics of neuronal computation; the dynamics of small artificial neural networks; the structural basis of actomyosin-based motility in muscle and non-muscle cells at the molecular level; the mechanisms by which cellular DNA can rapidly change in response to external stimuli; sensorimotor control of pheromone-guided flight in insects; the dynamics of motor control in neuronal networks that generate behavior.
- Development and Tissue Engineering: Isolation of mesenchymal stem cells; the cellular and molecular mechanisms that influence and regulate human mesenchymal stem cell development into various cell types; the role of human mesenchymal stem cells in blood vessel formation; control of developmental lineage progression by means of potent growth factors; factors that control morphogenesis; the mechanism by which secreted signaling molecules affect cell fate in the vertebrate embryo; investigation of the mechanisms regulating gene expression, especially transcription and processing of messenger RNA; the role of plant hormones and their second messengers in growth control and cell differentiation, using genetic and molecular techniques;
- Great Lakes Studies: Modeling of aquatic ecosystems; adaptive management of fisheries ecosystems, particularly in relation to Lake Erie; internalized management of resource ecosystems; epidemiological studies of large human populations.

Biology (BIOL)

Undergraduate Courses

BIOL 101. Introduction to Biotechnology (3)
Principles of genetic engineering and other aspects of biotechnology and their applications in science and society. Biological molecules and how they are derived from the genetic information in DNA. Theory and practice of recombinant DNA techniques; function and use of antibodies and vaccines. Applications will include biopharmaceuticals, the construction and uses of transgenic animals and plants, diagnosis and therapy of human diseases, the Human Genome Project, forensic science, and bioremediation. Patents and ethical aspects will be discussed. Assumes some high school biology but has no prerequisites. Fulfills a science requirement of the Arts and Sciences General Education Requirements but does not count toward biology major.

BIOL 103. Biological Issues (3)
This course will focus on controversial biological issues. The goal is to present basic biological and scientific knowledge about specific areas of
BIOL 114. Principles of Biology (3)
A basic biology course designed for the non-major. Topics include: molecules of life, cell structure, respiration and photosynthesis, molecular genetics and gene technology, heredity and human genetics, population genetics and evolution, diversity of life, and function of ecosystems. Course includes some applications of biological principles to agricultural, medical, and environmental concerns. Coreq: CHEM 105 or BIOL 119 or consent of department.

BIOL 119. Concepts for a Molecular View of Biology I (3)
Introduction to the principles of inorganic and organic chemistry essential to the study of biochemistry, molecular biology, and pharmacology. Topics include: atomic theory, the periodic table, chemical bonds, molecular geometry, ideal gas laws, equilibrium and reaction rates, acids and bases, nuclear chemistry, and nomenclature and reactions of organic compounds (including alkyl, aryl, alcohol, carbonyl, and amino compounds). Problems involving numeric computation are emphasized.

BIOL 121. Concepts for a Molecular View of Biology II (3)
The second semester of a two-course sequence in elementary inorganic, organic, and biochemistry. Topics include: carbohydrates, lipids, proteins, enzyme kinetics, metabolic pathways and bioenergetics, DNA and RNA, methods of molecular biology, and nutrition. Applications to human physiology and medicine emphasized. Prereq: BIOL 119.

BIOL 148. Human Physiology for Health Science Students (3)
This course addresses the normal physiology of humans and how the various organ systems are integrated to maintain a homeostatic state. The systems covered include: nervous system, cardiovascular system, respiratory system, gastrointestinal system, excretory system, and reproductive systems. Three lectures per week. This course does not count towards the biology major. Prereq: BIOL 114, BIOL 119, and BIOL 346. Coreq: BIOL 121.

BIOL 205. Chemical Biology (3)
Introduction to the chemistry of biological processes. The relationship of biological function to biological structure which ultimately depends on the chemical structure of biological macromolecules. Methods of purification of proteins and nucleic acids. Chemical mechanisms for simple and complex reversible binding, and for enzyme kinetics and derivation of functions and their graphical representations from these mechanisms and their use for analyzing binding and kinetic data. The relationship of function to biological and chemical structures. Thermodynamics of biological reactions and the bioenergetics associated with the glycolytic pathway and the tricarboxylic acid cycle. Oxidative phosphorylation. Prereq: CHEM 223 or CHEM 323.

BIOL 214. Genes and Evolution (4)
First in a series of three courses required of the Biology major. Topics include: biological molecules (with a focus on DNA and RNA); basics of cell structure (with a focus on the nucleus and chromosome); cell cycle, mitosis and meiosis; molecular genetics, viruses and gene technology; classical and microbial genetics; population genetics and evolution, diversity resulting from evolution. Laboratory and discussion sessions offered in alternate weeks. Prereq: CHEM 105.

BIOL 215. Cells and Proteins (4)
Second in a series of three courses required of the Biology major. Topics include: biological molecules (focus on proteins, carbohydrates, and lipids); cell structure (focus on plasma membrane, endomembrane system and organelles of energy metabolism); protein synthesis, targeting and trafficking; protein structure-function, including binding of antibodies to antigens, enzymes to substrates, and oxygen to hemoglobin. Transduction of neural and hormonal signals; cellular controls involved in development, cell cycle, and cancer; cellular energetics, respiration and photosynthesis. Laboratory and discussion sessions offered in alternate weeks. Prereq: CHEM 105 and CHEM 106; BIOL 214 or consent.

BIOL 216. Organisms and Ecosystems (4)
Third in a series of three courses required of the Biology major. Topics include: homeostasis, including endocrine and autonomic controls; function of neurons and nervous systems; function of organ systems involved in circulation, excretion, oosmoregulation, gas exchange, feeding, digestion, and temperature regulation; reproduction and development; behavior, population dynamics, community ecology, and function of ecosystems. Laboratory and discussion sessions offered in alternate weeks. Prereq: CHEM 105 and BIOL 214 or consent.

BIOL 223. Vertebrate Biology (3)
A survey of vertebrates from jawless fishes to mammals. Functional morphology, physiology, behavior and ecology as they relate to the groups' relationships with their environment. Evolution of organ systems. Two lectures and one laboratory per week. The laboratory will involve a study of the detailed anatomy of the shark and cat used as representative vertebrates. Students are expected to spend at least three hours of unscheduled laboratory each week. This course fulfills a laboratory requirement for the biology major, and is offered in the spring semester of even numbered years. Prereq: BIOL 110 or BIOL 214.

BIOL 225. Evolution (3)
(See PHIL 225.) Cross-listed as PHIL 225.

BIOL 300. Dynamics of Biological Systems: A Quantitative Introduction to Biology (3)
This course will introduce students to dynamic biological phenomena, from the molecular to the population level, and models of these dynamical phenomena. It will describe a biological system, discuss how to model its dynamics, and experimentally evaluate the resulting models. Topics will include molecular dynamics of biological molecules, kinetics of cell metabolism and the cell cycle, biophysics of excitability, scaling laws for biological systems, biomechanics, and population dynamics. Mathematical tools for the analysis of dynamic biological processes will also be presented. Students will manipulate and analyze simulations of biological processes, and learn to formulate and analyze their own models. Cross-listed as EBME 300.

BIOL 301. Biotechnology Laboratory: Genes and Genetic Engineering (3)
Laboratory training in recombinant DNA techniques. Basic microbiology, growth, and manipulation of bacteriophage, bacteria and yeast. Students isolate and characterize DNA, construct recombinant DNA molecules, and reintroduce them into eukaryotic cells (yeast, plant, animal) to assess their viability and function. Two laboratories per week. Prereq: BIOL 210 or BIOL 215.

BIOL 302. Human Learning and the Brain (3)
This course focuses on the question, “How does my brain learn and how can its learning best be facilitated?” Each student is required to develop a comprehensive theory about personal learning. These theories will take the form of a major paper which will be expanded and modified throughout the semester. Readings and class discussions will focus on the following five topics: major structures of the brain and their role in learning, neural wiring of the brain and how learning changes it, the emotional brain and its essential role in learning, language and the brain, and the role of images in learning. Students will be expected to incorporate information on these topics into their personal theory of learning. Final grades will be determined by the quality and comprehensiveness of the learning theories which students develop, as well as evidence of student progress and involvement during the semester. Prereq: BIOL 110 or BIOL 114 or BIOL 214 or PSCL 101.

BIOL 304. Laboratory in Quantitative Methods for Chemical Biology (2)
Laboratory course designed to provide skills and the background to analyze data from biochemical, biomedical, and pharmacological processes with the goal of determining their underlying chemical mechanisms. Focus on simple and complex equilibrium binding behavior, simple and complex enzyme kinetics, and some elemental bioenergetics. Use of these functions and graphs to analyze data from the biochemical literature. Preparation for students going on to graduate studies in chemical and molecular biology or to medical school. Prereq: BIOL 215.
Prereq: BIOL 210 or BIOL 214.

**BIOL 307. Evolutionary Biology of the Invertebrates (3)**
Important events in the evolution of invertebrate life, as well as structure, function, and phylogeny of major invertebrate groups.

**BIOL 308. Molecular Biology: Genes and Genetic Engineering (4)**
An examination of the flow of genetic information from DNA to RNA to protein. Topics include: nucleic acid structure; mechanisms and control of DNA, RNA, and protein biosynthesis; recombinant DNA; and mRNA processing and modification. Where possible, eukaryotic and prokaryotic systems are compared. Special topics include yeast as a model organism, molecular biology of cancer, and molecular biology of development. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Prereq: BIOL 205 or BIOL 215 or BIOL 307. Cross-listed as BIOL 308.

An introduction to the ecology and genetics of populations. The course takes an evolutionary approach to understanding the effects of ecological and biological constraints on adaptive characteristics of populations of plants and animals, including life-history strategy, social organization, and population substructure. Emphasis will be on understanding the regulation of abundance, distribution, and diversity of natural populations and on contrasts between humans and other species. Prereq: BIOL 210 or BIOL 215 and one year of math.

**BIOL 311. Field Biology Laboratory (2)**
Two projects involving taxonomy, abundance, density, and distribution of plants at Squire Valleyue Farm, with particular emphasis on tree species. Students will collect plant samples and make their own herbarium. Following this there will be four weeks of field work and three weeks of workshop sessions to analyze and interpret data. Use of personal computers for analysis of field data. A final report and a presentation required for the final project. Prereq: BIOL 110 or BIOL 216.

**BIOL 313. Genetics Laboratory (2)**
This laboratory exposes students to the methods used to study the genetics of a wide range of organisms. Some of the topics covered are: gene mapping in diploids, tetrad analysis, mutagenesis, complementation, and mitotic recombination. Emphasis is placed on the relationship between the genotype and the biochemical events which determine the phenotype. One laboratory per week. Prereq: BIOL 326 (or concur).

**BIOL 315. Quantitative Biology Laboratory (3)**
Application of personal computers to biological research. Emphasis on the use of structured programming and flow charting. Use of statistical techniques, analysis of experimental design, modeling strategies. The use of diverse software packages such as spreadsheets, word processing, statistical packages. Continuous interaction with the WWW. Weekly lectures and problem sets posted in the WWW home page. One lecture and one lab per week. Prereq: BIOL 216 or BIOL 310.

**BIOL 316. Fundamental Immunology (3)**
Introductory immunology providing an overview of the immune system, including activation, effector mechanisms, and regulation. Topics include antigen-antibody reactions, immunologically important cell surface receptors, antigen processing and presentation, cell-cell interactions, cell-mediated immunity, cytoxins, and basic molecular biology of B and T lymphocytes. Lectures emphasize experimental findings leading to the concepts of modern immunology. Prereq: BIOL 210 or BIOL 215.

**BIOL 326. Genetics (3)**
Transmission genetics, nature of mutation, microbial genetics, somatic cell genetics, recombinant DNA techniques and their application to genetics, human genome mapping, plant breeding, transgenic plants and animals, uniparental inheritance, evolution, and quantitative genetics. Prereq: BIOL 210 or BIOL 214.

**BIOL 334. Structural Biology of Proteins, Enzymes, and Nucleic Acids (3)**
A detailed consideration of the structure and function of proteins and enzymes. Topics include: enzyme structure, kinetics, and mechanisms; structural biology of proteins and protein-DNA complexes; and techniques for structural analysis. Prereq: BIOL 205 or BIOL 215 or BIOC 307. Cross-listed as BIOC 334.

**BIOL 336. Aquatic Biology (3)**
Physical, chemical, and biological dynamics of lake ecosystems. Factors governing the distribution, abundance, and diversity of freshwater organisms. Prereq: BIOL 110 or BIOL 216.

**BIOL 339. Aquatic Biology Laboratory (2)**
The physical, chemical, and biological limnology of freshwater ecosystems will be investigated. Emphasis will be on identification of the organisms inhabiting these systems and their ecological interactions with each other. This course will combine both field and laboratory analysis to characterize and compare the major components of these ponds. Students will have the opportunity to design and conduct individual projects. Prereq: BIOL 336.

**BIOL 340. Human Physiology (3)**
This course will provide functional correlates to the students' previous knowledge of human anatomy. Building upon the basic principles covered in BIOL 216 and 346, the physiology of organs and organ systems of humans, including the musculoskeletal, nervous, cardiovascular, lymphatic, immune, respiratory, digestive, excretory, reproductive, and endocrine systems, will be studied at an advanced level. The contribution of each system to homeostasis will be emphasized. The course is offered in the spring semester of odd-numbered years. Prereq: BIOL 216 or BIOL 220, and BIOL 346.

**BIOL 343. Microbiology (3)**
An introduction to the physiology, genetics, biochemistry, and diversity of microorganisms. The subject will be approached both as a basic biological science that studies the molecular and biochemical processes of cells and viruses, and as an applied science that examines the involvement of microorganisms in human disease as well as in workings of ecosystems, plant symbioses, and industrial processes. The course is divided into four major areas: bacteria, viruses, medical microbiology, and environmental and applied microbiology. Prereq: BIOL 110 or BIOL 215.

**BIOL 344. Laboratory for Microbiology (2)**
Practical microbiology, with an emphasis on bacteria as encountered in a variety of situations. Sterile techniques, principles of identification, staining and microscopy, growth and nutritional characteristics, genetics, enumeration methods, epidemiology, immunological techniques (including ELISA and T cell identification), antibiotics and antibiotic resistance, chemical diagnostic tests, sampling the human environment, and commercial applications. One laboratory per week. Prereq: BIOL 343 (or concur).

**BIOL 346. Human Anatomy (3)**
A detailed study of the anatomy of the human body. Two lectures and one laboratory demonstration per week. Prereq: BIOL 110 or BIOL 214 or concurrent registration in BIOL 114 and BIOL 119.

**BIOL 348. Human Anatomy and Physiology (4-5)**
The anatomy and physiology of the human body. Enrollment is restricted to students majoring in nutrition. Four lectures and one laboratory per week.

**BIOL 350. Introduction to Ecosystem Analysis and Environmental Science (3)**
Reviews major ecological theories and principles through analysis of contemporary environmental problems. Exploration of difficulties in applying scientific information to public policy formation and the role of computer models in linking theory and practice in managing the environment. Two lectures and one laboratory per week. Prereq: BIOL 110 or BIOL 114 or BIOL 214.

**BIOL 358. Animal Behavior (3)**
An evolutionary approach to animal behavior, with emphasis on experimental behavioral studies. Evolution of behavior, communication, learning and sensory approaches. Field excursions to Cleveland Zoo/Rain Forest, Mentor Marsh, Squire Valleyue Farm and Sea World. Each student will design and conduct an original, independent behavioral experiment outside of class. Prereq: BIOL 114 for non-majors. BIOL 214 for majors.
BIOL 362. Principles of Developmental Biology (3)
The descriptive and experimental aspects of animal development. Gametogenesis, fertilization, cleavage, morphogenesis, induction, differentiation, organogenesis, growth, and regeneration. Prereq: BIOL 216 or BIOL 220.

BIOL 364. Endocrinology (3)
Hormonal regulation of physiological processes of development, growth, metabolism, excretion, digestion, and reproduction and the neural control of hormone secretion in vertebrates. Effects of hormones at the cellular and organismic levels. Prereq: BIOL 216 or BIOL 220 and CHEM 224.

BIOL 370. Ecology (3)
The course is a review of basic principles governing abundance and distribution of organisms. Topics will include both theoretical and empirical analysis of community structure and ecosystem processes. The course will also emphasize the practical implication these principles to contemporary environmental concerns with the sustainable use of natural resources. Prereq: BIOL 216 or BIOL 220.

BIOL 373. Introduction to Neurobiology (3)
How nervous systems control behavior. Biophysical, biochemical, and molecular biological properties of nerve cells, their organization into circuitry, and their function within networks. Emphasis on quantitative methods for modeling neurons and networks, and on critical analysis of the contemporary technical literature in the neurosciences. Prereq: BIOL 216 or BIOL 220.

BIOL 374. Neurobiology of Behavior (3)
In this course students will be shown how a neurobiologist interested in animal behavior studies the linkage between neural circuitry and complex behavior. Several exercises will be used in this endeavor. In addition to traditional lectures providing background on neural systems selected for the insight that they provide to behavioral principles, we will spend approximately half of the formal class periods in reading contemporary papers and discussing their methods and conclusions. Various vertebrate and invertebrate systems will be considered. In addition, several class periods will be spent observing animal behavior in order to get an appreciation of the fantastic things animals do. Finally, students will be required to complete a term project that will be designed to give them a first-hand feel for the processes followed in studying neurobiology of behavior. The exact form of the project will vary from year to year. Prereq: BIOL 216 or BIOL 220.

BIOL 375. Autonomous Robotics (3)
Introduction to the design, construction and control of autonomous mobile robots. The first half of the course consists of focused exercises on mechanical construction with LEGO, characteristics of sensors, motors and batteries, and control strategies for autonomous robots. In the second half of the course, students design, build and program their own complete robots that participate in a public competition. All work is performed in groups. Biologically-inspired approaches to the design and control of autonomous robots are emphasized throughout. Prereq: Consent of department. Cross-listed as EECS 375.

BIOL 376. Neurobiology Laboratory (3)
Introduction to the basic laboratory techniques of neurobiology. Intracellular and extracellular recording techniques, forms of synaptic plasticity, patch clamping, immunohistochemistry and confocal microscopy. During the latter weeks of the course students will be given the opportunity to conduct an independent project. One laboratory and one discussion session per week. Prereq: BIOL 216 or BIOL 220.

BIOL 378. Computational Neuroscience (3)
Computer simulation of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural circuits, as well as to cable theory, passive and active compartmental modeling, numerical integration methods, models of plasticity and learning, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week.
BIOL 407. General Biochemistry (4)
(See BIOL 407.) Cross-listed as BIOL 407.

BIOL 408. Molecular Biology: Genes and Genetic Engineering (4)
An examination of the flow of genetic information from DNA to RNA to protein. Topics include: nucleic acid structure; mechanisms and control of DNA, RNA, and protein biosynthesis; recombinant DNA; and mRNA processing and modification. Where possible, eukaryotic and prokaryotic systems are compared. Special topics include yeast as a model organism, molecular biology of cancer, and molecular biology of development. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Prereq: BIOL 205 or BIOL 215 or BIOL 307. Cross-listed as BIOL 408.

BIOL 415. Quantitative Biology Laboratory (3)
Application of personal computers to biological research. Emphasis on the use of structured programming and flow charting. Use of statistical techniques, analysis of experimental design, modeling strategies. The use of diverse software packages such as spreadsheets, word processing, statistical packages. Continuous interaction with the WWW. Weekly lectures and problem sets posted in the WWW home page. During the last 6 weeks of the course the student will have a final project that consists of data analysis and interpretation. Report required for the final project. One lecture and one lab per week.

BIOL 416. Fundamental Immunology (3)
Introductory immunology providing an overview of the immune system, including activation, effector mechanisms, and regulation. Topics include antigen-antibody reactions, immunologically important cell surface receptors, antigen processing and presentation, cell-cell interactions, cell-mediated immunity, cytokines, and basic molecular biology of B and T lymphocytes. Lectures emphasize experimental findings leading to the concepts of modern immunology. A term paper is required. Prereq: BIOL 210 or BIOL 215. Cross-listed as PATH 416.

BIOL 417. Cytokines: Function, Structure, and Signaling (3)
(See PATH 417.) Cross-listed as CLBY 417 and PATH 417.

BIOL 426. Genetics (3)
Transmission genetics, nature of mutation, microbial genetics, somatic cell genetics recombinant DNA techniques and their application to genetics, human genome mapping, plant breeding, transgenic plants and animals, uniparental inheritance, evolution, quantitative genetics.

BIOL 427. Neural Development (3)
Topics include cell commitment, regulation of proliferation and differentiation, cell death and trophic factors, pathfinding by the outgrowing nerve fiber, synapse formation, relationships between center and periphery in development and the role of activity. Cross-listed as NEUR 427.

BIOL 431. Statistical Methods I (3)
(See EPBI 431.) Cross-listed as EPBI 431.

BIOL 432. Statistical Methods II (3)
(See EPBI 432.) Cross-listed as EPBI 432 and MPHP 432.

BIOL 434. Structural Biology of Proteins, Enzymes, and Nucleic Acids (3)
A detailed consideration of the structure and function of proteins and enzymes. Topics include: enzyme structure, kinetics, and mechanisms; structural biology of proteins and protein-DNA complexes; and techniques for structural analysis. Prereq: BIOL 215 or BIOL 205 or BIOL 307. Cross-listed as BIOL 434.

BIOL 436. Advanced Aquatic Biology (3)
Physical, chemical, and biological dynamics of lake ecosystems. Factors governing the distribution, abundance, and diversity of freshwater organisms.

BIOL 443. Advanced Microbiology (3)
The physiology, genetics, biochemistry, and diversity of microorganisms. The subject will be approached both as a basic biological science that studies the molecular and biochemical processes of cells and viruses, and as an applied science that examines the involvement of microorganisms in human disease as well as in the workings of ecosystems, plant symbioses, and industrial processes. The course is divided into four major areas: bacteria, viruses, medical microbiology, and environmental and applied microbiology. Prereq: BIOL 110 or BIOL 215.

BIOL 448. Human Anatomy and Physiology (4-5)
(See BIOL 348.)

BIOL 457. Proteins: Structure and Function (3)
(See PHOL 456.) Cross-listed as PHOL 456.

BIOL 458. Animal Behavior (3)
(See BIOL 358.)

BIOL 460. Introductory Molecular Biology (3)
(See PHOL 460.) Cross-listed as PHOL 460.

BIOL 462. Advanced Principles of Developmental Biology (3)
Same as BIOL 362 except the required term paper is an NIH-format research proposal. Prereq: BIOL 216 or BIOL 220. Cross-listed as ANAT 462.

BIOL 465. Endocrinology (3)
Hormonal regulation of physiological processes of development, growth, metabolism, excretion, digestion, and reproduction and the neural control of hormone secretion in vertebrates. Effects of hormones at the cellular and organismic levels.

BIOL 473. Introduction to Neurobiology (3)
How nervous systems control behavior. Biophysical, biochemical, and molecular biological properties of nerve cells, their organization into circuitry, and their function within networks. Emphasis on quantitative methods for modeling neurons and networks, and on critical analysis of the contemporary technical literature in the neurosciences. Term paper required. Two lectures per week. Prereq: Consent of department. Cross-listed as NEUR 473.

BIOL 474. Neurobiology of Behavior (3)
(See BIOL 374.) Cross-listed as NEUR 474.

BIOL 475. Autonomous Robotics (3)
Introduction to the design, construction and control of autonomous mobile robots. The first half of the course focuses on practical exercises on mechanical construction with LEGO, characteristics of sensors, motors and batteries, and control strategies for autonomous robots. In the second half of the course, students design, build and program their own complete robots that participate in a public competition. All work is performed in groups. Biologically-inspired approaches to the design and control of autonomous robots are emphasized throughout. Lab reports and a term paper required. Prereq: Consent of department. Cross-listed as EECS 475.

BIOL 476. Neurobiology Laboratory (3)
Introduction to the basic laboratory techniques of neurobiology. Intracellular and extracellular recording techniques, forms of synaptic plasticity, patch clamping, immunohistochemistry, and confocal microscopy. During the latter weeks of the course students will be given the opportunity to conduct an independent project. One laboratory per week. Prereq: BIOL 216 or BIOL 220. Cross-listed as NEUR 476.

BIOL 477. The Dynamics of Adaptive Behavior (3)
(See EECS 477.) Cross-listed as EECS 477.

BIOL 478. Computational Neuroscience (3)
Computer simulation of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural circuits, as well as to cable theory, passive and active compartmental modeling, numerical integration methods, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week. Cross-listed as EECS 478.

BIOL 479. Seminar in Computational Neuroscience (3)
Readings and discussion in the recent literature on computational neuroscience, adaptive behavior, and other current topics. Cross-listed as EBME 479, EECS 479, and NEUR 479.

BIOL 480. Physiology of Organ Systems (3)
This course presents an advanced introduction to the fundamental physiological principles governing the major organ systems in mammals. The function of the nervous, endocrine, digestive, muscle, circulatory, respiratory, and urinary systems are discussed. At the conclusion of the semester, integrative aspects of the major organ systems will be illustrated.
through consideration of exercise and high altitude physiology. Cross-listed as PHIL 480.

B I O L  494. Seminar in Evolutionary Biology (3) (See PHIL 494.) Cross-listed as PHIL 494.

B I O L  531. Seminar in Experimental Ecology (1-3)

B I O L  536. Seminar in Great Lakes Issues (1-3) Selected topics related to Great Lakes basin studies: research problems, scientific processes, classic research papers, current events, policy issues, and legislative initiatives. Course content will vary depending on interests of students and faculty. Cross-listed as GEOL 536.

B I O L  541. Seminar in Genetics (1)

B I O L  550. Neuromechanics Seminar (0) (See EBME 550.) Cross-listed as EBME 550.

B I O L  550A. Seminar in Experimental Biology: Plant Science (1-3)
B I O L  550C. Seminar in Experimental Biology (1-3)

B I O L  552. Seminar in Developmental Biology (1-3) Topics pertaining to the field of development, such as regeneration and induction, which address both vertebrate and invertebrate forms.

B I O L  569. Advanced Seminar in Developmental Biology (1-3) Participants prepare and present seminars on subjects of contemporary interest and importance in developmental biology.

B I O L  599. Advanced Independent Study for Graduate Students (1-3) Independent study of advanced topics in biology under the supervision of a biology faculty member. Registration requires submission of a proposal for a project or study and approval of the department.

B I O L  601. Research (1-9)
B I O L  651. Thesis M.S. (1-9)
B I O L  701. Dissertation Ph.D. (1-9)
B I O L  702. Appointed Dissertation Fellow (9)

B I O L  801. Biotechnology Workshop (2) The course will cover the topics of DNA structure and isolation, restriction enzyme digests, the fractionation of DNA by gel electrophoresis, southern blotting, hybridization and the nature of restriction fragment length polymorphisms, the cloning of DNA in various vectors and the identification of recombinant molecules, the use of the polymerase chain reaction to amplify DNA and its use in DNA fingerprinting. The ethical issues arising from the implementation of recombinant DNA technology and the advances in the human genome project will also form part of the course. The laboratory exercises include DNA extraction from pea seeds, digestion with restriction enzymes and gel electrophoresis followed by southern blotting and hybridization. A fragment of bacteriophage lambda will be cloned in a plasmid vector and recombinant molecules isolated. A fingerprint of the participants’ own DNA will be developed using the polymerase chain reaction. Prereq: Co-registration Biotec Institute.

B I O L  802. Terrestrial and Aquatic Ecology for High School Teachers (2) A 2-week summer ecology course to take place at the University Farm in Hunting Valley, OH. It is designed for teachers of grades 6-12 in both public and private schools who have an interest in current ecological problems. Participants will learn field sampling techniques and identification of a diversity of living organisms, both plant and animal. They will study the distribution and abundance of terrestrial and aquatic organisms. Field work in the varied habitats of the University Farm will be an integral part of the program. Data will be analyzed and interpreted using personal computers. Participants will receive supplies, field guides, and detailed laboratory exercises that are designed specifically for the classroom. The course will be offered during the last two weeks of June and is limited to 12 participants.

B I O L  803. Autonomous Robotics for High School Science Teachers (2) A 2-week, 10-day summer course in designing, building, and programming computer-controlled robots which are able to function autonomously in complex real-world environments. LEGO Technics components are used for structures and gear trains. Various mechanical and photodetection sensors provide sensory feedback. A microcontroller board programmed in C is used for sensory integration and behavioral control. Participants work in groups of two per workstation. Detailed written documentation and laboratory exercises will be provided. Topics include: mechanical design with LEGO, sensors and feedback control, C programming, multi-tasking control strategies, and an end-of-course robot competition. Eligibility: high school (grades 9-12) science teachers; those in the biological sciences preferred. Limit 10. Prereq: Consent of department.

B I O L  804. School Yard Ecology (2) This 13-day program (including 10 days of summer instruction) will introduce teachers of middle grades (4-9) to both ecological concepts and scientific inquiries. Participants will conduct daily observations and use hands-on studies to build understanding of the abiotic environment, diversity and adaptation, biogeochemical cycles and energy flow, interspecific interactions, population characteristics, and change in ecological time. After practicing using simple field instruments and basic methods, participants will be challenged to design instruments and methods to answer their own research questions using their schoolyards. Three follow-up sessions for this course will be held during the school year. These will permit teachers to investigate seasonal phenomena and share the results of personal and student investigations with other participants.

Department of Chemistry

Millis Science Center
Phone 216-368-5914; Fax 216-368-3006
Lawrence M. Sayre, Chair

The Department of Chemistry is the largest department and central focus of a wide array of departments representing the chemical sciences at the University. It consists of 22 faculty members, approximately 15 postdoctoral associates, more than 80 graduate students, and more than 100 undergraduate students majoring in chemistry. The department offers programs leading to both undergraduate degrees (Bachelor of Arts and Bachelor of Science) and graduate degrees (Master of Science and Doctor of Philosophy).

The general focus of chemistry is on (i) understanding the basic properties of matter, and (ii) employing this knowledge in the design, synthesis, and characterization of substances with novel and useful properties. The various degree programs strive to develop all aspects of the student’s chemical knowledge via a broad range of lecture and laboratory courses. Chemical research is an integral part of the department’s activities; more than $3 million of federal and private research support flows into the department each year. The facilities for carrying out first-rate research are outstanding and are available to both graduate and undergraduate students. Undergraduates are encouraged to participate in research projects with individual faculty members as a method of expanding their chemical training, and to more fully develop their comprehension of what is involved in the chemical research enterprise. These research programs typically involve interchange and collaboration across all levels of experience and may also involve faculty from other departments and institutions. Chemistry is often referred to as the central science because of the key role it plays in a number of areas of interdisciplinary studies. Correspondingly, an important aspect of a degree in chemistry is the broad range of employment opportunities it affords. Chemists can direct their talents to specialized problems of applied research, or they can choose to delve into fundamental investigations. They cover the spectrum of chemical specialties from microbiochemistry to the study of lunar materials. A chemical degree also provides a valuable preparation for various other related professions, such as medicine, dentistry, and law.

The American Chemical Society, with its more than 100,000 members, is the major professional society in the United States for
practicing chemists. Both undergraduate and graduate students may become affiliated with the society.

Faculty

Lawrence M. Sayre, Ph.D. (University of California, Berkeley)

Frank Horvorka Professor and Chair of the Department of Chemistry
Bioorganic and bioinorganic chemistry; redox enzyme mechanisms; protein oxidation/ modification; neurotoxicology

Alfred B. Anderson, Ph.D. (Johns Hopkins University)
Professor
Pure and applied theoretical chemistry; surface science, inorganic chemistry and properties of materials

Mary D. Barkley, Ph.D. (University of California, San Diego)
Professor
Time-resolved fluorescence spectroscopy; biophysical chemistry; HIV reverse transcriptase; HCV RNA polymerase

Clemens Burda, Ph.D. (University of Basel, Switzerland)
Assistant Professor
Physical chemistry of nanostructures; molecular electronics; femtosecond laser spectroscopy

James D. Burgess, Ph.D. (Virginia Commonwealth University)
Assistant Professor
Physical Chemistry of platinum-based anticancer drugs; electrode-supported bilayer membranes; electron transfer enzymes

Robert C. Dunbar, Ph.D. (Stanford University)
Professor
Gas phase ions and ion-neutral interactions: ion-molecular reaction kinetics

Philip P. Garner, Ph.D. (University of Pittsburgh)
Professor
Synthetic organic chemistry

Bachelor of Science in Chemistry Degree

(Recommended sequence for the required science and math courses)

Freshman Year

Fall
CHEM 105, Principles of Chemistry I .................. (3-0-3)
CHEM 113, Principles of Chemistry Laboratory .......... (1-3-2)
MATH 121, Calculus for Science and Engineering I ........ (4-0-4)

Spring
CHEM 106, Principles of Chemistry II .................. (3-0-3)
ENGR 131, Elementary Computer Programming .......... (2-2-3)
MATH 122, Calculus for Science and Engineering II ....... (4-0-4)
PHYS 121, General Physics I. Mechanics .................. (4-0-4)*

Sophomore Year

Fall
CHEM 323, Organic Chemistry I .......................... (3-0-3)
CHEM 321, Laboratory Methods & Techniques I .......... (1-6-3)
MATH 223, Calculus for Science & Engineering III ....... (3-0-3)
PHYS 122, General Physics II. Electricity & Magnetism .... (4-0-4)

Spring
CHEM 324, Organic Chemistry II .......................... (3-0-3)
CHEM 322, Laboratory Methods & Techniques II ........ (1-6-3)
MATH 224, Elementary Differential Equations ............ (3-0-3)
or
STAT 312, Statistics for Engineering and Science .......... (3-0-3)
PHYS 221, General Physics III. Modern ................... (3-0-3)

Fall
CHEM 335, Physical Chemistry I .......................... (3-0-3)
CHEM 331, Laboratory Methods & Techniques III ....... (1-6-3)
CHEM 311, Inorganic Chemistry I .......................... (3-0-3)

Spring
CHEM 336, Physical Chemistry II ........................ (3-0-3)
CHEM 332, Laboratory Methods & Techniques IV ...... (1-6-3)
Chemistry or approved elective ............................ (3-0-3)

Junior Year

Fall
CHEM 330, Computer Techniques in Chemistry .......... (1-3-2)
Chemistry or approved elective ............................ (3-0-3)
Technical elective ........................................... (3-0-3)

Spring
Chemistry or approved elective ............................ (3-0-3)
Biochemistry Requirement* ................................. (3-0-3)
Technical elective ........................................... (3-0-3)

Senior Year

Fall
CHEM 330, Computer Techniques in Chemistry .......... (1-3-2)
Chemistry or approved elective ............................ (3-0-3)
Technical elective ........................................... (3-0-3)

Spring
Chemistry or approved elective ............................ (3-0-3)
Biochemistry Requirement* ................................. (3-0-3)
Technical elective ........................................... (3-0-3)

a. Selected students may be invited to take PHYS 123, 124, 223 (Honors).
b. May be satisfied by CHEM 328, Introductory Biochemistry; CHEM 329, Chemical Aspects of Living Systems; or BIOC 307, General Biochemistry.
Robert G. Salomon, Ph.D. (University of Wisconsin, Madison)  
Professor  
Organic chemistry; synthesis; biosynthesis; homogeneous catalysis

Daniel A. Scherson, Ph.D. (University of California, Davis)  
Professor  
Electrochemistry; electrode kinetics; electrocatalysis; in-situ spectroscopic methods in electrochemistry

M. Cather Simpson, Ph.D. (University of New Mexico)  
Assistant Professor  
Biophysical chemistry; spectroscopic studies of biologically significant processes

John E. Stuehr, Ph.D. (Case Western Reserve University)  
Professor of Chemistry and Biochemistry; Associate Chair, Chemistry Department  
Rapid reactions in solution; metal complexing kinetics; proton transfer kinetics; protein and enzymatic dynamics

Fred L. Urbach, Ph.D. (Michigan State University)  
Professor  
Inorganic chemistry; multidentate transition metal chelates; models for copper protein active sites; reduct complex behavior of metal complexes and oxometalate species

Michael G. Zagorski, Ph.D. (Case Western Reserve University)  
Associate Professor  
Organic chemistry; nuclear magnetic resonance; structure of peptides

Associated Faculty

Vernon E. Anderson, Ph.D. (University of Wisconsin-Madison)  
Professor of Biochemistry and Chemistry  
Enzyme reactions and mechanisms

Paul Carey, Ph.D. (University of Sussex, UK)  
Professor of Biochemistry and Chemistry  
Raman spectroscopy; proteins and protein-ligand interactions

John J. Mieyal, Ph.D. (Case Western Reserve University)  
Professor of Pharmacology and Chemistry  
Hemoprotein chemistry, oxygen transport and activation; drug metabolism and related activity of cytochrome P 450

Charles R. Sanders, Ph.D. (The Ohio State University)  
Associate Professor of Physiology and Biophysics, and Chemistry  
Structural and chemical biology of membrane proteins; NMR spectroscopy

Witold K. Surewicz, Ph.D. (University of Lodz, Poland)  
Professor of Pathology and Chemistry  
Protein aggregation and the pathogenesis of aging-related diseases; prion protein; protein folding and protein-membrane interactions

Undergraduate Programs

The Department of Chemistry offers two basic curricula for undergraduate chemistry majors, leading to either a Bachelor of Science degree or a Bachelor of Arts degree.

Bachelor of Science Program

The Bachelor of Science degree program is designed for students who plan professional careers in chemistry and leads to certification by the American Chemical Society. The required science, math and computing courses for the B.S. curriculum are shown on the following page. The B.S. curriculum provides a rigorous background in chemistry yet has considerable flexibility in the senior year in the choice of electives. During the senior year, the B.S. major is expected to go a step beyond basic preparation in an area of chemistry of particular interest to him or her. Research is strongly encouraged. As many as nine hours of research (CHEM 397) may be credited toward the degree. B.S. majors who plan to go on to graduate study may elect to take advanced courses in inorganic chemistry (CHEM 412, 413); organic chemistry (CHEM 421, 422, 435); chemical thermodynamics (CHEM 407); quantum mechanics (CHEM 446); instrumental analytical chemistry (CHEM 410), or other graduate offerings. Interdisciplinary strengths can be achieved by selecting technical electives to follow designed “tracks” in biological chemistry, environmental chemistry, material science or polymer science.

Bachelor of Arts Degree in Chemistry

(Recommended sequence for the required science and math courses)

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<tr>
<th>Freshman Year</th>
<th>Class-Lab-Credit Hours</th>
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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>CHEM 105, Principles of Chemistry I ........................................ (3)</td>
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<td>CHEM 113, Principles of Chemistry Laboratory ................................ (2)</td>
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<td>MATH 125, Mathematics I ........................................................ (4)</td>
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<td><strong>Spring</strong></td>
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<td>CHEM 106, Principles of Chemistry II ......................................... (3)</td>
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<td>MATH 126, Mathematics II ........................................................ (4)</td>
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<th>Sophomore Year</th>
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<td>CHEM 223, Introductory Organic Chemistry I .................................. (3)</td>
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<td>CHEM 323, Organic Chemistry I .................................................. (3)</td>
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<td>CHEM 235, Organic Chemistry Laboratory I ..................................... (2)</td>
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<td>PHYS 115, Introductory Physics I ................................................ (4)</td>
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<td>CHEM 224, Introductory Organic Chemistry II .................................. (3)</td>
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<td>CHEM 324, Organic Chemistry II .................................................. (3)</td>
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<td>CHEM 234, Organic Chemistry Laboratory II ..................................... (2)</td>
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<td>PHYS 116, Introductory Physics II ................................................ (4)</td>
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<th>Junior Year</th>
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<td>CHEM 301, Introductory Physical Chemistry I .................................. (3)</td>
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<tr>
<td>CHEM 304, Chemical Measurements Lab ............................................. (3)</td>
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<td><strong>Spring</strong></td>
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<td>CHEM 302, Introductory Physical Chemistry II .................................. (3)</td>
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<td>CHEM 305, Introductory Physical Chemistry Laboratory ....................... (3)</td>
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<th>Senior Year</th>
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<td>Electives</td>
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<td><strong>Spring</strong></td>
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<td>Electives</td>
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Bachelor of Arts Program

The B.A. program is intended for students who plan careers in medicine or other health or science-related fields for which a baccalaureate degree in chemistry provides appropriate preprofessional training. B.A. majors may supplement their chemical training by electing additional chemistry courses or may utilize the curriculum flexibility in the Department of Chemistry to develop an interdisciplinary program of their choice. Many B.A. majors participate in undergraduate research within the Department of Chemistry (CHEM 397) or in other science departments including those in the medical school.

Honors Program

Chemistry majors who have excellent academic records may participate in the Honors in Chemistry program. To graduate with honors in chemistry, a student must satisfy the following requirements:

1. A combined grade point average of 3.30 in chemistry, physics, and mathematics and an overall grade point average of 3.00.
2. A minimum of six semester hours of CHEM 397, or, with departmental approval, chemical research done under another course number.
3. A thesis approved by the Undergraduate Committee of the department on the basis of the level of research, the quality of the manuscript, and the chemical content.

Minor

Students may complete a minor in chemistry, defined as one year of freshman chemistry (including laboratory); two additional three hour lecture courses; and two additional laboratory or approved courses. A recommended sequence would include: CHEM 105, 106, Principles of Chemistry I, II (3,3), and CHEM 113, Principles of Chemistry Laboratory (2); CHEM 223, 224, Introductory Organic Chemistry I, II (3,3), or CHEM 323, 324, Organic Chemistry I, II (3,3), and CHEM 233, 234, Introductory Organic Chemistry Laboratory I, II (2,2). Other sequences may be followed after consultation with the Department of Chemistry.

Teacher Licensure in Physical Science (Chemistry and Physics)

An option is available within the B.A. Chemistry major for students to become eligible for licensure as teachers of Physical Science (Chemistry and Physics) in secondary schools (Adolescents to Young Adults). Students interested in this option should contact Professor John Stuehr. A total of 57 contact hours in the content area is required for teacher licensure, as well as a 35-hour sequence in professional education (see Education [EDUC & EDJC]) taken here and at John Carroll University, including student teaching.

Subject Area Requirements for Chemistry majors:* ASTR 201 or BIOL 101 or GEOL 110; PHYS 121, 122, 196, 221; CHEM 105, 106, 113, 223, 224 (or 323, 324); PHYS 331; ENGR 125; MATH 125, 126; CHEM 301, 302, 304, 305, PHYS 310, 324; PHYS 315 or 316.

Graduate Programs

Master of Science Program

The Master of Science degree in chemistry may be obtained by completing a program including the preparation of a master’s thesis or a program involving only course work. Both programs require a minimum of 27 semester credit hours, of which up to 6 semester credit hours may be for the master’s thesis. Course work for the master’s degree may be taken on a part-time basis. Thesis research can be undertaken only by full-time graduate students. Only the master’s degree without thesis can be earned entirely on a part-time basis.

Master's Program in Science Entrepreneurship

In conjunction with four other departments in the College of Arts and Sciences (Biology, Mathematics, Physics, Statistics), the Chemistry Department offers an M.S. degree with specialization in Chemistry Entrepreneurship. This is a 27-credit-hour program that includes 18 hours of formal course work. The first year involves taking a two-semester science innovation sequence and a two-semester entrepreneurship sequence in the Weatherhead School of Management. During the two-year curriculum, the student will also take two technical electives, one of which must be in chemistry. The program capstone features a 9-credit-hour M.S. thesis based on the industrial internship of the student or on creation of a new venture. A seminar program provides continual exposure to scientists, technologists, and entrepreneurs.

Doctor of Philosophy Program

The Doctor of Philosophy degree in chemistry is granted to those students who have shown an extensive knowledge of advanced chemistry and the ability to do original research. The program usually requires four years of full-time study after the bachelor’s degree. Besides advanced courses, the program consists of cumulative and oral examinations, seminars and colloquia, and, most importantly, original research. At least twelve months must be spent in residence on campus while fulfilling the Ph.D. thesis research requirement.

Full-time graduate students who maintain satisfactory academic performance while pursuing the Ph.D. degree in chemistry normally receive a stipend for teaching and/or research which includes full tuition and a monthly amount sufficient to cover living expenses.

Facilities

Facilities for experimental and theoretical research are modern and extensive. They include diverse major instruments for use by faculty and students, as well as specialized equipment serving individual research groups. The major instrument facility centers on Varian Gemini 200 and 300 MHz NMR spectrometers, a Varian Inova 600 MHz NMR, a Kratos MS-25 RFA GC mass spectrometer, and an electron-spin resonance spectrometer.

Other departmental instrumentation includes equipment for ion cyclotron resonance spectrometry, laser Raman spectroscopy, x-ray diffraction, extremely rapid kinetics measurements, spectropolarimetry and circular dichroism, protein structure elucidation, ellipsometry, electrochemical measurements, and low-energy diffraction and Auger studies of surfaces. Access to very high field NMR instrumentation is available on campus at the Cleveland Center for Structural Biology (CCSB). Many faculty in the chemistry department are actively involved with the CCSB, which is equipped with a modern 300 and 500 MHz, plus two 600 MHz, spectrometers. A 900 MHz spectrometer will be added by 2003. The Frank Hovorka Information Center stands as the core of the Chemistry Department’s computer facility. This center and associated laboratories represents an array of advanced computational and graphics capabilities, including several Silicon Graphics Indigo computers and two SUN workstations. Many of the department’s analytical instruments are networked with these workstations together with computers in individual faculty research areas. The Chemistry Department’s computers are part of
the campus-wide communications network, CWRU/net. In addition to the full complement of software, Internet, and library database services offered by the University through CWRU/net, connections to off-site databases, such as STN and Ohio Supercomputer Center, are available to departmental users. A large number of laboratory microcomputers are in operation throughout the department.

Research

The Department of Chemistry is noted for the diversity of its research efforts. These range from synthetic studies of important bioactive substances, including antibiotics and DNA-binding substances, to a detailed understanding of the surface properties of materials used in batteries and electrolytic cells. Studies are being performed with molecules as simple as oxygen and as complicated as those which describe the active centers of enzymes or the protein core of insoluble aggregates which deposit in neurodegenerative disease. Multidisciplinary approaches are being applied to understanding energy transfer in proteins. Efforts are being made to understand the basic chemical properties leading to reactive modifiers generated from physiological lipids. Other research is aimed at developing new drugs for photodynamic therapy and at understanding biological activity through artificial intelligence approaches. The influence of metal ions in modulating reactivity is a common interest of several members of the faculty, as is the development of organometallic compounds for synthesis and catalysis. Experimental and theoretical studies of gas phase molecules are providing a fundamental understanding of unimolecular reaction dynamics and ionization processes important in atmospheric chemistry. Chemical surfaces are being studied. Of particular importance are studies designed to characterize the electrode-electrolyte interfaces important in electrocatalysis and the electrochemical properties of new semiconductors. These efforts are complemented by theoretical studies on the interfacial structure and bonding in composite materials.

The department uses some of the foremost equipment available in high-resolution nuclear magnetic resonance spectroscopy and in tunable laser spectroscopy. Work on various aspects of chemistry as studied by these techniques is recognized throughout the world.

The Graduate Program

The Chemistry of Life Processes offers the student the opportunity of pursuing a course of study that cuts across traditional disciplines. The three traditional areas of chemistry—inorganic, organic, and physical—are all represented in their biological aspects. Through strong ties with the biomedical community within the University surroundings, faculty who carry out research in biochemical areas have coordinated a program of integrated course work, seminar offerings, and research experience. Although the student receives a Ph.D. degree in chemistry, participants in this program gain a broader, interdisciplinary background which provides distinct advantages when embarking upon a career in teaching/research, industry, or at government laboratories.

Case Western Reserve University ranks among the leading universities internationally in its strengths in electrochemistry and has brought these strengths together under one coordinated structure, the Yeager Center for Electrochemical Studies (YCES). The interdisciplinary nature of electrochemistry involves the interaction of electrochemists in the chemistry and chemical engineering departments with metallurgists, surface physicists, inorganic and organic chemists, polymer membrane chemists, and electrical engineers. Such interactions, lacking on most campuses, are promoted at Case Western Reserve University through YCES.

Graduate students in the chemistry department have the opportunity to specialize in the area of electrochemistry with one of the most extensive course and research programs in the United States.

Colloquia and Seminars

The department sponsors a rich program of colloquia and seminars on recent advances in chemical research. Most notable among these is the Frontiers in Chemistry Lecture Series, in which scientists of international distinction lecture on major discoveries and developments in chemistry. In addition, a weekly colloquium series provides lectures by invited speakers in a variety of fields of chemical investigation. Both of these programs are addressed to the general audience of faculty, students, and other chemical scientists in the University and the Cleveland area, and are a vital means to a broad, current knowledge. Numerous other seminars and meetings are held on a more specialized and informal level. Most individual research groups conduct weekly discussions to evaluate their progress.

Chemistry (CHEM)

Undergraduate Courses

CHEM 101. The Wide, Wild World of Chemistry (3)
This is designed to give the non-science major an introduction to chemistry and its role in society. Chemical concepts will be presented in a non-mathematical way focusing on their implication for current scientific inquiry. Topics include forensics, explosives, green chemistry, nuclear energy, batteries, chemistry in the kitchen, and scientific ethics.

CHEM 105. Principles of Chemistry I (3)
Atomic structure; thermochemistry; periodicity, bonding and molecular structure; intermolecular forces; properties of solids; liquids, gases and solutions. Prereq: One year of high school chemistry.

CHEM 106. Principles of Chemistry II (3)
Thermodynamics, chemical equilibrium; acid/base chemistry; oxidation and reduction; kinetics; spectroscopy; introduction to nuclear, organic, inorganic, and polymer chemistry. Prereq: CHEM 105 or equivalent.

CHEM 111. Principles of Chemistry for Engineers (4)
A first course in University Chemistry emphasizing chemistry of materials for engineering students. Atomic theory and quantitative relationships; gas laws and kinetic theory; solutions, acid-base properties and pH; thermodynamics and equilibrium; kinetics, catalysis, and mechanisms; molecular structure and bonding. Prereq: One year of high school chemistry or permission of department.

CHEM 113. Principles of Chemistry Laboratory (2)
A one semester laboratory based on quantitative chemical measurements. Experiments include analysis, synthesis and characterization, thermochemistry and chemical kinetics. Computer analysis of data is a key part of all experiments. Coreq: CHEM 105, CHEM 106, CHEM 111, or ENGR 145.

CHEM 223. Introductory Organic Chemistry I (3)
Introductory course for engineering students and science majors. Develops themes of structure and bonding along with elementary reaction mechanisms. Includes extensive treatment of hydrocarbons, alkyl halides, alcohols, and ethers as well as an introduction to spectroscopy. Prereq: CHEM 106 or CHEM 111.

CHEM 224. Introductory Organic Chemistry II (3)
Continues and extends themes of structure and bonding from CHEM 223 and introduces spectroscopy and more complex reaction mechanisms. Includes extensive treatment of aromatic rings, carbonyl compounds, amines and selected special topics. Prereq: CHEM 223 or CHEM 323.

CHEM 233. Introductory Organic Chemistry Laboratory I (2)
An introductory organic laboratory course emphasizing microscale operations. Synthesis and purification of organic compounds, isolation of natural products, and systematic identification of organic compounds by physical and chemical methods. Prereq: CHEM 113 and CHEM 106 or equivalent. Coreq: CHEM 223 or CHEM 323.
CHEM 234. Introductory Organic Chemistry Laboratory II (2)  
A continuation of CHEM 233, involving multi-step organic synthesis, peptide synthesis, product purification and analysis using sophisticated analytical techniques such as chromatography and magnetic resonance spectroscopy. Prereq: CHEM 233.

CHEM 290. Chemical Laboratory Methods for Engineers (3)  
Techniques of chemical synthesis, analysis, and characterization. Uses students' backgrounds in general and organic chemistry, but requires no background in chemical laboratory operations. Coreq: CHEM 225 or CHEM 323.

CHEM 301. Introductory Physical Chemistry I (3)  
First of a two-semester sequence covering principles and applications of physical chemistry, intended for chemistry and chemical engineering majors and other students having primary interests in biochemical, biological or life-science areas. States and properties of matter. Thermodynamics and its application to chemical and biochemical systems. Chemical equilibrium. Electrochemistry. Prereq: CHEM 106 or equivalent and a year each of physics and calculus, preferably including partial derivatives.

CHEM 302. Introductory Physical Chemistry II (3)  

CHEM 304. Chemical Measurements Laboratory (3)  
A one-semester laboratory course involving quantitative chemical measurements, error analysis and advanced concepts in ionics equilibria. Electrogravimetric and volumetric analysis; separation techniques; metal complexation. Basic chemical instrumentation. Prereq: CHEM 233 and CHEM 234, or CHEM 321 and CHEM 322. Coreq: CHEM 301.

CHEM 305. Introductory Physical Chemistry Laboratory (3)  
A one-semester laboratory course in the principles and quantitative characterization of chemical and biomedical systems. Experiments such as phase equilibria, calorimetry, chemical equilibrium, kinetics, electrochemistry, spectroscopy and the use of computers to analyze data. Prereq: CHEM 304 and CHEM 301 or CHEM 335. Coreq: CHEM 302 or CHEM 356.

CHEM 311. Inorganic Chemistry I (3)  
Fundamentals of inorganic chemistry. Topics include molecular structure, molecular shape and symmetry, structure of solids, d-metal complexes, oxidation and reduction, and acids and bases. Prereq: CHEM 301 or CHEM 335 (may be taken concurrently).

CHEM 312. Inorganic Chemistry II (3)  
Continuation of CHEM 311. Fundamentals of inorganic chemistry. Topics include electronic spectra of complexes, structures and properties of solids and descriptive chemistry of representative elements. Prereq: CHEM 311.

CHEM 317. Radiochemistry: Radioactivity and its Applications (3)  
Application of radiotracers in chemistry, biology, engineering, and medical diagnosis and therapy. Covers radiation safety and basic theory, techniques, and uses of radiochemistry. Prereq: CHEM 106 or equivalent.

CHEM 321. Laboratory Methods and Techniques I (3)  
CHEM 321 and 322 are the first two semesters of an integrated laboratory course. Experimental approach to chemical problems. Introduction to analytical methods. Chemical measurements, synthesis, and characterization. Prereq: CHEM 113. Coreq: CHEM 223 or CHEM 325.

CHEM 322. Laboratory Methods and Techniques II (3)  
Continuation of CHEM 321 with special focus on chemical synthesis and qualitative analysis of organic compounds. Prereq: CHEM 321. Coreq: CHEM 224 or CHEM 324.

CHEM 323. Organic Chemistry I (3)  
An enriched course for the sufficiently able and interested student who wishes a deeper and broader appreciation of theory and practice of organic chemistry. Focuses on relationships between molecular structure and chemical reactivity, and stresses the development of sophisticated problem-solving skills in the context of organic reaction mechanisms and multi-step synthesis. Homolytic and heterolytic substitution, elimination, oxidation and reduction reactions; topics in stereochemistry and spectroscopy. Recommended for chemistry, biochemistry, and related majors. Prereq: CHEM 106 or equivalent and consent of department.

CHEM 324. Organic Chemistry II (3)  
Continuation of CHEM 323. Introduces the chemistry of carbonyl, aromatic and amino functional groups, and develops the concepts of conjugation and resonance, molecular orbital theory and pericyclic reactions. Prereq: CHEM 223 or CHEM 325 and consent of department.

CHEM 325. Physical Methods for Determining Organic Structure (3)  
Determination of structure of organic compounds, separation techniques. Application of infrared, ultraviolet, and visible spectroscopy, nuclear magnetic resonance spectroscopy, mass spectrometry, and modern instrumental techniques. Prereq: Two semesters of organic chemistry required.

CHEM 328. Introductory Biochemistry (3)  

CHEM 329. Chemical Aspects of Living Systems (3)  

CHEM 330. Computer Techniques in Chemistry Laboratory (2)  
Computer techniques for chemical research; searching chemical databases; data collection and analysis with computers; computational methods and molecular modeling. Introduction to software packages for computer applications in chemistry. Prereq: CHEM 322, and CHEM 302 or CHEM 356 and permission of department.

CHEM 331. Laboratory Methods and Techniques III (3)  
Synthesis, separation techniques, physical properties, and analysis. Advanced techniques of chemical synthesis, leading the student to the preparation of interesting inorganic and organometallic compounds. Prereq: CHEM 322.

CHEM 332. Laboratory Methods and Techniques IV (3)  
Modern techniques of physical measurement, including nuclear magnetic resonance, electronic spin resonance, and electrochemistry. Prereq: CHEM 351. Coreq: CHEM 336.

CHEM 335. Physical Chemistry I (3)  
First of a two-semester sequence of physical chemistry for chemistry majors and others with career goals in the physical sciences or engineering. States of matter. Kinetic theory of gases. Transport phenomena. Chemical thermodynamics and its application to chemical systems. Equilibrium. Ionic solutions and electrochemistry. Introduction to chemical quantum mechanics. Prereq: CHEM 106 or equivalent plus a year each of physics and calculus, including partial derivatives.

CHEM 336. Physical Chemistry II (3)  

CHEM 337. Quantum Mechanics I (3)  

CHEM 395. Chemistry Colloquium Series (1)  
Course content provided by Thursday chemistry department colloquia (or Frontiers in Chemistry lectures). Discussion sessions review previous lectures and lay foundation for forthcoming lectures.
CHEM 397. Undergraduate Research (1-6)
Independent research project within a research group in the chemistry department; arrangements should be made with the faculty member selected. Open to all chemistry majors and other qualified students; required for honors in chemistry. A written report is required each semester. Prereq: Consent of department.

Graduate Courses
CHEM 406. Chemical Kinetics (3)
Theory and characterization of chemical rate processes. Prereq: Two semesters of undergraduate physical chemistry.
CHEM 407. Chemical Thermodynamics (3)
Thermodynamics and statistical thermodynamics and their application to chemical problems. Prereq: Two semesters of undergraduate physical chemistry.
CHEM 410. Instrumental Analytical Chemistry (3)
Principles and applications of analytical instrumentation including optical spectroscopy (UV-vis, IR, Raman), photoelectron and ion bombardment spectrometry, NMR and magnetic resonance imaging. Prereq: Two semesters of undergraduate physical chemistry.
CHEM 412. Advanced Inorganic Chemistry I (3)
Chemistry of inorganic systems. Spectroscopy, magnetism, and stereochemistry of transition metal compounds. Prereq: One semester of undergraduate inorganic chemistry and two semesters of physical chemistry.
CHEM 413. Advanced Inorganic Chemistry II (3)
Chemistry of inorganic compounds; mechanisms of reactions. Prereq: CHEM 412 or equivalent.
CHEM 414. Organometallic Reactions and Structures (3)
Bonding, structure, and mechanistic aspects of organometallic chemistry and the relevance of organometallic species to chemical catalysis. Prereq: One semester of undergraduate inorganic chemistry.
CHEM 415. Chemical Applications of Group Theory (3)
Treatment of structure, bonding and spectroscopy in chemical systems based on a presentation of relationships and the theory of point and space groups. Prereq: CHEM 412 or permission of department.
CHEM 417. Radiochemistry: Radioactivity and its Applications (3)
Application of radioisotopes in chemistry, biology, engineering, and medical diagnosis and therapy. Covers radiation safety and basic theory, techniques, and uses of radiochemistry. Prereq: CHEM 106 or equivalent.
CHEM 421. Advanced Organic Chemistry I (3)
CHEM 422. Advanced Organic Chemistry II (3)
Determination of structure of organic compounds and application of infrared, ultraviolet, visible, and nuclear magnetic resonance spectroscopy, as well as mass spectrometry and other modern instrumental techniques. Prereq: Two semesters of undergraduate organic chemistry.
CHEM 429. Chemical Aspects of Living Systems (3)
CHEM 430. Advanced Methods in Structural Biology I (3)
(See BIOC 430.) Cross-listed as BIOC 430.
CHEM 435. Synthetic Methods in Organic Chemistry (3)
Systematic consideration of reactions which allow carbon-carbon bond formation or cleavage, as well as the introduction, removal, interconversion, or transposition of functional groups. Prereq: Two semesters of undergraduate organic chemistry.
CHEM 436. Complex Molecular Synthesis (3)
An advanced organic chemistry course providing students with an in-depth examination of the art of total synthesis focused on natural products. Topics will be selected from: Problem analysis and strategy, the logic of biosynthesis and biomimetic synthesis, and recent synthetic milestones. Prereq: CHEM 421 or consent of department.
CHEM 445. Electrochemistry I (3)
Electrochemical properties and processes of electrode/electrolyte interfaces. Fundamental background for work in corrosion, electrodeposition, industrial electrolysis, electro-organic synthesis, batteries, fuel cells, and photoelectrochemical energy conversion. Prereq: One undergraduate course in physical chemistry and a working knowledge of thermodynamics.
CHEM 446. Quantum Mechanics I (3)
CHEM 447. Quantum Mechanics II (3)
Continuation of CHEM 446. Ab initio and semi-empirical methods, configuration interactions, time dependent phenomena, and introduction to band theory of solids. Prereq: CHEM 446.
CHEM 448. Statistical Mechanics (3)
a systematic development of equilibrium statistical mechanics; the properties of the gaseous, liquid, and solid states of matter. Introduction to nonequilibrium statistical mechanics. Prereq: CHEM 407 and CHEM 446 or consent of department.
CHEM 450. Molecular Spectroscopy (3)
Rotation, vibration, and electronic spectra of simple and complex molecules. Prereq: CHEM 446.
CHEM 470. Macromolecular Synthesis (4)
Organic chemistry of macromolecules; mechanism of polyreactions, preparation of addition, condensation, and biopolymers, and the chemical reactions of polymers. Prereq: CHEM 224 or CHEM 324 and EMAC 270. Cross-listed as EMAC 470.
CHEM 479. X-ray Crystallography (3)
Scattering of x-rays by crystalline and semicrystalline solids including polymers. Technique of structure analysis.
CHEM 501. Special Topics in Inorganic Chemistry (1-6)
(Credit as arranged.) Lectures on advanced topics in inorganic chemistry presented by staff or visiting lecturers. Course title, content, and credit change from year to year.
CHEM 502. Special Topics in Inorganic Chemistry (1-6)
(Credit as arranged.) Lectures on advanced topics in inorganic chemistry presented by staff or visiting lecturers. Course title, content, and credit change from year to year.
CHEM 503. Special Topics in Organic Chemistry (1-6)
(Credit as arranged.) Lectures on advanced topics in organic chemistry presented by staff or visiting lecturers. Course title, content, and credit change from year to year. Prereq: CHEM 445 or permission of department.
opportunities for student involvement. Research, lectures, and programs on children also provide US. The Schubert Center for Child Development, sponsors enhance the educational opportunities for students at the university. Bolton School of Nursing. Close connections with the Rainbow School of Law, the School of Dentistry, and the Frances Payne Medicine, the Mandel School of Applied Social Sciences, the teaching throughout the University: including the School of.

Children and childhood are a focus of research and culture. The Childhood Studies Minor is situated in the College of Arts and Sciences. Children and childhood are a focus of research and teaching throughout the University: including the School of Medicine, the Mandel School of Applied Social Sciences, the School of Law, the School of Dentistry, and the Frances Payne Bolton School of Nursing. Close connections with the Rainbow Babies and Children’s Hospital and other Cleveland institutions enhance the educational opportunities for students at the university. The Schubert Center for Child Development, sponsors research, lectures, and programs on children and also provides opportunities for student involvement.

Faculty

Jill E. Korbin, Ph.D.
Professor of Anthropology
Director, Childhood Studies Minor
Co-Director, Schubert Center on Child Development
Richard Settersten, Ph.D.
Associate Professor of Sociology
Co-Director, Schubert Center on Child Development
Sandra Russ, Ph.D.
Professor of Psychology
Elizabeth Shott, Ph.D.
Associate Professor of Psychology

The Minor in Childhood Studies

The undergraduate minor in Childhood Studies is built on a foundation in the social sciences. It also is suited to students with interests in children in the natural sciences, the humanities, and the arts. The Minor requires at least 15 hours of course work in at least two different departments. The following courses are accepted toward the minor:

ANTH 306 Anthropology of Childhood and the Family - Child-rearing patterns and the family as an institution, using evidence from Western and non-Western cultures. Human universals and cultural variation, the experience of childhood and recent changes in the American family. Prerequisite: ANTH 102.

ANTH 309 Family Violence and Child Abuse - The prevalence and causes of intra-familial violence. Spouse abuse, child abuse, adolescent abuse, sexual abuse, parent abuse, and sibling violence. Major theoretical positions on the occurrence of these behaviors in light of information from both Western and non-Western cultures. Prerequisite: ANTH 102.


NTRN 328 Child Development and Health - Growth and development of the child from prenatal through adolescence, including individuality, maturation, and biological needs.

PSCL 230 Child Psychology - Basic facts and principles of psychological development from the prenatal period through adolescence. Prerequisite PSCL 101.

PSCL 329 Adolescence. Over the course of the past decade, the importance of adolescence as a separate field of study has grown in psychology and in other social sciences. This course will focus upon psychological perspectives of physical, cognitive, and social development during adolescence.

PSCL 344 Developmental Psychopathology - This course will focus on the interplay of biological, psychological, familial, and social determinants of disorders, ranging from autism to delinquency and bulimia. Prerequisites: PSCL 230 or PSCL 321.

PSCL 390 Seminars in Psychology, Development of the Preschool Child - This course will cover development from infancy through the preschool years from the perspective of psychoanalytic child development theory. A child’s progression through the pre-latency stages will be studied with particular focus on the “developmental lines” of childhood and the process of achieving mastery in self-care as a factor in the development of self-esteem.
The Department of Classics offers courses in the Greek and Latin languages and literatures, in ancient history, and in various other aspects of the culture and life of ancient Greece and Rome. In general, the purpose of the department is to provide the means by which students may acquaint themselves with the character and achievements of the ancient classical civilization of the Mediterranean world, which was the cultural progenitor of the modern West. A knowledge of classical antiquity constitutes the backbone of the liberal education. It also provides an excellent basis for further professional training of today’s student, no matter in what field he or she may ultimately earn a livelihood. Such knowledge is also a valuable source of enrichment for the student’s leisure. A major in classics, or even a minor may be, as it often has been, profitably combined with programs aimed toward law, medicine, management, diplomatic service, banking, journalism, librarianship, politics, religious, philosophic, literary, or historical studies, careers in the fine arts (visual or performing), museum or archival work.

**Faculty**

Martin Helzle, Ph.D. (Cambridge University, England)  
*Associate Professor and Chair*  
*Latin language and literature; Augustan and Silver poetry; palaeography and textual criticism*

Paul A. Iversen, Ph.D. (Ohio State University)  
*Visiting Assistant Professor*  
*Greek literature and history, comedy, epigraphy*

Donald R. Laing, Jr., Ph.D. (University of Cincinnati)  
*Associate Professor*  
*Ancient history and historical literature; epigraphy*

Angeliki Tzaneou, Ph.D. (University of Illinois at Champaign-Urbana)  
*Assistant Professor*  
*Greek language and literature; Greek tragedy, women in antiquity*

**Associate Faculty**

Jennifer Neils, Ph.D. (Princeton University)  
*Ruth Coulter Heede Professor*  
*Art History and Art*  
*Greek and Roman art and archaeology*

**Adjunct Faculty**

John J. Phillips, Ph.D. (Yale University), J.D. (Northwestern University)  
*Adjunct Assistant Professor, Assistant University Attorney*  
*Classical languages and literature*

**Undergraduate Programs**

**Major**

The classics major leading to the Bachelor of Arts degree requires 36 hours of departmental offerings. In addition, each student completing the classics major will be strongly advised to choose a related minor selected in consultation with and approved by the departmental advisor. Courses from the Department of Classics (36 hours): Eight courses (24 hours) in either Greek or Latin or a combination of both, provided that at least three courses are included from the most advanced level in one of the languages. Four classics courses, of which at least two must be numbered above 300. Recommended additional courses outside the Department of Classics (12 to 18 hours): We strongly advocate the addition of four to six courses in a closely related field to be selected by the student in consultation with the departmental advisor. Examples of closely related fields are anthropology, art history, philosophy, comparative literature, history, theater, and English. A second major or a minor in one of these fields will normally satisfy this recommendation.

**Minor**

The minor programs in the Department of Classics are designed to acquaint the student with aspects of the ancient civilization of Greece and Rome by means of a coherent sequence of 15 to 18 hours of course work. In order that the knowledge acquired may have the potential for depth and provide access to primary materials, some study of one or both of the classical languages is
recommended. The student may choose one of three basic patterns:

**Latin Concentration**
Nine hours from courses in Latin above the 102 level, plus six hours from:
- CLSC 112 Classical Civilization: Rome (3)
- CLSC 201 The Ancient World (3)
- CLSC 304 Ancient Rome: Republic and Empire (3)
- CLSC 395 Directed Readings (1-3)

**Greek Concentration**
Twelve hours in the Greek language, plus three hours from:
- CLSC 111 Classical Civilization: Greece (3)
- CLSC 201 The Ancient World (3)
- CLSC 301 Ancient Philosophy (5)
- CLSC 302 Ancient Greece: Archaic, Classical, and Hellenistic Periods (3)

**Classics Concentration**
(Requires consultation with departmental advisor)
Any two Latin or any two Greek courses, CLSC 111 or CLSC 112, or CLSC 201. Three courses from: CLSC 226 Introduction to Greek and Roman Art (3)
- CLSC 228 Theater History I (3)
- CLSC 301 Ancient Philosophy (3)
- CLSC 302 Ancient Greece: Archaic, Classical, and Hellenistic Periods (3)
- CLSC 304 Ancient Rome: Republic and Empire (3)
- CLSC 305 Selected Topics in Philosophy (3)
- CLSC 312 Women in the Ancient World
- CLSC 314 Love Poetry from Sappho to Shakespeare

Courses in Greek and Roman art at the 300 level
Any of these minor programs may be varied to suit the needs of the individual student, subject to the availability of other courses, after consultation with the department chair and with the approval of the student’s major advisor. A student may, with the consent of his or her major advisor, design and propose a more radically different minor in classics suited to his or her particular needs, with the approval of the department and such other curricular authorities as may be required.

**Sequences (Engineering Core Curriculum)**
All sequences should include CLSC 111, 112, and any other CLSC course above the 100 level in either Greek or Roman culture. Students should consult with the chair on the development of an acceptable sequence. The following are sample programs:

**Emphasis on Greece**
- CLSC 111 Classical Civilization: Greece (3)
- CLSC 112 Classical Civilization: Rome (3)
- CLSC 203 Heroes, Myth and Performance in Greek Literature (3)
- CLSC 302 Ancient Greece: Archaic, Classical, and Hellenistic periods (3)

**Emphasis on Rome**
- CLSC 111 Classical Civilization: Greece (3)
- CLSC 112 Classical Civilization: Rome (3)
- CLSC 204 Classical Literature II (3)
- CLSC 304 Ancient Rome: Republic and Empire (3)

**Departmental Honors**
A student desiring to earn the Bachelor of Arts degree with departmental honors in classics must make written application to the department chair no later than May 1 of the junior year. Permission to enter the Honors Program will be granted to majors who have earned an overall grade point average of 3.0 and an average of 3.25 in departmental offerings. Each candidate for honors must enroll in CLSC 381 in each semester of the senior year for a total of six hours credit and must pass a departmental examination on the work completed. A wide range of projects is available, and every attempt is made to suit the project to the interests and individual strengths of the candidate. Some projects require the completion of a thesis as the culmination of study; others employ different demonstrations of competence.

**Classics (CLSC)**

**Undergraduate Courses**

**Taught in Translation**
- CLSC 111. Classical Civilization: Greek (3)
  The enduring significance of the Greeks studied through their history, literature, art, and philosophy. Lectures and discussion.
- CLSC 112. Classical Civilization: Rome (3)
  The enduring significance of the Romans studied through their history, literature, art, and philosophy. Lectures and discussion.
- CLSC 201. The Ancient World (3)
  Ancient History from the origins of civilization in Mesopotamia to the dissolution of the Roman Empire in the West. Cross-listed as HSTY 200.
- CLSC 202. Classical Mythology (3)
  The myths of Classical Greece and Rome, their interpretation and influence.
- CLSC 203. Heroes, Myth, and Performance in Greek Literature (3)
  This course constitutes the first half of a sequence on Classical literature. As such, it examines the major works of Greek literature and seeks to place them within their immediate historical, literary and cultural context. It traces the evolution of heroes to citizens and analyzes oral and live performances while interpreting myth from a literary and socio-political standpoint. Constant themes are war and community, wandering, tyranny and democracy, and the literary manifestations of men's and women's roles within the household and the city.
- CLSC 204. Heroes and Hustlers in Latin Literature (3)
  This course constitutes the second half of a sequence on Classical literature. Its main themes are heroism vs. self-promotion, love vs. lust, and the struggle between democracy and tyranny. These topics are traced in a variety of literary genres from the period of the Roman republic well into the empire. Parallels with modern life and politics will be drawn.
- CLSC 210. Byzantine World 300-1453 (3)
  Development of the Byzantine empire from the emperor Constantine's conversion to Christianity and founding of the eastern capital at Constantinople to the fall of Constantinople to Turkish forces in 1453. Cross-listed as HSTY 210.
- CLSC 226. Introduction to Greek and Roman Art (3)
  (See ARTH 226) Cross-listed as ARTH 226.
- CLSC 227. Ancient Cities and Sanctuaries (3)
  (See ARTH 227) Cross-listed as ARTH 227.
- CLSC 295A. Greek and Latin Elements in English: The Basic Course (1.5)
  A self-paced, computer-assisted course in the classical foundations of modern English in which the student learns the basic principles on which roots, prefixes, and suffixes combine to give precise meanings to composite words. Available on CWRUnet.
CLSC 295B. Greek and Latin Elements in English: Biomedical Terminology (1.5) 
(See CLSC 295A.) Advanced section that is oriented especially toward scientific and medical terminology. Prereq: Previous or concurrent registration in CLSC 295A.

CLSC 301. Ancient Philosophy (3) 
Western philosophy from the early Greeks to the Skeptics. Emphasis on the pre-Socratics, Plato and Aristotle. Prereq: PHIL 101 and consent of department. Cross-listed as PHIL 301.

CLSC 302. Ancient Greece: Archaic, Classical, and Hellenistic Periods (3) 
The rise of Hellenic thought and institutions from the eighth to the third centuries B.C., the rise of the polis, the evolution of democracy at Athens, the crises of the Persian and Peloponnesian Wars, fifth century historiography, the growth of individualism, and the revival of monarchy in the Hellenistic period. Cross-listed as HSTY 302.

CLSC 304. Ancient Rome: Republic and Empire (3) 
Growth and development of the Roman state from the unification of Italy in the early third century B.C. to the establishment of the oriental despotism under Diocletian and Constantine. The growth of empire in the Punic Wars, the uncertain steps toward an eastern hegemony, the crisis in the Republic from the Gracchi to Caesar, the new regime of Augustus, the transformation of the leadership class in the early Empire, and the increasing dominance of the military over the civil structure. Cross-listed as HSTY 304.

CLSC 312. Women in the Ancient World (3) 
The course offers a chronological survey of women's lives in Greece, Hellenistic Egypt, and Rome. It focuses on reading primary sources as well as scholarly interpretations of the ancient record with a view to defining the construction of gender and sexuality according to the Graeco-Roman model. Additionally, the course aims to demonstrate how the various methodological approaches applied to the source material regarding women's lives have yielded significant insights into our own perception of the categories of sex and gender. Specific topics include matriarchy and patriarchy; the antagonism between male and female in myth; the legal, social, economical, and political status of women; the ancient family; women's role in religion and cult; ancient theories of medicine regarding women; paederasty and homosexuality. Cross-listed as WMST 312.

CLSC 314. Love Poetry from Sappho to Shakespeare (3) 
Introduction to the love poetry of ancient Greece and Rome and its impact on the later European tradition in such poets as Petrarch, Chaucer, and Shakespeare. Readings will focus especially on questions of generic convention, audience expectation, and the social setting of love poetry in the different ages under consideration. Cross-listed as CMPL 314.

CLSC 328. Greek Sculpture (3) 
(See ARTH 328.) Cross-listed as ARTH 328.

CLSC 332. Art and Architecture of Ancient Italy (3) 
(See ARTH 332.) Cross-listed as ARTH 332.

CLSC 333. Greek and Roman Painting (3) 
(See ARTH 333.) Cross-listed as ARTH 333.

CLSC 334. Art and Archaeology of Greece (3) 
(See ARTH 334.) Cross-listed as ARTH 334.

CLSC 381. Special Studies (1-6) 
Subject matter varies according to need. Prereq: 18 hours in the department of Classics and permission of the department.

CLSC 395. Directed Readings (1-3) 
Readings in English on a topic of interest to the student and acceptable to the instructor. Designed and completed under the supervision of the instructor with whom the student wishes to work. Prereq: Consent of department.

CLSC 481. Special Studies (1-6) 
Subject matter varies according to need. Prereq: Consent of department.

Greek (GREK) 
Undergraduate Courses 

GREK 101. Elementary Greek I (3) 
Beginning course in Greek language, covering grammar (forms and syntax) and the reading of elementary selections from ancient sources. Makes a start toward reading Greek authors. (Both GREK 101 and 102 must be completed to obtain credit.)

GREK 102. Elementary Greek II (3) 
Beginning course in Greek language, covering grammar (forms and syntax) and the reading of elementary selections from ancient sources. Makes a start toward reading Greek authors. (Both GREK 101 and 102 must be completed to obtain credit.) Prereq: GREK 101 or equivalent.

GREK 201. Greek Prose Authors (3) 
Readings from authors such as Plato, Lysias, Xenophon, and Herodotus. Prereq: GREK 102 or equivalent.

GREK 202. Introduction to Greek Poetry (3) 
Primarily readings from Homer, Hesiod, and Theocritus. Selections from Greek lyric may be introduced at the instructor's discretion. Prereq: GREK 201 or equivalent.

GREK 305. Readings in Ancient Philosophy: Plato (3) 
Reading and interpretation of selected dialogues by Plato or other philosophical works. Prereq: GREK 202.

GREK 306. Tragedy (3) 
Reading and interpretation of selected plays of Aeschylus, Euripides, and Sophocles. Prereq: GREK 202.

GREK 307. History (3) 
Extensive reading in Thucydides' History of the Peloponnesian War, especially Books VI and VII, the expedition against Syracuse. Prereq: GREK 202.

GREK 308. Comedy (3) 
Origin, ambiance, and development of Greek Old Comedy and persisting characteristics of the genre. Translation of selected plays from Greek into English. Prereq: GREK 202.

GREK 311. Homer (3) 
Reading and translation of extensive selections from the Odyssey. Introduction to epic meter, to Homeric Greek, and to the poet's style. Consideration of evidences of oral composition and discussion of the heroic tradition. Prereq: GREK 202 or equivalent.

GREK 380. Advanced Topics in Greek Literature (3) 
Study and discussion of important authors, works, and topics not covered regularly. Content will reflect particular interests of students and faculty and timeliness of the topics. Prereq: GREK 202 or equivalent.

GREK 395. Directed Readings (1-3) 
Readings in Greek of authors selected to serve the individual interests and needs of undergraduate students. Each program planned and completed under the supervision of the instructor with whom the student wishes to work. Prereq: Consent of department.

Hebrew (HBRW) 
Undergraduate Courses 

HBRW 101. Elementary Modern Hebrew I (4) 
(Credit for HBRW 101 only upon completion of HBRW 102.) For students with no knowledge of Hebrew. Introduces skills for speaking and writing. One hour of assigned lab work required.

HBRW 201. Intermediate Modern Hebrew I (4) 
Intensive review of grammar and conversational skills through readings, discussions, and other activities that explore contemporary Israeli life and Hebrew culture. Prereq: HBRW 102 or equivalent as determined by department.
Latin (LATN)

Undergraduate Courses

LATN 101. Elementary Latin I (3)
An introduction to the elements of Latin; pronunciation, forms, syntax, vocabulary, and reading. (Both LATN 101 and 102 must be completed to obtain credit.)

LATN 102. Elementary Latin II (3)
An introduction to the elements of Latin; pronunciation, forms, syntax, vocabulary, and reading. (Both LATN 101 and 102 must be completed to obtain credit.) Prereq: LATN 101 or equivalent.

LATN 201. Latin Prose Authors (3)
Reading and discussion of such prose authors as Cicero, Caesar, Livy or Pliny. Prereq: LATN 102 or equivalent.

LATN 202. Vergil (3)
Primarily readings from The Aeneid; selections from Vergil’s other work may be introduced at instructor’s discretion. Prereq: LATN 201 or equivalent.

LATN 305. Literature of the Republic (3)
A reading course in prose and poetry of the Roman Republic. Extensive selections from Cicero and Catullus, and one comedy of Terence. Prereq: LATN 202 or equivalent.

LATN 306. Survey of Latin Literature (3)
Reading and discussion of selections from the various genres of Latin literature of the Roman Republic and Empire such as historical narrative, lyric and elegiac poetry, comic drama, forensic rhetoric, philosophical dialogue, didactic literature, letters, and epigrams. Prereq: LATN 202 or equivalent.

LATN 307. Livy (3)
Readings in Books I and XXI, with other selections from this major Augustan historian. Prereq: LATN 202.

LATN 308. Horace: Odes and Epodes (3)
Readings and discussion of extensive selections from the poetry of Horace; consideration of Horace as exemplifying the spirit of the Augustan Age. Prereq: LATN 202.

LATN 309. Medieval Latin Translation (3)
Reading and interpretation of Latin texts from the Middle Ages. Material selected according to the needs and interests of the students. Prereq: LATN 202.

LATN 351. Latin Didactic Literature (3)
Readings from didactic poetry such as Lucretius and Vergil’s Georgics. Parodies like Ovid’s Ars Amatoria or prose treatises may also be introduced. Prereq: LATN 202.

LATN 352. History (3)

LATN 353. Epic (3)
Extensive readings in Latin epic poetry, including Catullus, Vergil’s Aeneid, Lucan, Statius or other “silver” epics. Particular attention to the artistic and literary qualities of the works and to the development of Latin epic tradition. Prereq: LATN 202.

LATN 354. Drama (3)
Reading of at least one play each by Plautus and Terence. Attention to the history of Latin and Greek New Comedy, and the contrasting styles of the two authors. Prereq: LATN 202.

LATN 356. Elegiac Poetry (3)
Translation and interpretation of selected elegies by Catullus, Tibullus, Propertius, and Ovid. Prereq: LATN 202.

LATN 380. Advanced Topics in Latin Literature (3)
Study and discussion of important authors, works, and topics not covered regularly. Content will reflect particular interests of students and faculty and timeliness of topics. Prereq: LATN 202.

LATN 395. Directed Readings (1-3)
Directed readings in Latin of authors selected to serve the individual interests and needs of undergraduate students. Each program planned and completed under the supervision of the instructor with whom the student wishes to work. Prereq: Consent of department.

College Scholars Program

Jonathan Sadowsky, Director
www.cwru.edu/artsci/scholars/

Faculty Committee

Jonathan Sadowsky, Ph.D. (The Johns Hopkins University)
Associate Professor, History; Director
African history; comparative history; cultural anthropology; medical history

Mary D. Barker, Ph.D. (University of California, San Diego)
Professor, Chemistry
Laser fluorescence spectroscopy; biophysical chemistry

Arwood D. Gaines, Ph.D. (University of California, Berkeley), M.P.H. (University of California, Berkeley, School of Public Health)
Professor, Anthropology; Professor of Nursing, Frances Payne Bolton School of Nursing; Professor of Psychiatry and Professor of Biomedical Ethics, School of Medicine
Medical and psychiatric anthropology; religion; aging; cultural studies of science; bioethics; social identity; United States, the Mediterranean.

Patricia Princehouse, M.A. (Yale University)
Lecturer, Philosophy

The College Scholars Program, instituted in 1997, is a three-year academic enhancement program open to undergraduates interested in forming a community of learners dedicated both to excellence in individual intellectual pursuits and applying classroom learning to larger world concerns. The program, funded by the Mandel Brothers Foundation, emphasizes broad interdisciplinary learning beyond the requirements of professional or disciplinary competence, connection of academic learning to the larger society, and development of a sense of the relationship between service and leadership. College scholars collaborate with faculty in the design, operation, and evaluation of the curriculum. The program takes the equivalent of one course for each of six semesters.

College Scholars (ARSC)

Undergraduate Courses

ARSC 201. Introduction to College Scholars I (3)
First course for students already admitted to the College Scholars Program. Principles and practice of leadership, learning styles, ethical decision making, group dynamics, and communication skills.

ARSC 202. Introduction to College Scholars II (3)
Continuation of ARSC 201. Emphasis on leadership, learning styles, ethical decision making, group dynamics, and communication skills. Prereq: ARSC 201.

ARSC 301. College Scholars Colloquia I (3)
Students in the second year of the College Scholars Program, in conjunction with CSP faculty, select topics for interdisciplinary study, construct curricula, and invite visiting speakers. Prereq: ARSC 201 and ARSC 202.

ARSC 302. College Scholars Colloquia II (3)
Continuation of ARSC 301. Multidisciplinary study of selected topics. Prereq: ARSC 202.

ARSC 397. CSP Senior Project I (3)
Year-long independent study project under the guidance of CSP faculty. In the first semester, pre-proposals are approved and funded and work
Department of Communication Sciences

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11206 Euclid Avenue
Phone 216-368-2470; Fax 216-368-6078
Claire Penn, Chair

Communication is an essential component of our culture. Today more than ever, competence in the classroom, workplace, and community is based on the ability to communicate. Mastery of the technical and theoretical aspects of communication can enhance success in professional and personal endeavors. At the same time, impairments of communication can deprive an individual of the success and satisfaction associated with human accomplishment. The Department of Communication Sciences offers programs leading both to undergraduate (BA) and graduate (MA and PhD) degrees. Two undergraduate major tracks are offered. The 

communication disorders track 

prepares students for graduate study in communication disorders (e.g., speech-language pathology, audiology) and provides useful background for students preparing for many other careers, especially in the health care professions. The 

communication studies track 

provides a theoretical and practical grounding in the gamut of human communication (e.g., media, public speaking, writing, persuasion). At the graduate level the Department offers widely recognized programs in speech-language pathology.

The Department enjoys a particularly close relationship with Cleveland Hearing and Speech Center, an outstanding independent, non-profit provider of care in speech-language pathology and audiology. The Center is located on campus and the Department is housed within the Center.

Faculty

Claire Penn, Ph.D. (University of Witwatersrand, South Africa)  
Professor and Chair  
Narrative medicine, cross-cultural and cross-linguistic speech pathology, and clinical supervision.

F. Joseph Routman, M.A. (Case Western Reserve University)  
Senior Instructor  
Speech communication

Lyn S. Turkstra, Ph.D. (University of Arizona)  
Assistant Professor  
Neuroscience of communication and communication disorders in adolescents and adults, with a primary focus on traumatic brain injury.

Peter J. Watson, Ph.D. (University of Arizona)  
Assistant Professor  
Acoustics and aeromechanics, with primary focus on respiratory control and respiratory-laryngeal interaction in normal and disordered populations; respiratory control in professional voice users.

Lecturers

Barbara Hugenberg, Ph.D. (Bowling Green State University)  
Organizational communication and corporate cultures, rhetorical strategies and social influence.

Barbara Hugenberg, Ph.D. (Bowling Green State University)  

Communication and Aging.

Adjunct Faculty

Laura Brady, M.A., CCC-A (Kent State University)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Audiology

Laurie E. Burman, M.A., CCC-A (The University of Connecticut)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Audiology

Bernard P. Henri, Ph.D. (Northwestern University)  
Adjunct Assistant Professor  
Fluency disorders; professional issues in speech-language pathology; health care management

Douglas Hicks, Ph.D. (Vanderbilt University)  
Adjunct Professor, primary appointment Cleveland Clinic Foundation  
Audiology

Karen Kantes, M.A., CCC-A (Ohio State University)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Audiology

Dell-Ann Lewis, M.A., CCC-SLP (Cleveland State University)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Speech-language pathology

Erwin Montgomery Jr., M.D. (State University of New York)  
Adjunct Professor, primary appointment Cleveland Clinic Foundation  
Neurology, Movement Disorders Program at the Cleveland Clinic

Kay McNeal, M.S., CCC-SLP (Purdue University)  
Adjunct Instructor and Coordinator of Clinical Education, Case Western Reserve University  
Speech-Language Pathology, Cleveland Hearing & Speech Center

Darlene Moenter, Ph.D. (Ohio State University)  
Adjunct Assistant Professor  
Auditory potentials

Jean Nisenboum, M.A. (Miami University)  
Adjunct Instructor  
Dysphagia, Diagnostics of Speech Language Pathology, and Communication and Aging

Richard H. Nodar, Ph.D., F.A.S.H.A. (Purdue University)  
Adjunct Professor  
Auditory evoked potentials; tinnitus; cochlear implants; hearing aids and hearing problems in the aging population

Erica Snelson, M.A., CCC-SLP. (Kent State University)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Speech-Language Pathology

Brigid Whitford, M.A., CCC-A (Kent State University)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Audiology

Mary M. Step, Ph.D. (Kent State University)  
Emotion and affect in human communication processes

Norman Wain, B.A. (Brooklyn College)  
Mass Communication

Associate Faculty

Barbara Lewis, Ph.D. (Case Western Reserve University)  
Assistant Professor, Pediatrics, Case Western Reserve University School of Medicine  
Familiality and genetic bases of speech/language disorders

Gail S. Murray, Ph.D. (Case Western Reserve University)  
Assistant Professor, Dept. of Otolaryngology, Case Western Reserve University School of Medicine  
Pediatric audiology; audiologic assessment of special populations; cochlear implants
Undergraduate Programs

Major
The communication sciences major leads to the Bachelor of Arts degree. Undergraduate students majoring in communication sciences choose a concentration in one of two tracks: communication disorders or communication studies.

The Communication Disorders Track
The Department offers a track in communication disorders for undergraduate students intending to pursue graduate degrees in speech-language pathology, audiology, behavioral science, or a variety of other health professions. A master’s degree is the entry-level degree for clinical practice in speech-language pathology. This track requires 36 hours of course work in normal processes of speech, language and hearing; sign language; psychology; and communication disorders. Throughout the course of study, students have opportunities to observe clinical treatment of persons with communication disorders at the Cleveland Hearing and Speech Center as well as other clinical and medical facilities in the surrounding community. Undergraduate students in communication disorders may take 6 credit hours of graduate course work beyond the 120 hours required for the B.A. degree. These 6 credits can be applied to course requirements for a graduate degree in communication disorders at Case Western Reserve. In addition, students can combine undergraduate and graduate study through the Integrated Graduate Studies Program (see below). Interested students should meet with an advisor for specific course requirements.

The Communication Studies Track
Communication is a fundamental activity that defines and differentiates the human experience. It is a formative process, shaping individuals, relationships, social and political institutions, and cultures. Courses in this track reflect the various contexts, skills, and theories necessary to understand and practice communicative processes in social and professional life. The focus is on the construction, dissemination and outcomes of messages from a variety of perspectives. Course work provides students with a theoretical foundation in the communication discipline. Students increase problem-solving ability through the practice of critical skills. There is also a focus on various symbol systems and how they enable social connections and relationships. The major offers development in the following competencies: conflict management, public speaking, sign language, multicultural perspectives, persuasion, rhetoric, argumentation, critical analysis, and relational and perceptual processes. The major also entails an interdisciplinary approach tailored by additional electives in the humanities and behavioral sciences. Communication studies is excellent preparation for a variety of professional careers. Interested students should meet with an advisor for specific course requirements.

Minors
Undergraduate students in other majors may choose a minor in one of two tracks: communication disorders or communication studies. Each minor requires a minimum of 15 credit hours.

Communication Disorders Track
The communication disorders minor track focuses on normal processes of speech, language, and hearing, as well as the speech, language and hearing disorders that result from breakdowns in these processes. Interested students should meet with and advisor for specific course requirements.

Communication Studies Track
Advanced skills and knowledge in communication are consistently ranked among the top qualifications in a wide range of careers such as business, law, political science, and medicine. The communication studies minor track focuses on skill enhancement and understanding of communication processes in a variety of contexts. Interested students should meet with an advisor for specific course requirements.

Sequences for Case School of Engineering students
Two sequences, emphasizing either communication studies or communication disorders course work, are offered to fulfill the social science requirements in the Engineering Core. Each includes three courses:

Communication Studies Sequence
COSI 100 and any two of the following: 220, 228, 236, 260, 300, 332, 336, 345

Communication Disorders Sequence
COSI 109 and any two of the following: 211, 321, 325

Departmental Honors
Juniors with a 3.0 overall grade point average and a 3.25 average in the communication sciences are encouraged to apply to the Honors Program. The Honors Program consists of one three-credit course, COSI 395, in which the student carries out an independent project in an area of interest, under the direction of a COSI faculty member. Satisfactory completion of the project qualifies the student to receive the Bachelor of Arts degree with Departmental Honors noted on the transcript. Admission to the Honors Program is by faculty approval. STAT 201 or PSCL 282 and PSCL 375 are prerequisites to COSI 395. Additional information is available from the academic advisor.

Integrated Graduate Studies Program
Students in the communication disorders track may be eligible for the Integrated Graduate Studies (IGS) Program. This program is intended for undergraduate students who are interested in obtaining a graduate degree in communication disorders (speech-language pathology). Qualified students may be accepted for admission to the School of Graduate Studies after completing 90 hours of undergraduate course work. Interested students should consult this bulletin and their academic advisor for additional information concerning the IGS program requirements.

Graduate Programs
Graduate programs leading to the Master of Arts and Doctor of Philosophy degrees in communication disorders (speech-language pathology) are offered.

Master of Arts
The principal goal of the Master of Arts program is to develop clinical scientists who are skilled in the management of individuals with speech and language disorders. The master’s program is accredited by the American Speech-Language-Hearing Association. Upon successful completion of the Masters of Arts degree, students will also meet the academic and clinical practicum requirements for certification by the American Speech-Language-Hearing Association and licensure in the State of Ohio. Students may also elect to obtain Ohio Teacher Licensure in speech-language pathology. Degree requirements include completion of
36 credit hours of course work and clinical practicum in communication disorders. In addition, students must satisfactorily complete written and oral comprehensive exams or may elect to write a master’s thesis. Specific course requirements are determined by the student’s undergraduate background and academic and career goals. The following courses are required for all students: COSI 497, Methods of Research (3); and four semesters of COSI 452, Graduate Clinical Practicum (1).

Clinical Opportunities in Speech, Language, and Hearing Disorders

The Department is affiliated with, and located in, the Cleveland Hearing and Speech Center (CHSC), a non-profit agency that serves children and adults with communication disorders. The CHSC is accredited by the Council on Academic Accreditation of the American Speech-Language-Hearing Association and serves as the primary training site for graduate students enrolled in clinical practicum. The personnel and facilities of the CHSC provide exceptional clinical experiences for students seeking clinical certification in speech-language pathology. The Department also draws upon clinical resources in University Circle and the greater Cleveland area. In addition to clinical practicum experiences at the CHSC, graduate students complete at least two externship site placements in the greater Cleveland area. Some of these include the Achievement Center for Children, Cleveland area HeadStart Programs, Cleveland Heights/University Heights Public Schools, Cleveland Public Schools, Cuyahoga Board of MR/DD, Easter Seals of Wayne County, Cleveland Clinic Foundation Children’s Hospital, Lakewood Public Schools, Maternal and Infant Clinics, Millridge School for Hearing Impaired, Parma Community Hospital, Positive Education Program, Rainbow Babies & Children’s Hospital, RoseMary Center, Shaker Heights Public Schools, Southwest General Hospital, Heather Hill Rehabilitation Hospital, MetroHealth Medical Center, Mt. Sinai Hospital, St. Augustine Manor, University Hospitals, and the Veterans Administration Medical Center.

Teacher Licensure

Students enrolled in the master’s program in communication disorders may also complete the requirements for Ohio Teacher Licensure in speech-language pathology. The Department’s Teacher Licensure Program meets the requirements of the Ohio Department of Education and prepares students for employment in a public school setting. (See the departmental advisor for additional details.)

Doctor of Philosophy

The Doctor of Philosophy is awarded to students in recognition of both the mastery, at an advanced level, of a body of knowledge that encompasses the disciplines of communication sciences and speech-language pathology, and the demonstration of the ability to perform independent research and communicate the results of that research. With the major advisor, the student designs an individual plan of study based on his/her professional goals and previous experience. Doctoral students develop expertise in a content area that is the primary focus of their course of study (e.g., communication and aging, medically based speech disorders, child language development and disorders). Each student is encouraged to enhance his or her scholarly preparation by completing course work outside of the primary content area. In addition to course work within the Department, doctoral students may choose course work from graduate programs in other departments of the College of Arts and Sciences, as well as from several professional schools at the University, including the School of Medicine (e.g., neuroscience, genetics), the Case School of Engineering (e.g., biomedical engineering), the School of Dentistry, the Weatherhead School of Management, and the Mandel School of Applied Social Sciences.

Requirements for the doctoral program include course work, research rotations, a supervised classroom teaching experience, written and oral comprehensive examinations, and a dissertation. Additional requirements for the program include:
- Twelve credit hours in the area of research are required (nine credit hours of statistics and research design; three credit hours of directed study and research). Fifteen credit hours in the primary content area are required.
- Two research rotations are required. One rotation is completed in the primary content area with the major advisor. The second rotation is completed with a faculty member other than the major advisor. The dissertation research is not included in either of the two research rotations.
- A supervised classroom teaching experience (COSI 690) is completed under the guidance of a faculty member in the Department.
- Written and oral examinations are undertaken after all course work and research rotations are completed.
- A dissertation prospectus is prepared under the guidance of a committee consisting of the dissertation advisor and two additional faculty members. A defense of the dissertation prospectus is required prior to commencing the dissertation study.
- An oral defense of the dissertation takes place at the end of the doctoral program.

Communication Sciences (COSI)

Undergraduate Courses

COSI 100. Introduction to Human Communication (3)
An overview of human communication processes with an emphasis on skills development. The focus is on the exchange of ideas through oral communication. The role of the individual as a sender/receiver is stressed. Students demonstrate abilities via daily/weekly skill building exercises, oral presentations, rhetorical analysis, and group processes/projects. There is a high degree of student participation and interaction in this course.

COSI 109. Introduction to Communication Disorders (3)
Forty-two million Americans have some type of communication disorder. How does a person with a communication disorder cope with the challenges of daily living? This course will examine the characteristics of communication disorders via first hand and fictionalized accounts in books, films, and simulated communication disorders experiences. Topics will include disorders of speech, language, and hearing in children and adults. Effects of communication disorders on families.

COSI 130. Workshop in Radio Broadcasting (1)
Training in radio broadcasting by participating in the operation of WRUW-FM.

COSI 200. Interpersonal Communication (3)
Communication is a primary means of initiating, maintaining, and dissolving relationships. Managing interpersonal relationships is a human concern across several contexts. Interpersonal communication is a highly interactive course whereby participants investigate the foundations, processes, and issues associated with communication in relationships. The student will become sensitized to theories, concepts and processes via traditional lectures and textbook readings. The student is also expected to participate in group discussions centered on selected case studies. The result is a continuous dialogue with others about communication perceptions, processes, and outcomes. The goal of this course is to provide a forum for both investigation and increased competence.

COSI 211. Phonetics and Phonology (3)
Theoretical and applied study of the speech sounds of language. The use of the international phonetic alphabet as a tool for characterizing normal
COSI 220. Introduction to American Sign Language I (3)
This course offers basic vocabulary training and conversational interaction skills in American Sign Language. Syntactic and semantic aspects of American Sign Language will be addressed.

COSI 221. Introduction to American Sign Language II (3)
This class is taught without voice, using functional, whole language approaches and in situ experiences, emphasizing communicative competency. It emphasizes sentence structure development, classifiers, and conversational regulating behaviors. It also covers inflection, role shifting, adverbial non-manual behaviors, temporal aspects, sequencing, and includes a brief introduction to ASL English diglossia and biolinguistic aspects. There will be opportunities for discussion of deaf culture. Prereq: COSI 220.

COSI 228. Mass Media and Communication (3)
The media of mass communication, particularly in this time of exploding channel availability and information overload, are central factors in the function, maybe even the evolution, of modern society. While most of us are intimately familiar with the products of mass communicators, few understand how media developed, how they function independently and interactively, or what their true effects are.

COSI 236. Public Speaking (3)
Process and lecture course. Develops ability to speak effectively in various contexts. Weekly preparation and delivery of speeches.

COSI 260. Multicultural Aspects of Human Communication (3)
Introduces intercultural/interracial communication by discussing specific communication principles and by putting theory into practice by exploring differences in perception, and verbal and nonverbal communication messages. Course emphasizes relationship between communication, race, culture; nature of race and culture; and how they influence the communication process. Various theories and approaches to study of intercultural/interracial communication will be discussed, along with significant concepts, processes and considerations. Practical outcomes of intercultural/interracial encounters also will be discussed.

COSI 280. Organizational Cultures (3)
Organizational Cultures focuses on organizations as cultural phenomena. Students learn the history of the study of organizational communication and several perspectives for assessing organizational cultures. Organizational theories, from management and culture orientations, provide students with tools for understanding the importance and impact of organizational narratives, artifacts, assumptions, values, goals, and missions.

COSI 300. Theories of Human Communication (3)
An introduction to theories and scholarship of communication. Addresses development and evaluation of theories. The focus is on explaining communication phenomena from a variety of perspectives and philosophies. Communication theories are presented via text, seminal articles, lectures, and discussion. Through discussion and case studies students discover new dimensions in their communicative lives, both personal and professional. Prereq: COSI 100.

COSI 305. Neuroscience of Communication and Communication Disorders (3)
The course focuses on neuroanatomy and neurophysiology related to motor control and cognition, particularly aspects of cognition involved in language functions. Topics to be addressed include: principles of neurophysiology and neurochemistry; functional neuroanatomy of the central and peripheral nervous systems; neurological and neuropsychological assessment of communication; neurodiagnostic methods. In part, the course material will be presented in a problem-based learning format. That is, normal aspects of human neuroscience will be discussed in the context of neurological disorders affecting communication. Prereq: Permission of department.

COSI 310. Nonverbal Communication (3)
This course provides an extensive opportunity for the student to become a competent observer and practitioner of nonverbal communication. We will study and discuss the various nonverbal codes in conjunction with contexts and important outcomes. Students will also practice nonverbal encoding and become sensitized to the rules governing contexts. These experiences will culminate in a research project conceptualized by the instructor and carried out by the students during the course. Students will receive training in research ethics and basic methodology prior to observation. Prereq: COSI 100.

COSI 313. Language Development (3)

COSI 321. Speech and Hearing Science (3)
Acoustics and the processes of speech/motor control. Human perception of speech sounds, methodological procedures, instrumentation, and research findings. Prereq: COSI 325.

COSI 325. Anatomy and Physiology of Speech and Hearing Mechanism (3)
The anatomy and physiology of normal speech production and of the hearing mechanism.

COSI 326. Anatomy and Physiology of Singing Voice (1)
For music students with interest in the use of the vocal mechanism in singing. The systems and processes that contribute to a normal voice for speaking and singing. Focus on normal respiration and phonation, with consideration of disorders resulting from vocal abuse.

COSI 328. Media Effects and Literacy (3)
Media play a pivotal role in constructing and delivering various realities. Knowledge of what science has revealed about media influence is a core dimension of media literacy. Media literacy penetrates beyond the rudimentary level of message processing to uncover multiple layers of meaning. This course provides training in the process of selective discrimination, analytical observation, and reasoned assessment of media messages. We will trace the history of effects research, identify philosophical and methodological trends, and compare approaches. Students will synthesize this information and construct their own priorities for understanding media consumption. Topics include: societal and individual approaches to media, parasocial interaction, portrayals, media credibility and skepticism, media and children, media organizations and economics.

COSI 330. Seminar in Radio Broadcasting (3)
One hour of class per week and participation in operation of WRUW-FM. The history of radio, government control and the FCC, public responsibility, program policy, station management with practical broadcast application. Prereq: Two semesters of COSI 130.

COSI 332. Persuasion (3)
This survey course explores the history, theories, and dynamics of persuasion. There is an extensive focus on theoretical models of attitude change. Persuasion also plays a strong role in everyday aspects of our culture. Along these lines, we will investigate persuasion activities in everyday life from compliance gaining to media campaigns and effects. Learning is conveyed through lecture, activities, and observation of the student’s everyday life. At the end of the semester, the astute student will be literate in a variety of persuasion strategies and dynamics.

COSI 336. Communication in Professional Contexts (3)
Communication interactions used by professionals; includes interviews, conferences, group interactions, counseling, and others where problem solving and decision making form the primary goal of the communication exchange. Provides an opportunity to gain skills in these activities.

COSI 345. Communication and Aging (3)
The normal and abnormal psychobiological changes that occur during aging and their effects on communication are addressed, as are communicative interaction styles, disordered communication, and rehabilitation practices.

COSI 352. Introduction to Clinical Practice in Speech-Language Pathology (3)
Clinical assessment and teaching procedures as well as the role of research/theory in clinical practice. Procedures to observe, measure, analyze communication skills. Practical application through case studies. Students complete 25 hours of observation of speech/language assessment and intervention. Prereq: COSI 211 or COSI 313 or consent of department.
COSI 370. Introduction to Audiology (3)
Disorders of hearing, assessment of hearing, including behavioral and objective measures; intervention strategies; and identification programs. Prereq: COSI 325 and COSI 321 or COSI 421.

COSI 390. Independent Study (1-6)
Individual study, under the guidance of a faculty member, involving specific programs of reading, research and special projects.

COSI 395. Honors Program (3)
Student completes an independent project in the student’s area of interest under the supervision of a faculty member. Prereq: STAT 201 or PSCL 282, and PSCL 375, and/or department approval.

**Graduate Courses**

COSI 405. Neuroscience of Communication and Communication Disorders (3)
The course focus is neuroanatomy and neurophysiology related to motor control and cognition, particularly aspects of cognition involved in language functions. Topics to be addressed include: principles of neurophysiology and neurochemistry; functional neuroanatomy of the central and peripheral nervous systems; neurological and neuropsychological assessment of communication; neurodiagnostic methods. In part, the course material will be presented in a problem-based learning format. That is, normal aspects of human neuroscience will be discussed in the context of neurological disorders affecting communication. COSI 405 is an introduction to COSI 557 and COSI 561. Prereq: Permission of department.

COSI 413. Language Development (3)
(See COSI 313.)

COSI 421. Speech and Hearing Science (3)
(See COSI 321.)

COSI 445. Communication and Aging (3)
(See COSI 345.) Graduate students are given an opportunity to incorporate information from their own disciplines in a special project, where appropriate.

COSI 452A. Graduate Clinical Practicum I: Case Management (1)
Addresses professional issues in speech-language pathology including case management, clinical effectiveness, counseling and working with families from diverse backgrounds. Four to ten hours of clinic contact per week at the Cleveland Hearing and Speech Center. (Maximum of 2 credits.) Prereq: COSI 352 and COSI 413.

COSI 452B. Graduate Clinical Practicum II: Professional Issues (1)
Addresses professional issues in speech-language pathology including case management, managed health care, ethics and interviewing. Four to ten hours of clinic contact per week at the Cleveland Hearing and Speech Center. (Maximum of 2 credits.) Prereq: COSI 352, COSI 413, COSI 452A, and COSI 455.

COSI 452C. Graduate Clinical Practicum III: Special Populations (1)
Addresses professional issues in speech-language pathology including case management, special clinical populations, collaborating with other professionals, teaming, leadership, and use of technology. Fifteen to thirty hours of clinic contact per week at area skilled nursing facilities, hospitals, rehab centers, early intervention centers, centers for developmentally disabled, private practices, etc. (Maximum of 2 credits.) Prereq: COSI 352, COSI 452A, COSI 452B, COSI 453, and COSI 456.

COSI 452D. Graduate Clinical Practicum IV: Student Teaching (1)

COSI 452E. Graduate Clinical Practicum V: Medical Speech Pathology (1)
Addresses professional issues in speech-language pathology including case management, special clinical populations, collaborating with other professionals, documentation, managed health care, and use of technology. Fifteen to thirty hours of clinic contact per week at area skilled nursing facilities, hospitals. (Maximum of 2 credits.) Prereq: COSI 352, COSI 452A, COSI 452B, COSI 452C, COSI 453, and COSI 456.

COSI 453. Articulation and Phonology Disorders (3)
Overview of normal speech sound development and characterization of children with speech sound disorders. Distinctions between phonology and articulation are drawn. Theoretical as well as assessment and treatment issues are addressed.

COSI 455. Fluency Disorders (3)
Stuttering and related disorders of rhythm and prosody in terms of the symptomatology, etiology, measurement, and treatment of nonfluent speaking behavior.

COSI 456. Child Language Disorders (3)

COSI 463. Speech and Language Therapy in Educational Settings (3)
Organization and administration of speech, language, and hearing programs within public and private educational settings. Focus on federal legislation on education of children with disabilities, alternative service delivery models, emergent literacy, reading, writing, and classroom discourse as they relate to speech, language, and hearing disorders. Overview of special populations. Team-based service delivery and (para) professional supervision discussed. Requires supervised practicum experience in public schools that is completed in the following semester.

COSI 464. Diagnosis of Speech and Language Disorders (3)
Diagnosis as a clinical skill involving scientific hypothesis testing with clinical problem solving. The course includes academic learning combined with diagnostic clinic experiences. Overview of psychometric principles, survey of psychological communication tests and measurements. Section on non-biased assessment. Instruction and practice in effective family interviewing techniques. Prereq: COSI 453 and COSI 456.

COSI 470. Introduction to Audiology (3)
Disorders of hearing; assessment of hearing, including behavioral and objective measures; intervention strategies; identification programs. Prereq: COSI 325.

COSI 497. Methods of Research (3)
Pure and applied research design for speech language pathologists. Focus on evaluation of research methodology and the formulation of testable research questions.

COSI 557. Acquired Adult Language Disorders (3)
A model relating communication impairment to activities of daily living and quality of life will serve as the study of acquired neurogenic communication disorders in adults. The focus will be on dementia, aphasia, and the communication disorders associated with traumatic brain injury and right hemisphere stroke. Knowledge about the biological basis of neurogenic communication disorders will be applied in discussion on assessment and intervention for these disorders. Prereq: COSI 405 or equivalent.

COSI 560. Medical Aspects of Speech Pathology I: Voice Disorders (3)
Aspects of normal and abnormal voice production, evaluation and management of various voice and resonance disorders.

COSI 561. Med Aspects of Speech Path II: Neuromotor and Craniofacial Anomalies (3)
Speech disorders resulting from conditions acting on motor speech production including dysarthria and apraxia will be discussed. The speech production system, diseases and acquired and congenital neuropathological conditions that affect motor process and resulting speech disorders of phonation, articulation, resonance and prosody will be reviewed. Also covered will be the speech, language and hearing disorders stemming from craniofacial anomalies; cleft lip and palate. Principles and methods of assessment and treatment within an interdisciplinary rehabilitation framework will be reviewed for both types of disorders. Coreq: COSI 321 or COSI 421 and COSI 505.

COSI 562. Medical Aspects of Speech Pathology III: Dysphagia (2)
Survey of clinical problems involving dysphagia in medical speech pathology. Normal swallowing, pediatric dysphagia, adult dysphagia, the clinical swallowing assessment, the modified barium swallow study, and
COSI 580. Aural Rehabilitation (3)
The effects of hearing impairment, especially related to speech perception and language processing. Remediation and intervention strategies for hearing impaired children and adults, including speech reading, auditory training, and the use of hearing aids.

COSI 600. Special Problems and Topics (1-3)
Topics and instructors by arrangement of the department chair.

COSI 601. Directed Study and Research (1-6)
Individual study and research under the direction of a faculty member. COSI 651. Thesis M.A. (1-6)

COSI 690. Supervised Classroom Teaching (3)
Required of all doctoral students. Teaching of an undergraduate course planned in conjunction with a supervising faculty member. Follows the doctoral student’s earlier experience of observing and assisting a faculty member in classroom teaching.


Department of Economics

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Phone 216-368-2970; Fax 216-368-5039
James B. Rebitzer, Chair

Faculty

James B. Rebitzer, Ph.D. (University of Massachusetts-Amherst)
Frank Tracy Carlton Professor of Economics; Chair, Economics Department

Economics of organizations, employment relationships and labor markets, human resource management and industrial relations, behavioral economics

Eric Bettinger, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor of Economics

Labor economics, economics of education

Bo A. Carlson, Ph.D. (Stanford University)
E. Mandell de Windt Professor of Industrial Economics; Associate Dean for Research and Graduate Programs
Managerial economics, industrial economics

David J. Cooper, Ph.D. (Princeton University)
Assistant Professor of Economics

Industrial Organization, Microeconomic Theory

Avi Dor, Ph.D. (City University of New York)
John R. Mannix Blue Cross & Blue Shield Associate Professor of Health Care Economics
Health care economics, industrial economics

Robin A. Dubin, Ph.D. (The Johns Hopkins University)
Associate Professor of Economics
Spatial econometrics, urban economics, regional economics

Asim Erdiliek, Ph.D. (Harvard University)
Professor of Economics
International economics, international finance

Susan Helper, Ph.D. (Harvard University)
Associate Professor of Economics
Economic history, technical change, economics of supplier relations

Mari Rege, Ph.D. (University of Oslo)
Assistant Professor
Evolutionary game theory and behavioral economics

Robert L. Slonim, Ph.D. (Duke University)
Assistant Professor of Economics
Game theory, learning, behavioral economics, reference theory, price theory, auctions, decision theory and experimental economics

Marcus Stanley, M.A. (Syracuse University)
Assistant Professor of Economics
Labor economics, economics of education

Secondary Appointments

Paul D. Gottlieb, Ph.D. (Princeton University)
Associate Director, Center for Regional Economic Issues; Senior Lecturer of Economics
Economics of cities and regions, public policy, labor markets and commuting, amenity and environmental development

David C. Hammack, Ph.D. (Columbia University)
Elbert Jay Benton Professor of History, College of Arts and Sciences; Professor of Economics
Nonprofit organizations, urban and social policy history

Dennis R. Young, Ph.D. (Stanford University)
Professor of Nonprofit Management, Mandel School of Applied Social Sciences; Professor of Economics
Economics of nonprofit organizations, economics of public services, entrepreneurship

Adjunct Faculty

Martine Lussier, Ph.D. (University of Toronto)
Instructor of Economics

Ayhan Talu, Ph.D. (Arizona State University)
Lecturer

Bachelor of Arts

(College of Arts and Sciences)
Economics is concerned with the problems of allocating scarce resources to meet human needs. Students who study economics gain an understanding of how consumers (households), producers (firms) and governments make decisions affecting the allocation of resources and, therefore, a society’s economic performance. Economics also involves an examination of how the interaction of these decisions in markets and in the political process produces certain outcomes, and how legal and institutional arrangements can influence these outcomes. Finally, the study of economics leads to a better appreciation of the ways in which trade, investment and the movement of people and information across national boundaries tie the global economy together.

An undergraduate major in economics provides an excellent preparation for a variety of professional careers, such as management, law and government service. A major is essential for those wanting to pursue graduate work in economics.

Major

(for B.A. degree)
A major in economics consists of 33 hours, with a minimum of 30 hours of economics courses. It leads to the Bachelor of Arts degree.

Required courses (18 hours)
ECON 102, 103, 307, and either 308 or 309 (12 hours)
STAT 201 or 207 or equivalent (5 hours)
ECON 326 (3 hours)
Electives (12 hours)
2 elective courses in each of 2 concentrations (12 hours)
(see concentrations on following page)

Capstone Experience (3 hours)
The Senior Project requirement can be satisfied by choosing from a menu of options. This Senior Project course requirement can be satisfied by taking ECON 399 – Individual Readings and Research, which could be tailored around service (action) learning, or active student participation, requiring effective
written and oral presentation, in our LESS and MOPPS seminars under the supervision of a faculty advisor. It can also be satisfied by taking ECON 598 – Honors I, as well as certain existing electives, such as ECON 377 – Economics of Nonprofit Organizations and ECON 386 – Urban Economics, that are offered as service (action) learning oriented courses.

Minor
(for B.A. or B.S. degree)
A minor in economics consists of 15 hours, as follows:
ECON 102, ECON 103, and three additional economics courses (9 hours). At least 2 of the elective courses must be within one concentration.

Social Science Sequence
(for B.S. based upon Engineering Core Curriculum)
The sequence requirement is satisfied by taking ECON 102, ECON 103, and one other 200- or 300-level ECON course.

Economics (ECON)
Undergraduate Courses
ECON 102. Principles of Microeconomics (3)
This course covers how productive resources are allocated in a market economy, the determination of individual prices and costs of production, consumer behavior, the consequences of governmental controls over prices and wages, and problems related to allocating resources between the private and public sectors.

ECON 103. Principles of Macroeconomics (3)
This course covers how incomes, employment, inflation, and the national output of goods and services are determined, as well as the monetary system and its management. Government revenue and expenditure policies and their influence on economic stability and growth are also studied.

ECON 205. Economic Perspectives (3)
This course covers important contemporary and historical issues from an economic perspective. It enables students to think about the world ‘like an economist.’ Possible topics of current interest include the transformation of Eastern Europe, ethnic and racial strife, environmental policy and sustainable development, and professional sports.

ECON 255. The Economic History of the United States (3)
(See HSTY 255.) Cross-listed as HSTY 255 and PLCY 255.

ECON 306. History of Economic Thought (3)
In this course you will study first hand the writings of the great economists. The course focuses on such famous thinkers as Adam Smith, David Ricardo, Karl Marx, Leon Walras, John Maynard Keynes, Milton Friedman, and Ronald Coase. For many of these writers, economics went beyond contemporary boundaries and encompassed the study of history, philosophy and sociology. Their original texts are “classics”—books that everybody talks about yet nobody reads. As such they are often misinterpreted. In this course you should develop your own interpretation—hopefully it will surprise you. Prereq: ECON 102 and ECON 103.

ECON 307. Intermediate Macroeconomic Theory (3)
This course examines the theories of the determination of national income, the unemployment rate, inflation, and the rate of interest, as well as alternative theories of income determination, the theory of capital, monetarists vs. Keynesians, and dynamic analysis. Prereq: ECON 103.

ECON 308. Intermediate Microeconomic Theory (3)
This course examines pricing and resource allocation, welfare economics, general equilibrium, and relative economic efficiencies of capitalist and alternative forms of economic organization. Prereq: ECON 102.

ECON 309. Intermediate Microeconomic Theory: Math Based (3)
Course covers the same topics as ECON 308 but uses calculus. Prereq: MATH 121 or MATH 125 and ECON 102.

ECON 326. Econometrics (3)
This course covers the techniques used by economists to estimate the parameters of economic relationships such as demand curves and consumption functions. Prereq: ECON 102 and ECON 103 and one semester of statistics.

ECON 328. Experimental Economics (3)
This course covers the methods of experiments to study economic behavior. This course will examine the role of market institutions, game theory, and individual choice. Specific topics will depend on both the instructor and student interest, but will include market organization, game theory and rational choice and recent modifications to economic thinking on this topics. Prereq: ECON 102.

ECON 329. Game Theory: The Economics of Thinking Strategically (3)
The term ‘game theory’ refers to the set of tools economists use to think about strategic interactions among small groups of individuals and firms. The primary purpose of this course is to introduce students to the basic concepts of game theory and its applications. The class will stress the use of game theory as a tool for building models of important economic phenomena. The class will also include a number of experiments designed to illustrate the game theoretic results, and to highlight how reality may depart from the theory. The course will stress the value of thinking strategically and provide students with a framework for thinking strategically in their everyday lives. Rather than approaching each strategic situation they encounter as a unique problem, students will be taught to recognize patterns in the situations they face and to generalize from specific experiences. Prereq: ECON 102.

ECON 332. Economic Analysis of Labor Markets (3)
This course examines the determinants of the demand for and supply of labor, the operation of labor markets under differing degrees of competition, and the relationship between the operation of the labor market and the level of inflation. Prereq: ECON 102.

ECON 335. Comparative Economic Systems (3)
This course examines the way that different institutions affect economic performance. An alternative course title might be “Comparative Institutional Analysis.” In particular, we look at the economic institutions of three capitalist economies (the U.S., Japan and Sweden), one socialist economy (the former Soviet Union), and two economies in transition (Poland and Hungary), together with the unique institutional arrangements in Iran (the “Islamic Model”) and the former Yugoslavia (“worker self-management”). We combine insights from traditional economic theory, recent developments in “information economics,” and the use of case studies. Prereq: ECON 102 and ECON 103.

ECON 338. Law and Economics (3)
This course examines legal institutions and rules from an economic perspective. Students will learn when and how legal rules can be efficient. Topics will depend on both the instructor and student interest, but will include commercial law, accident law, property rights, contracts, and polycentric legal systems. Prereq: ECON 102.

ECON 341. Money and Banking (3)
(See BAFI 341.) Prereq: ECON 103. Cross-listed as BAFI 341.

ECON 342. Public Finance (3)
This course covers economic aspects of government spending and taxation, allocation of scarce resources among competing claims in the public and private sectors, application of equity and efficiency criteria to tax and expenditure systems, and theories of bureaucratic performance. Prereq: ECON 102 and ECON 103. Cross-listed as BAFI 342.

ECON 343. Economics of State and Local Governments (3)
This course examines economic analysis of the roles of federal, state, and local government; economic effects of state and local property, sales, and other taxes; effects of intergovernmental grants; public school finance; the urban fiscal crisis. Prereq: ECON 102.

ECON 345. Public Choice (3)
This course covers economic theory and empirical analysis of the behavior of politicians, bureaucrats, and voters based on the assumption of rational pursuit of self-interest, comparison with other approaches to the study of political behavior, and implications of alternative collective decision procedure. Prereq: ECON 102 and ECON 103.
ECON 361. Managerial Economics (3)
This course explores the economic principles that underlie strategic decisions in firms. Topics include the determination of vertical and horizontal boundaries of firms, strategic positioning and the sources of competitive advantage. Prereq: ECON 102.

ECON 364. Competition and Public Policy (3)
This course covers alternative market structures and their performance in terms of profit, prices, and productivity, as well as antitrust laws and regulations and their importance to industrial organization. Prereq: ECON 102.

ECON 367. Economics of Energy (3)
The economic aspects of energy are studied. Long term trends in consumption, sources of supply, the theory of nonrenewable resources, interactions with environmental problems, and current questions of energy policy are included. Prereq: ECON 102.

ECON 368. Environmental Economics (3)
This course examines the economics of both the causes of pollution and the remedies for it. Among the topics covered will be: citing of environmentally undesirable facilities (such as nuclear waste repositories), tradable air pollution emissions permits, pesticide use in agriculture, and international cooperation in cleaning up the Great Lakes. Prereq: ECON 102.

ECON 369. Economics of Technological Innovation (3)
This course looks at the process of technological change. We will explore topics such as: the computer/internet revolution, Japanese manufacturing techniques, the mechanization of housework, the impact of new technology on workers and consumers, and how managers and government policy-makers can affect the nature of technological change.

Prereq: ECON 102.

ECON 370. Managerial Economics (3)
This course covers alternative market structures and their performance in terms of profit, prices, and productivity, as well as antitrust laws and regulations and their importance to industrial organization. Prereq: ECON 102.

ECON 372. International Finance (3)
This course deals with open-economy macroeconomics and international financial markets, covering open-economy national income analysis, international macroeconomic policy coordination, exchange rate determination, foreign portfolio investment, and global financial crises. Prereq: ECON 102 and ECON 103. Cross-listed as BAFI 372.

ECON 373. International Trade (3)
This course deals with international trade theories and policies, covering gains from and patterns of trade, immigration, foreign direct investment, protectionism, multilateral trade liberalization, regionalism and the costs and benefits of globalization within as well as among nations. Prereq: ECON 102 and ECON 103.

ECON 375. Economics of Developing Countries (3)
This course examines the problems of less developed countries, including theories of economic growth, policies for capital accumulation, criteria for resource allocation, foreign trade problems, inflation, population trends, and development planning. Prereq: ECON 102 and ECON 103.

ECON 377. Economics of Nonprofit Organizations (3)
The purpose of this course is to familiarize students with the private nonprofit sector of the U.S. economy, with economic theory contributing to our understanding of this sector, and with economic analysis of policy and management issues affecting nonprofit organizations. Topics include understanding the different types of nonprofit organizations; the size, scope and economic impact of the nonprofit sector; economic theories of why nonprofit organizations exist and how they behave; economic analysis of tax and regulatory policy issues affecting nonprofits. Prereq: ECON 102.

ECON 378. Health Care Economics (3)
This course deals with the health care system, the fastest growing sector of the U.S. economy. Because of its complexity and sheer size, the health care system affects virtually every facet of the economy, including labor productivity, income distribution and international competitiveness. The course will foster an understanding of economic analysis of health care markets and related public policy issues by developing a general understanding of the health care system, and then focusing on (1) the behavior of consumers; (2) the supply side (physicians, hospitals and their markets); (3) insurance and regulation with special emphasis on current events. Prereq: ECON 102; ECON 103 recommended.

ECON 386. Urban Economics (3)
Microeconomic theory as taught in principles (and even intermediate) does not usually take into account the fact that goods, people, and information must travel in order to interact. Rather, markets are implicitly modeled as if everyone and everything is at a single point in space. In this course, we examine the implications of spatial location for economic analysis. One of the most important implications is that households and firms can find it advantageous to cluster together in cities in order to reduce transportation costs. The course will emphasize applying the theoretical analysis to real world issues, with a special emphasis on important problems facing the Cleveland metropolitan area. Prereq: ECON 102.

ECON 397. Honors Research I (3)
ECON 398. Honors Research II (1-3) Prereq: ECON 397.

ECON 399. Individual Readings and Research (1-6)
Intensive examination of a topic selected by the student.

Graduate Courses

ECON 403. Economics for Management (3)
This course surveys the basic principles of micro and macroeconomics. Topics covered in microeconomics include supply and demand, the theory of production and costs, market structures and factor markets. Macroeconomics topics are the national incomes accounts, the determination of national income, employment and inflation, fiscal and monetary policies and international trade.

ECON 415. Economic Analysis for Managers-E.M.B.A. (2)
This course, which is limited to students in the Executive M.B.A. program, explores the basic elements of the economic system which the executive needs to know in order to understand how the firm interacts with the system and how economic factors affect decision making.

ECON 421. Health Economics and Strategy (3)
This course has evolved from a theory-oriented emphasis to a course that utilizes economic principles to explore such issues as health care pricing,
anti-trust enforcement and hospital mergers, choices in adoption of managed care contracts by physician groups, and the like. Instruction style and in-class group project focus on making strategic decisions. The course is directed for a general audience, not just for students and concentration in health systems management. Prereq: ECON 403 or MBAC 426. Cross-listed as HSMC 421 and MPHP 421.

ECON 431. Economics of Negotiation and Conflict Resolution (3) Students frequently enroll in a negotiation class with one thought in mind—negotiating a better job offer from an employer. They soon learn, however, that negotiation skills can do far more than improve a pay check. Negotiations occur everywhere: in marriages, in divorces, in small work teams, in large organizations, in getting a job, in losing a job, in deal making, in decision making, in board rooms, and in court rooms. The remarkable thing about negotiation is that, wherever they occur, they are governed by similar principles. The current wave of corporate restructuring makes the study of negotiations especially important for M.B.A.s. Mergers, acquisitions, downsizing and joint ventures call into question well established business and employment relationships. Navigating these choppy waters by building new relationships requires negotiation skills. The increased stress on quality and other hard-to-measure aspects of relationships with customers and suppliers makes the process of negotiation even more complex and subtle. For these reasons, negotiation classes have taken center stage in the study of management. Every major business school now offers classes in negotiation and these classes are overflowing with students. Cross-listed as LHRP 413.

ECON 434. Business and Nonprofit Entrepreneurship (3) This course examines the power of entrepreneurship in the nonprofit sector. It will cover large scale policy initiatives, new services and for-profit activities. Course elements include vision, staffing, leadership, and funding. Cross-listed as ENTP 434 and MAND 434.

ECON 435. Industrial Economics and Technical Innovations-E.M.B.A. (2) This course, which is limited to students in the Executive M.B.A. program, presents the basic elements in the analysis of production and technological change. It explores the uses and limitations of theory in analyzing innovative activity in industry and examines the role of technological progress in the growth of firms and industries.

ECON 436A. Economics of Organizations-E.M.B.A. (2) Dramatic changes in technology, work force demographics and economic competition are forcing firms to rethink their internal organization. Implementing new internal strategies is remarkably hard for organizations and managers to do. This class is designed to provide the economic tools that managers need to understand why their organizations are the way they are and why change can be as difficult as it is important. This course focuses on two elements of a firm’s internal strategy: structuring incentives and investing in relationships. In the incentives section, we analyze how organizations allocate decision rights; evaluate performance; and implement motivation strategies. In the relationships section, we analyze how organizations sustain functional, long-term relationships in competitive or conflictual environments. A small number of surprisingly simple economic models, it turns out, offer important insights into incentive design and investments in long-term relationships.

ECON 436B. Economics of Organizations-M.B.A. (3) Dramatic changes in technology, work force demographics and economic competition are forcing firms to rethink their internal organization. Implementing new internal strategies is remarkably hard for organizations and managers to do. This class is designed to provide the economic tools that managers need to understand why their organizations are the way they are and why change can be as difficult as it is important. This course focuses on two elements of a firm’s internal strategy: structuring incentives and investing in relationships. In the incentives section, we analyze how organizations allocate decision rights; evaluate performance; and implement motivation strategies. In the relationships section, we analyze how organizations sustain functional, long-term relationships in competitive or conflictual environments. A small number of surprisingly simple economic models, it turns out, offer important insights into incentive design and investments in long-term relationships.

ECON 441. Economics of Financial Intermediation (3) (See BAFI 441) Cross-listed as BAFI 441.

ECON 461. Managerial Economics (3) This course explores the economic principles that underlie strategic decisions in firms. What determines their boundaries? What are the sources of competitive advantage, and how do firms position themselves strategically? Prereq: ECON 403 or MBAC 426.

ECON 462. E-Business and the New Economy (3) This new economy course focuses on the following questions: What is this phenomenon variously called the digital economy, the global information economy, the new economy, or the networked society? How is it related to E-business or E-commerce? What are its most important features? What impact will it have on competition, business organization, and business strategy? What does it mean for businesses in Cleveland (U.S.A.) or Kuala Lumpur (Malaysia)? Cross-listed as PRCT 425 and GAMBL 422 lower than that of companies that have been around for only a couple of years and never made a profit? Prereq: ECON 403 or MBAC 426.

ECON 472. The World’s Regions and Strategic Advantage (3) This course will focus on business decisions in an increasingly complex regional and global economic environment and the significance of place in business success. Every company decision involves location—recruiting, locating headquarters or an R&D lab, choosing where to invest, evaluating a merger, evaluating the investment portfolio of a bank, locating a new facility, and marketing your product. Topics include: high technology development, interpreting business climate indexes, the business location decision, sources of regional advantage, case studies of the world’s important cities, geographic clustering of industries, and business partnerships for improving regional economies. Prereq: ECON 403.

ECON 474. International Trade (3) This course deals with the causes and effects of international trade and investment. Its coverage includes the global and regional commercial agreements and institutions that affect the international business environment. The European Union, the North American Free Trade Agreement, and the World Trade Organization are treated extensively. Prereq: ECON 403.

ECON 475. International Finance (3) This course covers the global financial markets that multinational corporations, government agencies, and banks use in conducting business. These financial markets include the market for foreign exchange, the Eurocurrency and related money markets, the Eurobond and global equity markets, the commodity markets, the markets for forward contracts, options, swaps, and other derivatives. Prereq: ECON 403.

ECON 476. Fundamentals of International Business-E.M.B.A. (3) This course deals with the fundamentals of business activities that cross national boundaries. It focuses on not only exports and imports, but all other issues, such as foreign direct investment, international technology transfer, organizational structure, and financial management, that required a corporate strategy in establishing and maintaining global competitiveness. It covers the basic international business activities within an interdisciplinary framework, drawing from economics, finance, accounting, marketing, organizational behavior, political science, and history. Its aim is not only to enable an understanding of such technical issues as how the effects of tariffs and quotas differ or how foreign exchange rates are determined, but also to provide a systemic view of how government policies and corporate strategies interact in changing the environment of international business. The basic premise of the course is that to formulate successful global corporate strategies, we must comprehend and cope with the political, cultural, and economic environment of international business.

ECON 482. High-Tech Regions and Business Strategy (3) Many regions of the world seek to emulate Silicon Valley’s success as a high-tech center. These include Taiwan, Israel, India, Britain, Cote d’Azur (“Europe’s California”), Pyramid Technology Park of Egypt, and Malaysia. A region’s innovation system serves as both a source of strategic advantage for high-tech companies and as a critical infrastructure for supporting the development and use of new technology by a region’s companies and industries. In this course we look at what makes Silicon Valley so successful in as a high-tech region and whether it can be used as a model for high-tech development in other countries and regions. We examine alternative systems of innovation in other regions of the world and the
Program Faculty
Tim Shuckerow, M.A. (Case Western Reserve University)
Director of Teacher Licensure
Phil Safford, Ph.D. (University of Michigan)
Associate Director of Teacher Licensure, Clinical/Field Lectures
David Bellini, M.A. (Cleveland State University)
Educational Psychology Instructor
Rita Saslaw, Ph.D. (Case Western Reserve University)
Introduction to Education Instructor

Education (EDUC & EDJC)

Undergraduate Courses
EDUC 301. Introduction to Education (3)
The historical, sociological, and philosophical role of education in a diverse society. Contemporary practices and issues are introduced, researched, and debated. Issues of professional development. Application of research to instructional methodologies. Clinical/Field experiences required.
EDUC 304. Educational Psychology (3)
EDUC 338. Seminar and Practicum in Adolescents (3)
Supervised field placement and attendance in early childhood, child, and adolescent settings including preschools, schools, hospitals, and neighborhood centers. This class is used to fulfill requirements by the Ohio Department of Education teacher licensure program. Prereq: PSCL 101, EDUC 301, EDUC 304, and permission of program director. Cross-listed as PSCL 338 and SOCI 338.

Graduate Courses
EDUC 401. Introduction to Education (3)
(See EDUC 301.) Research project required for graduate students.
EDUC 404. Educational Psychology (3)
(See EDUC 304.) Research project required for graduate students. Prereq: PSCL 101.

Taken at John Carroll University
EDJC 186. Instructional Technology (2)
Principles and techniques of instructional design and use of technology in educational settings. Includes examination of emerging technologies and production of instructional materials. Lab fee required. Prereq: EDUC 301, EDUC 338, and EDUC 304.
EDJC 255. Literacy Across the Curriculum (3)
Literacy development examined through psychological, socio-cultural and historical perspectives. Examines reading as an interactive, problem-solving process. Strategies that foster critical thinking, active engagement and social interaction in the teaching of reading and writing across the curriculum. Includes field experience. Prereq: EDUC 301, EDUC 338, and EDUC 304.
EDJC 337. Adolescent Education Special Methods (3)
For Adolescent and Multi-Age licensure program students. General methods and specific content area methods for planning, implementing, and integrating curriculum, evaluating pupil achievement, and teaching to individual differences. Aligned with Ohio Department of Education’s Competency-Based Models, Praxis II, and Learned Society Guidelines. Emphasis given to strategies related to effective teaching and learning in each licensure content area. Additional emphasis placed on nurturing a risk-taking classroom community responsive both to high standards of performance and to students with diverse backgrounds, abilities, and learning styles. Prereq: EDUC 301, EDUC 338, and EDUC 304.
Department of English

106 Guilford House
Phone 216-368-2340; Fax 216-368-2216
Gary L. Stonum, Chair

The Department of English offers courses of study leading to the Bachelor of Arts, Master of Arts, and Doctor of Philosophy degrees. Included among the department’s offerings are literary and cultural studies, linguistics, film, journalism, creative writing, and composition.

Combining the intellectual resources of a major research university with a scale and a set of values more typical of a liberal arts college, the department puts great stress on class discussion, individual conferences or tutorials, and other opportunities for students and faculty to work closely together. Likewise, the curriculum is deliberately flexible enough to respond to student needs and interests and to encourage close cooperation with the faculty in planning a course of study.

An undergraduate major in English prepares one first and foremost to be a thoughtful, responsible person and a lifelong learner. A major in English also prepares one for various sorts of careers. Three paths are common:

- English leads readily to careers which put a premium on writing skills and on the ability to analyze complex human situations. In addition to the fields that have often been of first interest to English majors (writing and publishing, journalism, advertising, the film industry, and public relations), significant opportunities exist in the corporate world, in government, and in non-profit organizations such as those devoted to social service, the environment, or the arts.
- The B.A. in English is usually essential to anyone expecting to do graduate work in English or to pursue a career as a teacher or a scholar in the field.
- The B.A. in English traditionally has been an important stepping stone to success in professional school, and many of our English majors choose this path. A significant number go on to law school, many to medical or business school, and some to nursing, journalism, social work, or library school, as well as directly into the business world.

The department is home to The Emily Dickinson Journal and The Society for Critical Exchange, an international community of scholars in literary and cultural theory.

Faculty

Gary Lee Stonum, Ph.D. (Johns Hopkins University)
Oviatt Professor and Chair
Editor, The Emily Dickinson Journal
American literature, literary theory

Thomas G. Bishop, Ph.D. (Yale University)
Associate Professor
Director, Baker-Nord Center for the Humanities
Shakespeare, Renaissance literature; post-colonial literature

Mary Grimm, M.A. (Cleveland State University)
Associate Professor
Creative Writing (poetry); African-American Literature

Christopher Flint, Ph.D. (University of Pennsylvania)
Associate Professor
18th Century English literature; history of the book

Louis D. Giannetti, Ph.D. (University of Iowa)
Professor
Film

Heather Meakin, D. Phil. (University of Oxford)
Assistant Professor
American literature; modernism

Ted Gup, J.D. (Case Western Reserve University)
Classical literature

Kurt Koenigsberger, Ph.D. (Vanderbilt University)
Assistant Professor
The teaching of English; American literature; poetry

Todd V. Oakley, Ph.D. (University of Maryland)
Assistant Professor
Rhetoric; linguistics

Judith Oster, Ph.D. (Case Western Reserve University)
Assistant Professor
Renaissance literature, women’s studies

Martha Woodmansee, Ph.D. (Stanford University)
Editor, The Emily Dickinson Journal
American literature, literary theory

Undergraduate Programs

Major

The major in English includes two tracks. The primary track consists of at least 30 semester hours in English above the 100 level, including ENGL 200 (Literature in English), ENGL 380 (Senior Seminar), and a minimum of 15 additional hours at the 300 level or above. To qualify for honors, one follows a track consisting of at least 36 hours above the 100 level, including ENGL 200, ENGL 380, 27 hours of approved electives in literary and cultural studies, and one of the following language courses: FRCH 202, GREK 202, GRMN 202, JAPN 202, LATIN 202, SPAN 202, or equivalent in a language for which 300-level literature courses are available. In addition, of the 27 hours of electives, six must be in
Interested students should note the general requirements and the admission procedures in this publication.

Graduate Program

The Department of English offers programs in American and English literature and language leading to the Master of Arts and Doctor of Philosophy degrees. At either the M.A. or Ph.D level students may elect a concentration in Writing History and Theory. For current information on this and other graduate programs in the department consult the department’s website, http://www.cwru.edu/artsci/engl.html.

Candidates for graduate work in English should present an undergraduate major in English or a minimum of 18 semester hours of English (or its equivalent) beyond the freshman level. In some cases, students will be required to make up deficiencies without graduate credit. The department requires all candidates for admission to submit their scores on aptitude sections of the Graduate Record Examination. Candidates are also required to submit a writing sample of at least 15 pages of academic writing. Students whose native language is not English are normally admitted only as provisional students. After 12 semester hours of satisfactory work they are granted regular status.

A maximum of six semester hours of transfer credit will be accepted from another institution provided it was earned in graduate-level courses and has the approval of the department and the dean of graduate studies. Such courses must have been taken within five years of matriculation at Case Western Reserve University and passed with grades of B or better. The department welcomes part-time students.

Although not formally a requirement for graduate degrees, teaching is viewed as part of the education of every graduate student. The department provides opportunities for graduate assistants to gain teaching experience in a variety of courses offered by the department. Other teaching opportunities exist elsewhere in the university and in the Greater Cleveland area.

New and continuing graduate students may apply for graduate student assistantships, which are awarded by the dean on recommendation of the department. Applicants with previous teaching experience are preferred. Graduate assistants without previous teaching experience will be required to take ENGL 400, Seminar in Rhetoric and the Teaching of Writing, before or during the first semester in which they teach.

Special Master of Arts Programs

Master of Arts in Comparative Literature (English and French, German or Spanish). A more detailed description of all graduate programs in English is available from the departmental office or the Office of Graduate Admissions.

Facilities

Faculty and graduate student offices are in Guilford House, as is a faculty/student lounge and reading room (Guilford 223). In cooperation with the undergraduate Film Society and the Department of Modern Languages and Literatures, the English Department maintains a library of classic movies on videotape. Camera, recorders, and monitors are available in Guilford for making and viewing video tapes. The Film Society maintains a state-of-the-art film projection facility in Strosacker Auditorium. Kelvin Smith Library, a part of the University Libraries, houses the collections of printed material. In addition to manuscript and rare-book holdings in the Special Collections Division, the library has strengths in Renaissance literature, 18th- and 19th-century English literature, and American literature. The Library has recently acquired an
outstanding collection of approximately 6500 art films on videocassette, supported in part by English department endowment funds.

Current Areas of Research

Current topics of faculty research include 16th and 17th century women’s writing, Shakespeare’s theater, biography and autobiography, cognitive linguistics, authorship and intellectual property, the export of American popular culture, immigrant and cross-cultural literature in the United States; the history of the book; native American literature, medical and psychological contexts of Victorian literature; the literature of empire; and the aesthetics of modernism.

English (ENGL)

Undergraduate Courses

ENGL 148. Introduction to Composition (3)
Practice and training in various modes of writing. Includes regular individual conferences as well as classes. Texts and readings vary from section to section. May be repeated in special instances, but a maximum of three semester hours will count toward a Bachelor’s degree. Students placing into ENGL 148 must complete the course with a grade of C or higher in order to enroll in ENGL 150.

ENGL 150. Expository Writing (3)
Practice and training in expository writing. Although a common quantity of writing is assigned, methods and texts may vary from section to section. A grade of C or better in ENGL 150 fulfills the university composition requirement.

ENGL 180. Writing Tutorial (1-2)
Students who pass ENGL 150 with a grade of D and transfer students who are placed in ENGL 180 on the basis of the ENGL placement test must pass ENGL 180 with a grade of C or higher to meet the ENGL composition requirement of the colleges. Others desiring substantial scheduled tutorial work in composition may report to the Writing Center during the first week of classes to arrange a tutorial appointment. May be repeated in special instances, but no more than three semester hours of ENGL 180 credit will count toward the degree.

ENGL 181. Reading Tutorial (1)
Scheduled tutorial in reading for those who need work beyond ENGL 148 or who come to the Writing Center seeking substantial help. May be repeated in special instances, but only one semester hour will count toward the degree.

ENGL 200. Literature in English (3)
This course introduces students to the reading of literature in the English language. Through close attention to the practice of reading, students are invited to consider some of the characteristic forms and functions imaginative literature has taken, together with some of the changes that have taken place in what and how readers read. Prereq: ENGL 150.

ENGL 202. Expository Writing (3)
A workshop-style course for students who wish to refine the skills acquired in ENGL 150. Special attention to style and presentation.

ENGL 203. Introduction to Creative Writing (3)
A course exploring basic issues and techniques of writing narrative prose and verse through exercises, analysis, and experiment. For students who wish to try their abilities across a spectrum of genres. Prereq: ENGL 150.

ENGL 204. Introduction to Journalism (3)
Print news and feature stories, broadcast writing, advertising copy, and public relations. Considerable writing. Guest speakers from the profession. Prereq: ENGL 150.

ENGL 213. Introduction to Fiction Writing (3)
A beginning workshop in fiction writing, introducing such concepts as voice, point of view, plot, characterization, dialogue, description, and the like. May include discussion of literary examples, both classic and contemporary, along with student work. Prereq: ENGL 150.

ENGL 214. Introduction to Poetry Writing (3)
A beginning workshop, focusing on such elements of poetry as verse-form, syntax, figures, sound, tone. May include discussion of literary examples as well as student work. Prereq: ENGL 150.

ENGL 255. Major British Writers (3)
Introduction to literary studies and survey of selected English authors from the Medieval period to the present. Prereq: ENGL 150.

ENGL 256. Major American Writers (3)
Introduction to literary studies and survey of literature of United States from colonial times to the present. Prereq: ENGL 150.

ENGL 257A. The Novel (3)
Introductory readings in the novel. May be organized chronologically or thematically. Some attention to the novel as a historically situated genre.

ENGL 257B. Poetry (3)
Introductory readings in poetry. May be organized chronologically or thematically. Attention to the formal qualities of poetry in relation to meaning, expressivity, etc.

ENGL 268. Understanding Movies (3)
An introductory course designed to familiarize students with the language systems and aesthetic components of the movies and provide the means to analyze how movies work as complex aesthetic entities. Films are shown in 35mm. Prereq: ENGL 150.

ENGL 270. Introduction to Gender Studies (3)
This course introduces women and men students to the methods and concepts of gender studies, women’s studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, and art history. It is the required introductory course for students taking the women’s studies major. Prereq: ENGL 150. Cross-listed as WMST 201.

ENGL 273. Literature and the Environment (3)
American writers—primarily of the 19th and 20th centuries—whose works deal with themes of the environment. Approved for the Environmental Studies program. Prereq: ENGL 150.

ENGL 285. Special Topics Seminar (1)
One-credit seminars on special topics in literature or language; see departmental listings for topics each term. Maximum of 3 credits. Prereq: ENGL 150.

ENGL 290. Masterpieces of Continental Fiction (3)
Major works of fiction from the 19th century and earlier. Cross-listed as CMPL 290.

ENGL 291. Masterpieces of Modern Fiction (3)
Major works of fiction of the 20th century. Cross-listed as CMPL 291.

ENGL 301. Linguistic Analysis (3)
Analysis of modern English from various theoretical perspectives: structural, generative, discourse analytical, sociolinguistic, psycholinguistic, and cognitive linguistic. Some attention to the major dialects of American English. Prereq: ENGL 150.

ENGL 303. Intermediate Writing Workshop: Fiction (3)
Continues developing the concepts and practice of the introductory courses, with reading, writing, and discussion of fiction in various forms, including the short story, the novella and the novel. Maximum 6 credits. Prereq: ENGL 203 or ENGL 213.

ENGL 304. Intermediate Writing Workshop: Poetry (3)
Continues developing the concepts and practice of the introductory courses, with emphasis on experiment and revision as well as consideration of poetic genres through examples from established poets. Maximum 6 credits. Prereq: ENGL 203 or ENGL 214.

ENGL 305. Playwriting (3)
Theory and practice of dramatic writing, in the context of examples, classic and contemporary. Prereq: Any one of the following: ENGL 203 or ENGL 213 or ENGL 214, ENGL 303, ENGL 304. Cross-listed as THTR 312.

ENGL 307. Intermediate Writing Workshop: Journalism (3)
Continues developing the concepts and practices of the introductory course, with emphasis on feature writing for magazines, story structure, and repertorial techniques. Prereq: ENGL 150 and ENGL 204, or permission of department.
ENGL 309. Topics in Journalism (3)
Study and practice of specialized forms of journalism. Maximum of six credits. Prereq: ENGL 150.

ENGL 310. History of the English Language (3)
An introductory course covering the major periods of English language development: Old, Middle, and Modern. Students will examine both the linguistic forms and the cultures in which the forms were used. Prereq: ENGL 150.

ENGL 312. Chaucer (3)
An introduction to the work of Geoffrey Chaucer, with emphasis on “The Canterbury Tales.” Prereq: ENGL 150.

ENGL 317. Business and Technical Writing (3)
Professional communication in theory and practice, including audience analysis, logic and strategy applied to the writing of technical reports, proposals, manuals, progress and feasibility studies, memoranda, and letters. Prereq: ENGL 150.

ENGL 320. Renaissance Literature (3)
Aspects of English Renaissance literature and its contexts from 1500-ca. 1620. Genres studied might include poetry, drama, prose fiction, expository and polemic writing, or some works from Continental Europe. Writers such as Skelton, More, Erasmus, Wyatt, Sidney, Spenser, Marlowe, Lanier, Wroth, Shakespeare, Donne. Maximum 6 credits. Prereq: ENGL 150.

ENGL 323. Milton (3)
Poetry and selected prose, including the careful study of “Paradise Lost.” Prereq: ENGL 150.

ENGL 324. Shakespeare: Histories and Tragedies (3)
Close reading of a selection of Shakespeare’s tragedies and history plays (e.g., “Richard the Third,” “Julius Caesar,” “Hamlet,” “King Lear”). Topics of discussion may include Renaissance drama as a social institution, the nature of tragedy, national history, gender roles, sexual politics, the state and its opponents, theatrical conventions. Assessment may include opportunities for performance. Prereq: ENGL 150. Cross-listed as THTR 334.

ENGL 325. Shakespeare: Comedies and Romances (3)
Close reading of selected plays of Shakespeare in the genres of comedy and romance (e.g., “The Merchant of Venice,” “Twelfth Night,” “Measure for Measure,” “The Tempest”). Topics of discussion may include issues of sexual desire, gender roles, marriage, the family, genre conventions. Assessment may include opportunities for performance. Prereq: ENGL 150. Cross-listed as THTR 335.

ENGL 326. Seventeenth-Century Literature (3)
Selected topical readings drawn from a variety of sources: drama, lyric and epic poetry, political and philosophical writings, and prose fiction. Writers studied may include Donne, Jonson, Herrick, Milton, Marvell, Herbert, Finch, Behn, Dryden, and Cavendish. Maximum 6 credits. Prereq: ENGL 150.

ENGL 327. Eighteenth-Century Literature (3)
Survey of a variety of writings from or relevant to the eighteenth century. Writers discussed may include Dryden, Behn, Defoe, Pope, Swift, Gay, Fielding, Richardson, Burney, Wollstonecraft and others working in drama, lyric and epic poetry, biography and autobiography, political and philosophical writings and prose fiction. Thematic approaches may include: satire, journalism, and literature, the rise of the novel. Maximum 6 credits. Prereq: ENGL 150.

ENGL 328. Studies in the Eighteenth Century (3)
This course examines selected topics in the English literary culture of the eighteenth century, a culture which extended to the Americas and to other English colonies. Literary writings will be examined in relation to other aspects of the century culture, which may include visual arts, material institutions, the printing industry, property law, medicine, and other topics. Maximum 6 credits. Prereq: ENGL 150.

ENGL 329. English Literature, 1780-1837 (3)
Aspects of English literature and its contexts in the early 19th century. Genres might include poetry, prose fiction, political and philosophical writing, literary theory of the period. Writers such as the Wordsworth, Coleridge, Blake, Austen, Byron, the Shelles. Maximum 6 credits. Prereq: ENGL 150.

ENGL 330. Victorian Literature (3)
Aspects of English literature and its contexts during the reign of Queen Victoria. Genres studied might include poetry, prose fiction, political and philosophical writing. Writers such as the Brontes, Gaskell, Dickens, Eliot, Hardy, Tennyson, the Brownings, Arnold, Carlyle, Ruskin, Gosse, Swinburne, and Hopkins. Maximum 6 credits. Prereq: ENGL 150.

ENGL 331. Studies in the Nineteenth Century (3)
Individual topics in English literary culture of the 19th century. Topics might be thematic or formal, such as literature and science, medicine, labor, sexuality, or Empire; literature and other arts; Gothic fiction, decadence. Maximum 6 credits. Prereq: ENGL 150.

ENGL 332. Twentieth-Century British Literature (3)
Aspects of British literature (broadly interpreted) and its contexts during the 20th century. Genres studied might include poetry, fiction, and drama. Such writers as Joyce, Woolf, Conrad, Ford, Lawrence, Mansfield, Shaw, Beckett, Stoppard, Yeats, Edward or Dylan Thomas, Stevie Smith, Bowen, Spark. Maximum 6 credits. Prereq: ENGL 150.

ENGL 333. Studies in the Twentieth Century (3)
Individual topics in twentieth-century literary culture. Particular issues and topics may cross national boundaries and genre lines as well as exploring political, psychological, and social themes, such as movements, comparative studies across the arts, literature and war, literature and occultism. Maximum 6 credits. Prereq: ENGL 150.

ENGL 334. Major Writers (3)
Close and detailed study of the work of one or two writers: development, social and aesthetic contexts, reception, interpretation, significance. Maximum 6 credits. Prereq: ENGL 150.

ENGL 335. American Literature Before 1865 (3)
Aspects of American literature and its contexts from the colonial period through the end of the Civil War. Writers such as Bradstreet, Taylor, Franklin, Poe, Stowe, Alcott, Melville, Hawthorne, Emerson, Douglass. Maximum 6 credits. Prereq: ENGL 150.

ENGL 337. American Literature 1865-1914 (3)
Aspects of American literature and its contexts from the Civil War to the First World War. Writers such as Whitman and Dickinson, Twain, Howells, James, Chopin, Wharton. Maximum 6 credits. Prereq: ENGL 150.

ENGL 338. American Literature 1914-1960 (3)
Aspects of American literature and its contexts from the First World War to the Cold War. Genres studied might include fiction, poetry, drama, polemics. Writers such as T.S. Eliot, Pound, Stevens, Moore, W.C. Williams, Dos Passos, West, Fitzgerald, Hemingway, Cather, Faulkner, Barnes, Miller, T. Williams, O’Neill. Maximum 6 credits. Prereq: ENGL 150.

ENGL 339. Studies in Contemporary American Literature (3)
Individual topics in literary culture since the 1960s. Topics may include the Beats, literature of the Vietnam war, post-modern fiction, contemporary poetry, the documentary novel. Maximum 6 credits. Prereq: ENGL 150.

ENGL 340. Studies in American Literature (3)
Individual topics in American literary culture such as regionalism, realism, impressionism, literature and popular culture, transcendentalism, the lyric, proletarian literature, the legacy of the Civil War. Maximum 6 credits. Prereq: ENGL 150.

ENGL 341. African-American Literature (3)
A historical approach to African-American literature. Such writers as Wheatley, Equiano, Douglass, Jacobs, DuBois, Hurston, Hughes, Wright, Baldwin, Ellison, Morrison. Topics covered may include slave narratives, African-American autobiography, the Harlem Renaissance, the Black Aesthetic, literature of protest and of assimilation. Maximum 6 credits. Prereq: ENGL 150.

ENGL 345E. The Immigrant Experience (3)
Study of fictional and/or autobiographical narrative by authors whose families have experienced immigration to the U.S. Among the ethnic groups represented are Asian-American, Jewish-American, Hispanic-American. May include several ethnic groups or focus on a single one. Attention is paid to historical and social aspects of immigration and ethnicity. Maximum 6 credits. Prereq: ENGL 150.
ENGL 365N. Topics in African-American Literature (3)
Selected topics and writers from nineteenth and twentieth-century Afri-
can-American literature. May focus on a genre, a single author or a group
of authors, a theme or themes. Maximum 6 credits. Prereq: ENGL 150.

ENGL 365Q. Post-Colonial Literature (3)
Readings in national and regional literatures from former European colo-
nies such as Australia and African countries. Maximum 6 credits. Prereq:
ENGL 150.

ENGL 366G. Minority Literatures (3)
A course dealing with literature produced by ethnic and racial minority
groups within the U.S. Individual offerings may include works from sev-
eral groups studied comparatively, or focus on a single group, such as Na-
tive Americans, Chicanoas/Chicanas, Asian-Americans, Caribbean-Ameri-
cans. African-American works may also be included. May cover the entire
history of the U.S. or shorter periods. Maximum 6 credits. Prereq: ENGL
150.

ENGL 368A. Introduction to Film Studies (3)
This course will help students develop a sophisticated awareness of some
of the major schools of thought employed in analyzing Hollywood and
world cinema, such as formalism, psychoanalytic theory, Marxist critici-
cism, postmodernism, feminist film theory, and reception theory, among
other interpretive approaches. Attention will also be paid to the role
of the cinema in a world of rapidly changing technologies. Prereq: ENGL
150 and ENGL 268 or permission of the department. Cross-listed as CMPL
368A.

ENGL 368B. History of Film (3)
Analysis of selected topics in film history, such as film before 1940,
American cinema 1940 to the present. European or Asian cinema since
1940. Maximum 6 credits. Prereq: ENGL 150.

ENGL 368C. Topics in Film (3)
Individual topics in film, such as a particular national cinema, images of
women in film, film comedy. New Wave film, literature and film. Maxi-
mum 12 credits. Cross-listed as CMPL 368C.

ENGL 370. Women Writers (3)
Study of the work of a selection of women writers oriented toward their
themes, forms, reception, relationships; may cross national boundaries or
temporal eras. Maximum 6 credits. Prereq: ENGL 150.

ENGL 371. Topics in Women's Studies (3)
Individual topics and issues in women's studies relating to writing by and
about women, such as feminist theory and criticism; the politics of gen-
der and sexuality; women in popular culture; women in the writing busi-
ness. Maximum 6 credits. Prereq: ENGL 150.

ENGL 372. Studies in the Novel (3)
Selected topics in the history and formal development of the novel, such
as detective novels; science fiction; epistolary novels; the rise of the
novel; the stream of consciousness novel; the Bildungsroman in English.
Maximum 6 credits. Prereq: ENGL 150.

ENGL 373. Studies in Poetry (3)
Selected topics and issues in the study of poetry, such as reading poetry,
the elegy, pastoral poetry, love poetry, the long poem, form and meter in
poetry. Maximum 6 credits. Prereq: ENGL 150.

ENGL 374. Internship in Journalism (3-6)
Students work as interns at area newspapers, magazines, trade publica-
tions, radio or television and meet as a class to share their experiences as
interns and to focus on editorial issues—reporting, writing, fact-check-
ing, editing—that are a part of any journalistic enterprise. Students are re-
sponsible for pre-arranging their internship prior to the semester they in-
tend to take the class but can expect guidance from the instructor in this
regard. Prereq: ENGL 204 or permission of the department.

ENGL 375. Internship in Technical Communication (3-6)
Students create technical and professional documents in a selected cor-
porate or organizational setting, do assigned reading, and meet as a class
to participate in seminar discussions and review of work. Students must
pre-arrange internship assignment with instructor prior to semester.
Prereq: ENGL 317 or ENGL 398N and permission of department.

ENGL 376. Studies in Genre (3)
Topics in literary genres, such as comedy, biography and autobiography,
satire, allegory, the short story, the apologue, narrative poetry. May cross
over the prose/poetry boundary. Maximum 6 credits. Prereq: ENGL 150.

ENGL 379. Topics in Language Studies (3)
Aspects of contemporary language studies. Topics such as history of
rhetoric, Saussurean linguistics, generative grammar, psycholinguistics,
sociolinguistics, cognitive and construction grammars, metaphor, lan-
guage acquisition, stylistics. Maximum 9 credits. Prereq: ENGL 150.

ENGL 380. Senior Seminar (3)
Capstone course required of all English majors in the senior year. Limited
to senior English majors. Maximum 6 credits.

ENGL 385. Special Topics in Literature (3)
Close study of a theme or aspect of literature not covered by traditional
generic or period rubrics, such as “spatial imagination,” “semiotics of
fashion in literature,” “epistolarity.” Maximum 9 credits. Prereq: ENGL
150.

ENGL 386. Studies in Literature and Culture (3)
Boundary-crossing study of the relations between literary and other as-
pacts of a particular culture or society, including theoretical and critical
issues raised by such study. For example, literature and medicine, gay
and lesbian literature, Asian/Western literary relations, emotion in liter-
ature, philosophy and literature, literature and music. Maximum 9 credits.
Prereq: ENGL 150.

ENGL 387. Literary and Critical Theory (3)
A survey of major schools and texts of literary and critical theory. May be
historically or thematically organized. Maximum 6 credits. Prereq: ENGL
150.

ENGL 390. Independent Study and Creative Projects (1-6)
Up to six semester hours of independent study may be taken in a single
semester. Must have prior approval of faculty member directing the
project. Projects may be critical or creative in nature.

ENGL 392. Classroom Teaching (3)
For undergraduate students who assist in the teaching of ENGL 150, 180,
or 181. Interested students should check with the director of composi-
tion (for ENGL 150, 180, 181) before the beginning of the semester in
which they wish to participate. May be repeated only once; not more
than three semester hours in ENGL 392 may be counted toward the ma-
jor. May also include up to three semester hours of supervised peer tutor-
ing at the University Writing Center.

ENGL 393. Seminar and Practicum in Literacy (3)
For seniors scheduled to take a student teaching teaching practicum
section. Taken for credit in conjunction with teaching in Project STEP-UP,
a University-sponsored collaboration with city middle schools. Students must
commit to 60 hours of tutoring at one of the approved sites during the
term they take ENGL 393, as well as participating in weekly one-hour
seminar sessions and completing reading and writing assignments.

ENGL 398. Professional Communication for Engineers (2)
A writing course for engineering majors only. Subjects covered include
audience adaptation, problem/solution formats, lab reports, journal ar-
ticles, proposals, feasibility studies, and oral presentations. Co requisite is
a particular engineering lab course; students should consult advisors.
Prereq: ENGL 150. Coreq: Concurrent enrollment in appropriate engi-
neering course.

ENGL 398N. Professional Communication for Engineers (3)
Principles and practices of effective communication in the workplace,
with an emphasis on computer-mediated communication. Topics include
analyzing audience needs in context, visual communication, computer-
mediated documents, ethics, and team writing. Typical assignments in-
clude e-mail, memos, letters, reports, documentation, and oral presenta-
tions. Prereq: ENGL 150.

ENGL 399. Senior Thesis (3)
Elective research or creative project. Should be used for Honors Projects
option. By department approval only. Maximum 6 credits. Prereq: Con-
sent of department.
Graduate Courses

ENGL 400. Rhetoric and Teaching of Writing (3)
Classical and modern theories of rhetoric; their application in the classroom. Required of graduate assistants and tutors who have had no prior experience in the teaching of composition.

ENGL 401. Linguistic Analysis (3)
(See ENGL 301.)

ENGL 406. Advanced Creative Writing (3)
Workshop for serious undergraduate and graduate writers. Offered alternate years; alternates between poetry and fiction. Admission requires review of writing sample by faculty. Maximum 6 credits. Prereq: Consent of department.

ENGL 410. History of the English Language (3)
(See ENGL 310.) Prereq: ENGL 150.

ENGL 420. Renaissance Literature (3)
(See ENGL 320.)

ENGL 423. Milton (3)
(See ENGL 323.)

ENGL 424. Shakespeare: Histories and Tragedies (3)
(See ENGL 324.)

ENGL 425. Shakespeare: Comedies and Romances (3)
(See ENGL 325.)

ENGL 426. Seventeenth-Century Literature (3)
(See ENGL 326.)

ENGL 427. Eighteenth-Century Literature (3)
(See ENGL 327.)

ENGL 428. Studies in the Eighteenth Century (3)
(See ENGL 328.)

ENGL 429. English Literature, 1780-1837 (3)
(See ENGL 329.)

ENGL 430. Victorian Literature (3)
(See ENGL 330.)

ENGL 431. Studies in the Nineteenth Century (3)
(See ENGL 331.)

ENGL 432. Twentieth-Century British Literature (3)
(See ENGL 332.)

ENGL 433. Studies in the Twentieth Century (3)
(See ENGL 333.)

ENGL 435. Major Writers (3)
(See ENGL 353.)

ENGL 450. American Literature Before 1865 (3)
(See ENGL 356.)

ENGL 456. American Literature 1865-1914 (3)
(See ENGL 357.)

ENGL 458. American Literature 1914-1960 (3)
(See ENGL 358.)

ENGL 459. Studies in Contemporary American Literature (3)
(See ENGL 359.)

ENGL 460. Studies in American Literature (3)
(See ENGL 360.)

ENGL 463H. African-American Literature (3)
(See ENGL 363H.)

ENGL 465E. The Immigrant Experience (3)
(See ENGL 365E.)

ENGL 465N. Topics in African-American Literature (3)
(See ENGL 365N.)

ENGL 465Q. Post-Colonial Literature (3)
(See ENGL 365Q.)

ENGL 466G. Minority Literatures (3)
(See ENGL 366G.)

ENGL 468A. Introduction to Film Studies (3)
(See ENGL 368A.)

ENGL 468B. History of Film (3)
(See ENGL 368B.)

ENGL 468C. Topics in Film (3)
(See ENGL 368C.)

ENGL 470. Women Writers (3)
(See ENGL 370.)

ENGL 471. Topics in Women's Studies (3)
(See ENGL 371.)

ENGL 472. Studies in the Novel (3)
(See ENGL 372.)

ENGL 473. Studies in Poetry (3)
(See ENGL 373.)

ENGL 476. Studies in Genre (3)
(See ENGL 376.)

ENGL 479. Topics in Language Studies (3)
(See ENGL 379.)

ENGL 480. ESL Composition Theory (3)
Study of theories related to teaching ESL composition, including second language acquisition; specialized grammar related to common ESL problems; cultural and affective issues; different Englishes; composition theory and research as it relates to ESL.

ENGL 485. Special Topics in Literature (3)
(See ENGL 385.)

ENGL 486. Studies in Literature and Culture (3)
(See ENGL 386.)

ENGL 487. Literary and Critical Theory (3)
(See ENGL 387.)

ENGL 501. Theories of Rhetoric (3)
ENGL 502. Critical Theory (3)
Theories and methods of contemporary literary study. Required of all graduate degree-seeking students.

ENGL 506. Teaching Technical and Professional Communication (3)
Prepares graduate students to teach technical and professional writing in academic and non-academic settings. Prereq: ENGL 500.

ENGL 508. Seminar: English Literature 1550-1660 (3)
ENGL 517. Seminar: American Literature (3)
ENGL 518. Seminar: English Literature 1660-1800 (3)
ENGL 519. Seminar: English Literature 1800-1900 (3)
ENGL 520. Seminar: 20th Century Literature (3)
ENGL 521. Seminar: The Novel (3)
ENGL 522. Seminar: Topics in Poetry (3)
ENGL 524. Seminar: Criticism and Other Special Topics (3)
ENGL 550. External Seminar (3)
Course work offered in cooperation with participating English departments in the region; content and approach vary. Requires prior approval of the Graduate Director.

ENGL 590. Special Reading or Research (3)
Preparatory study as arranged with individual instructors. Prereq: Graduate status or consent of department.

ENGL 601. Directed Reading (1-6)

ENGL 651. Thesis M.A. (1-18)
ENGL 701. Dissertation Ph.D. (1-18)
Prereq: Ph.D. candidates only.
ENGL 702. Appointed Dissertation Fellow (9)
Environmental Studies Program

211 Smith Building
Phone 216-368-3676; 216-368-2741
Fax 216-368-3691
Peter McCall, Director

Program Faculty

Peter L. McCall, J.D., Ph.D. (Yale University)
Professor, Geological Sciences; Director, Environmental Studies
Joseph F. Koonce, Ph.D. (University of Wisconsin, Madison)
Professor, Biology
Timothy K. Beal, Ph.D. (Emory University)
Associate Professor, Religion
Mihajilo Mesarovic, Ph.D. (Serbian Academy of Science)
Cady Staley Professor of Engineering
Carroll W. Pursell, Ph.D. (University of California, Berkeley)
Adeline Barry Davee Distinguished Professor of History of Technology
Norman Robbins, M.D. (Harvard University), Ph.D. (Rockefeller University)
Professor of Neurosciences; Director, Center for Environment
Theodore Steinberg, Ph.D. (Brandeis University)
Associate Professor of History; Associate Professor, School of Law

Undergraduate Program

Environmental studies is a multi-disciplinary program that introduces students to the societal determinants and implications of environmental problems. Emphasis is given to the moral, cultural, and political dimensions of environmental problems and solutions. It brings to bear the issues and methods of the humanities and social sciences as well as the sciences and professions on environmental questions. The program is designed to serve the needs of students seeking a liberal education as well as those who desire a broad intellectual base for more technical training in environmental sciences. Students in environmental studies can pursue a major, a minor, or Engineering Core sequence.

Major

The environmental studies program offers a major (30 credit hours) leading to the Bachelor of Arts degree. However, it may be elected only as a second major. The double major is required so that the multi-disciplinary perspective offered by the program may be complemented by a concentrated disciplinary major. To declare the major, students should have declared a first major and have sophomore or junior standing. Up to six credits in required and elective courses taken by students for their first major may be applied to their environmental studies major. None of the required courses may be taken pass/no pass.

The required courses are:

ESTD 101. Introduction to Environmental Thinking
ESTD 398. Environmental Seminar (1-3)
and one course from each of the three following areas of emphasis:

Humanities

RLGN 206. Religion and the Environment
HSTY 378. History of the American Environment

Social Policy

ECON 368. Environmental Economics
GEOL 303 (POSC 303). Environmental Law

Science and Engineering

ESCI 340. Introduction to Global Issues
BIOL 350. Introduction to Ecosystem Analysis
GEOL 202. Global Environmental Problems

At least 15 credit hours must be taken from a list of approved electives. This list will change from time to time as departmental offerings change. An approved Washington Semester internship may be used to satisfy part or all of the elective requirement. Students should consult with the program director for current information. All student programs must be approved by the director.

Minor

The minor in the College of Arts and Sciences (15 credit hours) consists of ESTD 101, one course from two of the three disciplinary groups above, and two of the approved electives, which may include courses from the third unselected disciplinary grouping.

Sequence

The sequence in environmental studies in the Case School of Engineering consists of 9 credit hours comprising ESTD 101 and two courses from the above disciplinary list.

Environmental Studies (ESTD)

Undergraduate Courses

ESTD 101. Introduction to Environmental Thinking (3)
Critical comparison of scientific, historical, religious, and literary conceptions of nature. Theories of environmental ethics, legal, and economic conceptions of environmental goods. Current controversies concerning human population growth, energy use, the consumer society, and attitudes towards animals.

ESTD 387. Multidisciplinary Approach to Environmental Problems (1-3)
This course is designed to illustrate, using a different topic each year, the necessity for a multidisciplinary approach to environmental problems in order to understand and manage environmental problems. Multiple faculty and community leaders participate in the teaching. Students registering for 1 credit attend weekly seminars; those registering for 2-3 credits do an individual research project in addition. Past topics include: lead poisoning in the urban environment, sustainability and the Great Lakes, setting environmental priorities, and reducing the University's environmental impacts.

ESTD 398. Seminar in Environmental Studies (3)
Small group discussion and student presentations concerning the cultural determinants of environmental attitudes. Each student presents two seminars on current environmental issues, one local and one global. Prereq: ESTD 101.

Graduate Course

ESTD 487. Multidisciplinary Approach to Environmental Problems (1-3)
(See ESTD 387.)

French Studies

201 Guilford House
Phone: 216-368-3071; Fax 216-368-2216
Marie Lathers, Director

French Studies Program

Committee and Advisors

Marie Lathers, Director French Studies
Elizabeth M. and William C. Treuhaft Professor of Humanities and French
Christine M. Cano
Assistant Professor of French
The French Studies Program

Designed to develop cross-cultural awareness and to foster international understanding in a global world, the French Studies Program adds an exciting new dimension to the traditional liberal arts curriculum. The French studies major differs from the traditional French major in two respects: by its interdisciplinary nature and by its greater flexibility to accommodate students’ own areas of interest. The French studies major answers the needs of students with a strong interest in cultural issues in general and in French history and society in particular.

The French Studies Program is an interdisciplinary, integrated program that understands the term “French” in its broadest sense, in an effort to represent the diversity characteristic of the field of French studies today as reflected in a variety of cultures of Francophone expression: Canada, the Caribbean, North and West Africa, the Middle East, and Southeast Asia. Reaching beyond disciplinary and national boundaries, the program encourages students to study in several disciplines, choosing from a large selection of courses in the humanities, the arts, and the social sciences. The program takes advantage of the varied resources the university has to offer in order to provide a meaningful course of study and an outstanding preparation for various graduate and professional schools or for careers in international business and finance, law, journalism, foreign service, or the arts.

French Studies Major

Each student prepares a program of study, indicating specific course selections to meet the two area requirements below, in close consultation with a faculty advisor drawn from the Steering Committee membership. Students should also discuss their choice of a minor or a second major with their advisor. The major in French studies requires a minimum of 33 credit hours in the following areas:

I. Foundations in French History and Culture (9)

These required courses introduce French civilization and culture from a contemporary (FRCH 316) and a historical perspective (FRCH 318, FRCH 319, or HYST 310). They also expose students to a variety of themes and issues particular to French culture and history.

II. French Area Courses (6)

From the list of French offerings, students select two courses that concentrate on a single historical period or cultural area (may not repeat courses taken as foundations courses). Two to three French area courses are offered in a given semester:

FRCH 308 Study in France
FRCH 314 Translation Techniques
FRCH 315 Business French
FRCH 316 Contemporary France
FRCH 317 French Cinema
FRCH 318 The Origins of France
FRCH 319 Modern France
FRCH 320 Introduction to French Literature
FRCH 321 French Literature to 1600
FRCH 331 Seventeenth-Century French Literature
FRCH 341 Eighteenth-Century French Literature
FRCH 351 Nineteenth-Century French Literature
FRCH 361 Twentieth-Century French Literature
FRCH 371 Topics in French Poetry
FRCH 372 Topics in French Drama
FRCH 373 The Novel and the Novella
FRCH 374 Major Writers and Literary Movements
FRCH 375 Francophone Literature
FRCH 376 Women Writers
FRCH 377 Special Topics
FRCH 399 Directed Reading

III. Courses in Other Disciplines (15)

Courses in disciplines other than French provide an international and interdisciplinary perspective on French and Francophone cultures. They foster an appreciation for complexity through the study of particular historical periods, issues, and disciplinary methods.

Students have the opportunity to experiment or tailor the program to suit their particular interests. When designing their program, students select five courses from a list of suggested courses in the following disciplines. Students should note the prerequisites for the courses they choose. Courses with the note “French content” should be cleared with the French studies advisor before registration.

Anthropology
ANTH 322 Living Africa
ANTH 337 Comparative Medical Systems
ANTH 356 Mediterranean Culture and Society
ANTH 399 Independent Study (French content)

Art History
ARTH 240 Introduction to Medieval Art
ARTH 260 Art in the Age of Grandeur
ARTH 280 Modern Art and Modern Science
ARTH 284 History of Photography
ARTH 367 Seventeenth- and Eighteenth-Century French Art
ARTH 374 Impressionism to Symbolism
ARTH 379 Issues in Nineteenth-Century Painting (French content)
ARTH 381 Neoclassicism to Realism
ARTH 392 Issues in Twentieth-Century Art (French content)
ARTH 398 Independent Study (French content)

Comparative Literature
CMPL 211 Great Books: Middle Ages to 1600
CMPL 212 Great Books: 1600 to Present
CMPL 229 Theater History II (also THTR 229)
CMPL 371 Philosophy and Literature (also PHIL 370) (French content)
CMPL 275 Postcolonial Francophone Literature
CMPL 290 Masterpieces of Continental Fiction (also ENGL 290)
CMPL 291 Masterpieces of Modern Fiction (also ENGL 291)
CMPL 300 Turning Points of Modern Culture (French content)
CMPL 368A Introduction to Film Studies (also ENGL 368A)
CMPL 368C Topics in Film (also ENGL 368C) (French content)
CMPL 390 Topics in Comparative Literature (French content)
CMPL 399 Independent Study (French content)

Economics
ECON 372 International Finance
ECON 373 International Trade
ECON 375 Economics of Developing Countries
English
ENGL 290 Masterpieces of Continental Fiction (also CMPL 290)
ENGL 291 Masterpieces of Modern Fiction (also CMPL 291)
ENGL 301 Linguistic Analysis (French content)
ENGL 368A Introduction to Film Studies (also CMPL 368A)
ENGL 368B History of the Film (French content)
ENGL 368C Topics in Film (also CMPL 368C) (French content)
ENGL 379 Topics in Language Studies (when taught as Semiotics)
ENGL 387 Literary and Critical Theory

History
HSTY 151 Technology in European Civilization
HSTY 201/202 Science in Western Thought
HSTY 212 Modern European History
HSTY 215 Europe in the Twentieth Century
HSTY 220 The Early Modern Mediterranean
HSTY 250 Issues and Methods in History (French content)
HSTY 268 Colonialism in Africa
HSTY 309 Reformation Europe, 1500-1650 (also RLGN 374)
HSTY 310 The French Revolutionary Era
HSTY 313 Women in Modern European History
HSTY 315 Heresy and Dissidence in the Middle Ages (also RLGN 315)
HSTY 321 Colonialism, Sex, Race, and Gender (French content)
HSTY 323 European Diplomacy in the Age of Nationalism: 1789-1945
HSTY 348 Political and Social Thought in the Machine Age (also POSC 348)
HSTY 397 Undergraduate Tutorial (French content)

International Studies
INTL 396 International Independent Study (French content)

Music
MUSC 321 History of Western Music I
MUSC 322 History of Western Music II
MUSC 336 History of Western Music III

Philosophy
PHIL 302 Modern Philosophy
PHIL 315 Selected Topics in Philosophy (French content)
PHIL 325 Philosophy of Feminism (French content)
PHIL 370 Philosophy and Literature (also CMPL 371) (French content)
PHIL 399 Directed Study (French content)

Political Science
POSC 326 Comparative Constitutions
POSC 348 Political and Social Thought in the Machine Age (also HSTY 348)
POSC 351 Modern Political Thought (French content)
POSC 366 Government and Politics of Africa
POSC 367 Western European Political Systems
POSC 370A Political Economy
POSC 374 Politics of Development in the Global South
POSC 395 Special Projects (French content)

Religion
RLGN 315 Heresy and Dissidence in the Middle Ages (also HSTY 315)
RLGN 374 Reformation Europe, 1500-1650 (also HSTY 309)
RLGN 392 Independent Study (French content)

Theater
THTR 229 Theater History II
THTR 329 Dramatic Literature (French content)
THTR 399 Independent Study (French content)

Courses offered in a given semester with a French studies component are posted in Guilford House at registration time and on the French studies website.

IV. Senior Colloquium (3)
In the last semester of the senior year, the student’s experiences in French area courses as well as in courses in other disciplines are integrated in a colloquium (FRCH Studies Colloquium) which involves the writing of a substantial research paper in French or English. A faculty director will approve the selection of the topic, facilitate discussion of research with other faculty and students through periodic colloquia, and direct the research and writing of individual papers. Students will be expected to identify their faculty directors and topics by the end of the fall semester of senior year. Exceptional papers will be considered for honors.

Language Requirement
All 300-level FRCH courses are taught in French. FRCH 201 or equivalent is a prerequisite for Foundations in French History and Culture courses.

Study Abroad
Study abroad in France, Belgium, Switzerland, French Canada or a Francophone African or Middle Eastern country is strongly encouraged but not required for French Studies majors. The Department of Modern Languages and Literatures offers a summer study abroad program in Bordeaux, France (FRCH 308).

Teacher Licensure Option
Students participating in the teacher licensure program complete a 45-47 semester hour major in French, including course work in French language, culture, and literature, and a 35 hour sequence in professional education. Course work in French begins in the freshman year with a language course appropriate to the student’s proficiency level and continues until the student has completed a range of upper-level courses and has met the goals of the program. Students are strongly urged to complete some of their course work in a French-speaking country and are assisted in identifying opportunities for study abroad. Interested students should contact Professor Marie Lathers. The professional education component (see Education [EDUC & EDJC] for overview and course requirements) begins with a sequence taken on campus, followed by 23 semester hours at John Carroll University, culminating in the student teaching requirements.

Subject Area Requirements (select from):
*Required only for students who begin their French Major at the Intermediate Level.
**Students at the Intermediate (200) Level select five courses (15 credit hours); students entering the program at the Advanced (300) Level select seven courses (21 credit hours).

Minor And Sequence Requirements
The minor in French studies requires at least one course from among FRCH 316, FRCH 318, FRCH 319, or HSTY 310; four additional 300-level courses on the list of French studies courses from any two departments, or a thematic course of study (12 hours) approved in advance by the director of the French studies program.

The sequence in French studies consists of one of the following courses: FRCH 316, FRCH 318, FRCH 319, or HSTY 310; and two additional 300-level courses.
Department of Geological Sciences

112 A.W. Smith Building
Phone 216-368-3690; Fax 216-368-3691
Gerald Matisoff, Chair

The geological sciences encompass a wide range of inquiries into the physical, chemical, and biological processes that shape the earth and the planets. Application of these inquiries to understanding a planet’s evolution through time is a unique attribute of geological investigations. Knowledge of the past and present reveals the constraints of our environment and serves as a guide for the future. In recent years major advances have been made in the understanding of plate tectonics, properties of the earth’s interior, the nature of surface and near-surface processes, the history of the earth’s climate, the ecology of living and ancient organisms, and the comparative geology of other planets. Geologic knowledge is fundamental to resource conservation, land use planning, environmental geochemistry, hydrology, engineering construction works, and other environmental concerns.

The Department of Geological Sciences offers degree programs leading to the B.A. and B.S. in geological sciences, B.A. in environmental geology, Master of Science (M.S.), and Doctor of Philosophy (Ph.D.).

Faculty

Gerald Matisoff, Ph.D. (Johns Hopkins University)
Professor and Chair
Sedimentary and environmental geochemistry

Ralph P. Harvey, Ph.D. (University of Pittsburgh)
Assistant Professor
Planetary geology

Peter L. McCall, Ph.D. (Yale University)
Professor; Director, Environmental Studies Program
Benthic ecology, paleoecology

Samuel M. Savin, Ph.D. (California Institute of Technology)
Professor; Dean, College of Arts and Sciences
Geochronology, igneous petrology

Beverly Z. Saylor, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor
Sedimentary geology

James A. Van Orman, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor
Geology

Peter J. Whiting, Ph.D. (University of California, Berkeley)
Associate Professor
Geomorphology and environmental geology

Adjunct Faculty

James Aronson, Ph.D. (California Institute of Technology)
Adjunct Professor
Geochronology, igneous petrology

Enriqueta Barrera, Ph.D. (Case Western Reserve University)
Adjunct Associate Professor
Geochronology, paleoclimate

Roger Burtner, Ph.D. (Harvard University)
Adjunct Professor
Aqueous geochemistry, clastic petrology

Joseph T. Hannibal, Ph.D. (Kent State University)
Adjunct Assistant Professor; Cleveland Museum of Natural History
Invertebrate paleontology

Michael Ketterer, Ph.D. (University of Colorado)
Adjunct Assistant Professor; Northern Arizona University
Analytical chemistry

Undergraduate Programs

Major Programs

Students in the geological sciences obtain a solid background in basic science and mathematics as well as intensive training in the major. In addition, because of the wide variety of ways in which geologic knowledge can be applied, all students are encouraged to take electives in subjects appropriate to their personal objectives, which may be as diverse as the engineering applications of geology or the socioeconomic and legal systems bearing on environmental issues. The undergraduate programs stress practical experience and field work as well as classroom study. The environmental geology major combines courses in geological sciences with courses in basic and applied sciences to provide students with an understanding of environmental problems, with employable skills, and with a background for graduate study or professional school. All students participate in a three-semester Senior Project sequence in which they propose a research project, conduct the research, write a thesis, and present it to the Department.

Geological Sciences Major

The minimum requirements set by the department include 8 hours each of chemistry, physics, and calculus, plus any one of GEO 101, 110, and 115, plus GEO 119, 210, 301, 315, 317, 341, 344, 360, 390, 391, and 392. GEO 360 provides comprehensive field training in the summer between the junior and senior years (this course necessitates transfer credit, which must be approved by the department).

Environmental Geology Major

The minimum requirements set by the department include 8 hours each of chemistry and calculus, plus BIOL 110, ESTD 101, PHYS 115, and STAT 201, plus GEO 110, 119, 210, 220, 303, 305, 317, 321, 390, 391, and 392.

In the above majors, the student and his or her advisor will design the remainder of the curriculum based on individual interests, consonant with departmental and college requirements. An integrated undergraduate-graduate program leading to a master’s degree in five years is available. Special programs, such as interdisciplinary majors, also may be arranged.

Minor in Geological Sciences

Students may complete a minor in geological sciences by taking up to three of GEO 101, 110, 115, and 117, plus GEO 119 and sufficient upper level GEO courses to total 15 hours.

Graduate Programs

Graduate programs leading to the Master of Science and Doctor of Philosophy degrees are offered. Both programs are flexible so as to meet the needs of the individual student. General areas of study include aquatic systems, aquatic and groundwater chemistry, environmental geochemistry, benthic ecology, biostratigraphy and paleontology, environmental and urban geology, geomorphology,
limitology, paleoclimatology, petrology, sedimentary geochemistry, sedimentation and stratigraphy, stable isotope studies, meteoritics, and planetary geology. More specific information will be furnished upon request by the departmental office and the Office of Admission of the School of Graduate Studies.

Facilities

The department is housed in the Albert W. Smith Building. Research facilities include thin sectioning and mineral separation facilities; laboratories for chemical analysis of water including an ion chromatograph, colorimetric spectrometer, electrochemistry, and an environmental glove box; alpha and gamma spectroscopic facilities for analysis of environmental nuclides; equipment for studying animal-sediment relations, including a scanning gamma spectrometer; scanning electron microscope; electron microprobe; and two double collecting gas source mass spectrometers and extraction equipment for stable isotope studies; and chemical reactors for high-temperature and high-pressure geochemical experiments. Also housed in the department are laboratories for

Bachelor of Arts Degree
Major in Geological Sciences*

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<tr>
<th>Freshman Year</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>CHEM 105, Principles of Chemistry I ................. (3)</td>
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<td>or equivalent</td>
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* Suggested outline only. Program is finalized in consultation with the departmental advisor.

a. GEOL 101 or 115 may be substituted for GEOL 110.
b. GEOL 210 is offered even-numbered years.
c. GEOL 301 (3 credits) is offered even-numbered years, GEOL 341 (4 credits) odd-numbered years.
d. GEOL 315 (3 credits) is offered odd-numbered years, GEOL 344 (4 credits) even-numbered years.
e. GEOL 317 (3 credits) is offered odd –numbered years

Minor in Geological Sciences

Up to three courses from GEOL 101, 110, 115, and 117, plus GEOL 119 and sufficient upper level GEOL courses to total at least 15 hours.
paleontological and micropaleontological investigations and for work in ecology and sedimentology. A well-field owned by the University is available for groundwater sampling and analysis. The department also contains a wide range of other equipment such as reflected and transmitted light microscopes, fluid inclusion microscope, cathodoluminescence microscope, submicron and clay-silt-sand particle size analyzers, high magnetic field mineral separator, X-ray diffractometer, and field equipment for groundwater and geophysical work including resistivity meter, seismic refraction instrument, ground conductivity meter, magnetometer, and gravimeter.

**Bachelor of Science in Geological Sciences Degree**

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<td>CHEM 105, Principles of Chemistry I (3)</td>
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<td>ECES 131, Elementary Computer Programming (3)</td>
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<td>CHEM 106, Principles of Chemistry II (3)</td>
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<td>Elective (3)</td>
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* Suggested outline only. Program is finalized in consultation with the departmental advisor.

a. Another computer programming course may be substituted for ECES 131.
b. GEOL 101 or 115 may be substituted for GEOL 110.
c. GEOL 210 is offered even-numbered years.
d. GEOL 301 (3 credits) is offered even-numbered years, GEOL 341 (4 credits) odd-numbered years.
e. Upper level Science course must be in a discipline other than geology.
f. GEOL 315 (3 credits) is offered odd-numbered years, GEOL 344 (4 credits) even-numbered years.
g. GEOL 317 is offered odd-numbered years.
Geological Sciences (GEOL)

Undergraduate Courses

GEOL 101. The Earth and Planets (3)
An examination of the geological processes that have shaped the planets and moons of the inner solar system, focusing on those with relevance to our own planet Earth. Following an introduction to the fundamentals of planetary geology, lectures and exercises will explore how the inner planets (the asteroids, Mercury, Venus, Earth, the Moon, and Mars) exhibit the effects of planetary differentiation, impact cratering, volcanic activity, tectonics, climate, and interactions with life.

Bachelor of Arts Degree
Major in Environmental Geology*

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<td>ESTD 101, Introduction to Environmental Thinking .................. (3)</td>
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<td>MATH 125, Calculus I ................................................................. (4)</td>
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<td>GEOL 303, Environment and Law .................................................. (3)</td>
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<td>STAT 201, Basic Statistics for Social and Life Sciences ............... (3)</td>
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<td>or</td>
<td>Elective ................................................................. (3)</td>
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a. GEOL 210, 305, and 317 are offered even-numbered years.
b. GEOL 303 or 317 and 322 are offered odd-numbered years.
c. GEOL 202 (offered in Fall of even-numbered years) may be substituted for GEOL 303.
GEOL 115. Introduction to Oceanography (3)
The sciences of oceanography. Physical, chemical, biologic, and geologic features and processes of the oceans. Differences and similarities between the oceans and large lakes including the Great Lakes. Required: Sunday field trip.

GEOL 117. Weather and Climate (3)
Introduction to the study of weather and climate. Covers the basics of meteorology, climate zones, the hydrologic cycle, and weather prediction. Lectures address timely topics including greenhouse warming, past global climates, and recent advances in meteorology.

GEOL 119. Geology Laboratory (1)
Principles and techniques common to the geological sciences including rock and mineral identification, map interpretation, land form analysis, application of geological information to engineering works, and more. One three-hour laboratory or field trip weekly. Prereq: GEOL 110.

GEOL 196. Energy and Society (3)
(See PHYS 196.) Cross-listed as PHYS 196.

GEOL 202. Global Environmental Problems (3)
Science, policy and ethics of environmental problems that affect the entire planet. Examination of problems of current interest, such as population growth, climate change, ozone depletion, and fisheries, from a variety of viewpoints. Construction of simple computer models of a global process using Stella II. No previous computer experience or knowledge of numerical methods is required.

GEOL 210. Historical Geology/Paleontology (3)
History of life as recorded in sedimentary rocks. Case histories of important basins of deposition; the interrelationships of paleogeography, plate tectonics, and evolution. Two lectures and one laboratory weekly.

GEOL 220. Environmental Geology (3)

GEOL 225. Evolution (3)
(See PHIL 225.) Cross-listed as PHIL 225.

GEOL 301. Stratigraphy and Sedimentation (3)
Formation, distribution, and composition of sediments and sedimentary rocks. Modern depositional environments and their ancient analogues; principles of stratigraphic and biostratigraphic correlation. Two lectures and one laboratory per week.

GEOL 303. Environmental Law (3)
Problems in the environmental geosciences and the legal response. Types of pollution regulation, regulation of petroleum and coal exploration and development, water rights, wildlife and public lands management, common law remedies, and the role of scientific experts. Topics of current social interest.

GEOL 305. Geomorphology and Remote Sensing (3)
Recognition and interpretation of land forms and their significance in revealing present and past geologic processes. Introduction to acquisition and analysis of data through aerial photography and satellite imagery. Two lectures and one laboratory weekly. Prereq: GEOL 110 and GEOL 119.

GEOL 307. Evolutionary Biology and Paleobiology of Invertebrates (3)
Important events in the evolution of invertebrate life; structure, function, and phylogeny of major invertebrate groups.

GEOL 314. Economic Geology (3)

GEOL 315. Structural Geology (3)
Geometrical characteristics and theoretical analysis of deformation in earth materials, with illustrations of deformational styles in various tectonic settings. Two lectures and one laboratory weekly. Prereq: GEOL 110.

GEOL 317. Introduction to Field Methods (3)
Practice in field procedures, recognition and testing of hypotheses in the field, field mapping and analysis of sedimentary, igneous, and metamorphic rocks in deformed and tectonically active settings. Weekly meeting plus spring break field trip. Students required to pay partial cost of meals, lodging, and travel. Prereq: GEOL 119.

GEOL 318. Topics in Field Methods (3)
Field analysis of geological and environmental problems. Topics and locations will vary. Requires preparatory meetings and week-long field trip, usually during spring break. Students required to pay partial cost of meals, lodging, and travel. Prereq: GEOL 119 or permission of instructor.

GEOL 321. Hydrogeology (3)
Basic and applied concepts pertaining to the occurrence and movement of groundwater. Definitions, basic equations, applications to a variety of geologic settings, wells. Requires one Saturday field trip to make field measurements, collect and analyze data, and prepare a report.

GEOL 330. Geophysical Field Methods and Laboratory (4)
Use of seismic refraction and reflection, gravity, electrical, magnetic, and electromagnetic methods to infer the earth’s structure and composition. Application of inverse theory to estimate model parameters. Requires students to make field measurements, analyze data, and prepare a report. Three lectures and one three-hour laboratory weekly.

GEOL 331. Geophysical Field Methods (3)
Same as GEOL 330 but without laboratory and field report.

GEOL 336. Aquatic Chemistry (4)
Chemical equilibria occurring in natural waters. Quantitative methods of describing acid-base, metal ion/ligand, precipitation/dissolution, and oxidation/reduction reactions. Geochemical cycling of trace metals and nutrients.

GEOL 341. Mineralogy (4)
Crystallography, hand specimen mineralogy and petrology, principles of crystal structure and crystal chemistry, and an introduction to the petrographic microscope. Three lectures and one three-hour laboratory weekly. Prereq: GEOL 119.

GEOL 344. Igneous and Metamorphic Petrology (4)
Composition, classification, and genesis of igneous and metamorphic rocks, emphasizing physical and chemical principles governing their origin. Laboratory study of rocks in thin section. Two lectures and two three-hour laboratories weekly. Prereq: GEOL 341.

GEOL 345. Planetary Materials (1-3)
An introduction to the materials that make up the solid matter of the solar system. Student presentations will review our current understanding of accessible primitive materials such as meteorites, cosmic dust, lunar and ancient terrestrial rocks, and their relationship to modern natural materials and solar system processes.

GEOL 349. Geological Problems (1-3)
Special work arranged according to the qualifications of the student.

GEOL 352. Environmental Geochemistry (3)
The role of geochemistry in environmental problems. Basic principles and engineering techniques applied to local, regional and global problems such as acid mine drainage, landfills, septic tanks, leaky underground storage tanks, soil and groundwater contamination, hazardous waste remediation, nuclear wastes, water and wastewater treatment; smog, lake eutrophication, radon, oil spills, global warming, ozone depletion. Prereq: CHEM 106.

GEOL 360. Summer Field Camp (6)
Six-week course in geologic field methods and mapping. Not offered at Case Western Reserve; must be taken at another college or university. Credits will be transferred.

GEOL 390. Introduction to Geological Research (2)
Examination of factors in the selection, design, and conduct of research projects and in the analysis and interpretation of research results. Consideration of ethical issues in scientific research. Practice in proposal writing and oral presentation. Consultations with department faculty in preparation for individual Senior Project proposals.
and ancient terrestrial rocks, and their relationship to modern natural materials. Student presentations will review our current understanding of the rock record.

**GEOL 403. Clay Mineralogy (3)**

**GEOL 405. Geomorphology and Remote Sensing (3)**
Recognition and interpretation of land forms and their significance in revealing present and past geologic processes. Introduction to acquisition and analysis of data through aerial photography and satellite imagery. Two lectures and one laboratory weekly. Prereq: GEOL 110 and GEOL 119.

**GEOL 414. Economic Geology (3)**

**GEOL 416. Animal-Sediment Relations (3)**
Distribution, community structure, and adaptive strategies of marine and freshwater benthos; animal-sediment relations and the influence of benthic animals on chemical and physical properties of the sea floor. Prereq: GEOL 307 and BIOL 336.

**GEOL 421. Hydrogeology (3)**
(See GEOL 321.)

**GEOL 425. Geotectonics (3)**
Interpretation of the major crustal features of the earth in terms of plate tectonics and associated phenomena.

**GEOL 436. Aquatic Chemistry (4)**
Chemical equilibria occurring in natural waters. Quantitative methods of describing acid-base, metal ion/ligand, precipitation/dissolution, and oxidation/reduction reactions. Geochemical cycling of trace metals and nutrients.

**GEOL 437. Chemistry of Natural Waters (3)**
Advanced topics in aquatic chemistry. Thermodynamics models for ion/ligand speciation in natural waters; origin and composition of seawater, chemical and mineralogical sequence during evaporation, chemical weathering, groundwater and river water chemistry, chemical cycling, and a global mass balances; perturbations on natural systems by man. Predictive capabilities of box models.

**GEOL 444. Flow and Sediment Transport (3)**
This course focuses on open channel flow and sediment transport mechanics. A mathematical framework for the description of free surface flow and various modes of particle transport is built. This framework is used in discussions of geomorphic and sedimentologic processes and features. Specific topics covered include dimensional analysis, forces on settling particles, fluid flow, initiation of particle movement, bedload and suspended load transport and their calculation, and channel form.

**GEOL 445. Planetary Materials (1-3)**
An introduction to the materials that make up the solid matter of the solar system. Student presentations will review our current understanding of accessible primitive materials such as meteorites, cosmic dust, lunar and ancient terrestrial rocks, and their relationship to modern natural materials and solar system processes.

**GEOL 455. Isotope Geochemistry (3)**
Principles and applications of naturally occurring variations of isotopic abundances in geologic, hydrologic, and biologic systems. Includes consideration of radioactive and radiogenic isotopes and their use in geochronology and as tracers; consideration of isotopic fractionations (especially of light stable isotopes), their thermodynamic and kinetic causes, and their use in understanding mechanisms and conditions of geologic processes and as tracers. Prereq: Consent of department.

**GEOL 494. Seminar in Evolutionary Biology (3)**
(See PHIL 394.) Cross-listed as PHIL 394.

**GEOL 503. Seminar: Geomorphology/Glacial Geology (1)**

**GEOL 504. Seminar: Geochemistry (1)**

**GEOL 509. Seminar: Graduate Research (1)**

**GEOL 511. Special Readings in Geology (1-6)**
Detailed study of a selected topic in geology under the guidance of a faculty member.

**GEOL 512. Special Readings in Geology (1-6)**
Detailed study of a selected topic in geology under the guidance of a faculty member.

**GEOL 536. Seminar in Great Lakes Issues (1-3)**
Selected topics related to Great Lakes basin studies: research problems, scientific processes, classic research papers, current events, policy issues, and legislative initiatives. Course content will vary depending on interests of students and faculty. Cross-listed as BIOL 536.

**GEOL 601. Special Problems and Research (1-18)**
(Credit as arranged.)

**GEOL 651. Thesis M.S. (1-18)**
(Credit as arranged.)

**GEOL 701. Dissertation Ph.D. (1-18)**
(Credit as arranged.)

**GEOL 702. Appointed Dissertation Fellow (9)**

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**German Studies Program**

**Max Kade Center for German Studies**
112 Clark Hall
Phone 216-368-4144
Kenneth F. Ledford, Director

**German Studies Program Committee**

Kenneth F. Ledford
Associate Professor of History and Law, and Director, Max Kade Center for German Studies

David Benseler
Assistant Professor of Modern Languages

Margaretmary Daley
Associate Professor of German

Martin Helze
Assistant Professor of Classics

Jutta Ittner
Assistant Professor of German

Vincent E. McHale
Professor of Political Science

Alan J. Rocke
Henry Eldridge Bourne Professor of History

Peter Jianhua Yang
Associate Professor of German

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**The German Studies Program**
In its reconstituted form, Germany has again become a major player in European and global affairs. Germany has always been considered important to European development—at various times it has been called the crossroads of the entire continent—but the
economic might of modern Germany and the integration of the European Union have now made American understanding of German culture and civilization, of German contributions to the development of western civilization, more important to—and worthy of study by—American students than at any other time since 1945.

Based on the premise that understanding is beneficial to the citizens of both nations in a variety of ways, Case Western Reserve University has responded to Americans’ need for preparation for the challenges of the 21st century by establishing the German Studies Program, an integrated program of study leading to the B.A. degree. The German Studies Program prepares students for life-long learning, enables and encourages them to pursue a course of study that helps prepare them for a career in international business, for study toward a graduate degree in a variety of disciplines, or for future study in professional programs such as law, business administration, and others.

The German studies major differs from the traditional German language and literature major by the breadth of its offerings. A German studies major encourages students to study in several disciplines from a generous selection of approved courses in the humanities, arts, social sciences, and economics. A Graduate of the German Studies Program is expected: to be prepared for lifelong learning; to be knowledgeable about and conversant in German contributions to western culture in such areas as literature, film, philosophy, and music; to be proficient in the German language; to understand and be able to discuss German history, government, attitudes about religion; and to use all of the above as the mark of an educated person in pursuit of a career in business or in study toward a graduate or professional degree.

Facilities available to students in the German Studies Program include the many printed and other resources available in the Max Kade Reading Room, Clark Hall Room 113.

Requirements for the Major in German Studies

Thirty hours from the list of approved German studies courses, including German 303 and 304, German Studies 398 (Senior Colloquium), and 21 additional hours from the approved list, no more than 9 of which may be in any one department.

Sample Concentrations for the German Studies Major

History and philosophy; German literature and theater history; political science and history; art history, music history, and religion; etc. Note that the above combinations are examples only. Within program requirements, students are free to shape the major as they wish based on their own intellectual interests.

Requirements for a Minor in German Studies

At least one of German 303 or 304; four additional 300-level courses on the approved list of German studies courses from any two departments; or a thematic course of study (12 hours) approved in advance by the director of the German Studies Program.

Approved German Studies Courses

(Complete course descriptions are given under the appropriate departmental listings in this General Bulletin.

Art History Courses (Prerequisite: None)

ARTH 374 Impressionism to Symbolism
ARTH 381 Neoclassicism through Realism

ARTH 382 Twentieth-Century European Painting and Sculpture
ARTH 399 Independent Studies

Comparative Literature Courses (Prerequisite: None)

CMPL 190 Introduction to Comparative Literature
CMPL 300 Turning Points in Modern Culture
CMPL 399 Independent Studies

Economics Courses (Prerequisite: ECON 102; 103)

ECON 335 Comparative Economic Systems
ECON 374 International Economics
ECON 399 Independent Studies

English Courses

ENGL 366K Feminist Theory
ENGL 368A Introduction to the Film
ENGL 368B International Cinema since 1940
ENGL 368M History of Cinema to 1940
ENGL 390 Independent Study & Creative Projects

German Language & Literature Courses (Prerequisite: GRMN 202)

GRMN 302 Advanced Written and Spoken German
GRMN 303 Studies in German Civilization I
GRMN 304 Studies in German Civilization II
GRMN 311 Advanced Conversation
GRMN 313 Introduction to German Literature
GRMN 330 The German Novella
GRMN 365 Literature of Enlightenment/Storm & Stress
GRMN 366 From Lessing to Young Goethe
GRMN 367 German Classicism/Romanticism
GRMN 375 19th-Century Literature
GRMN 380 20th-Century Literature I
GRMN 386 20th-Century Literature II
GRMN 395 Special Topics in German Literature
GRMN 399 Independent Studies

German Studies Course (Prerequisite: Senior Status in GRST)

GRST 398 Senior Colloquium

History Courses (Prerequisite: None)

HSTY 309 Reformation Europe
HSTY 313 Women in Modern European History
HSTY 334 History of Nineteenth-Century Germany
HSTY 335 History of Twentieth-Century Germany
HSTY 397 Independent Studies

Music History Courses (Prerequisite: MUSC 221 is prerequisite for MUSC 222; consent of instructor required for all 300-level courses)

MUSC 221 Intro to Music: The Listening Experience I [if student has no significant musical background]
MUSC 222 Intro to Music: The Listening Experience II
MUSC 322 History of Western Music II
MUSC 326 Symphonic Literature
MUSC 327 Vocal Literature
MUSC 399 Independent Studies

Philosophy Courses (Prerequisite: PHIL 101)

PHIL 355 Nineteenth and Twentieth-Century Philosophy
PHIL 358 The Frankfurt School
PHIL 399 Independent Studies

Political Science Courses (Prerequisite: None)

POSC 260 Introduction to Comparative Politics
POSC 367 Western Political Systems
POSC 399 Independent Studies

Religion Courses (Prerequisite: None)

RLGN 254 The Holocaust
RLGN 314/414 Jews and Christians in Germany
RLGN 331/431 German-Jewish Thought & History
Gerontological Studies

226 Mather Memorial
Phone 216-368-2700; Fax 216-368-2676
Eva Kahana, Ph.D., Director

The gerontological studies program is a multi-disciplinary program designed to integrate research and theory about aging and old age. Prompted in part by the “graying” of the world’s population, humanists, scientists, social scientists, and professionals have become interested in understanding the position of the aged in society, the aging process in various contexts, the meaning of aging to individuals, and the physical changes that accompany aging. The program draws on the most recent thinking and research in a variety of disciplines to provide students with a background that will be helpful after graduation both in work and in graduate or professional school.

In keeping with the interdisciplinary nature of the program, the core courses are drawn from five departments: anthropology, communication sciences, history, psychology, and sociology. Students may choose from a variety of courses according to their own interests. Most of the electives are not specifically gerontological courses but cover topics that contribute to the understanding of aging and the aged. The perspectives gained in the core courses will provide the student with the background needed to relate the material in the more general courses to gerontological issues. The program is firmly grounded in the liberal arts and thus provides the student with the challenge to think and communicate effectively and to integrate diverse information, theories, and practice. Gerontological studies is an appropriate major or minor for students with a wide variety of career goals. The aging of the population has made available entry-level positions for persons with baccalaureate degrees in organizations that provide services for students with a wide variety of career goals. The aging of the population has made available entry-level positions for persons with baccalaureate degrees in organizations that provide services to and formulate policy for the elderly. Many graduate programs now include an emphasis on aging for which a degree in gerontological studies would serve as a useful background. Students planning to pursue professional degrees will find that an increasing number of their clients or patients will be older adults and that problems with which they must deal will be related to the aged. The perspective provided by participating in the Gerontological Studies Program will provide students with excellent background in working with older populations. This background is particularly important for students who plan to pursue careers in human services, business, law, medicine, academics, or the sciences.

Current Areas of Research

Faculty members associated with the program are engaged in a variety of funded research projects which include studies of: Alzheimer’s disease; cancer survivorship; patterns of care for the urban elderly in China; visual perception changes that accompany aging; the impact of high levels of physical activity on the biological aging process; grandparent-grandchild relationships; and stress, coping, and adaptation among urban community and institutionalized elderly.

Program Faculty

Eva Kahana, Ph.D. (University of Chicago)
Pierce T. and Elizabeth D. Robson Professor of Humanities and Chair, Sociology; Director, Elderly Care Research Center Sociology of aging; coping and stress in late life; institutionalization

Cynthia Beall, Ph.D. (Pennsylvania State University)
Sarah Idell Pyle Professor, Anthropology Physical anthropology; human growth and development; human and medical ecology; biology of aging; Andes; Himalayas

Robert Binstock, Ph.D. (Harvard University)
Henry R. Luce Professor, School of Medicine Public policy and aging; Health care policy

Gary T. Deimling, Ph.D. (Bowling Green State University)
Professor, Sociology
Sociological of aging; medical sociology; family sociology

Atwood Gaines, Ph.D. (University of California, Berkeley), M.P.H. (University of California, Berkeley, School of Public Health)
Professor, Anthropology
Medical and psychiatric anthropology; cultural anthropology; religion, urban

Grover C. Gilmore, Ph.D. (Johns Hopkins University)
Professor, Psychology
Perceptual development and aging; visual information processing; memory; psychophysics

Melvyn Goldstein, Ph.D. (University of Washington)
John Reynolds Harkness Professor, Anthropology
Social anthropology; population-medical anthropology; aging; cultural ecology; development; Nepal; Tibet; India

Robert Binstock, Ph.D. (Northwestern University)
Assistant Professor, Sociology
Sociology of law; political sociology, comparative sociology, health care policy

Charlotte Ikels, Ph.D. (University of Hawaii)
Professor, Anthropology
Gerontology; ethnicity; Chinese and overseas Chinese; life cycle; Hong Kong, China, United States

Kyle Kercher, Ph.D. (University of Washington)
Associate Professor, Sociology
Methodology; statistics; sociology of aging; criminology

Richard Settersten, Ph.D. (Northwestern University)
Associate Professor, Sociology
Sociology of aging; social theory; life course

Eleanor Stoller, Ph.D. (Washington University)
Selah Chamberlain Professor, Sociology
Medical sociology; Sociology of aging

Milton Strauss, Ph.D. (Harvard University)
Professor, Psychology
Adult psychopathology; schizophrenia; mental disorders of aging

Kurt Stange, M.D., Ph.D. (University of North Carolina School of Public Health)
Professor of Family Medicine, School of Medicine"Epidemiology; preventive health care; biostatistics; health services research; disability prevention in the elderly

May L. Wykle, Ph.D., R.N., F.A.A.N. (Case Western Reserve University)
Florence Cellar Professor and Dean, School of Nursing; Director, University Center on Aging and Health
Health and mental health; caregiving in minority populations

Undergraduate Programs

Major

The gerontological studies program offers a major that leads to the Bachelor of Arts degree. However, it may be selected only as a second major, the first major being in a traditional academic department. The major consists of a minimum of 30 credits; 15 are in required courses and 15 are in approved elective courses. The required courses are:

ANTH 374 (same as HSTY 309)
RLGN 399 Independent Studies

Theater History Courses (Prerequisite: None)

THTR 228 Theater History I
THTR 229 Theater History II
THTR 399 Independent Studies in Theater Arts
The University Center on Aging and Health sponsors a certificate program in gerontology. The program is open to students enrolled in the graduate certificate program in gerontology. A student interested in a graduate certificate in gerontology must be enrolled in a master’s or doctoral program, or be a special non-degree student with at least a master’s degree (or equivalent). To receive a certificate in gerontology, a student must submit a formal application, be approved by the University Center on Aging and Health, and take 12 credit hours of course work. The student must complete the following courses:

1. Two three credit hour courses in gerontology within the student’s discipline, one of which can be an independent study.
2. One three credit hour course in gerontology or independent study outside the student’s discipline.
3. A three credit hour seminar in gerontology offered by the center.

For further information, contact the University Center on Aging and Health at the address listed above. Any changes in the requirements must be approved by the center director.

## Department of History

106 Mather House
Phone 216-368-2380; Fax 216-368-4681
Carroll Pursell, Chair

The Department of History offers comprehensive undergraduate and graduate programs in American history; the history of science, technology, environment and medicine; social history and policy; and the history of law. Historical studies are sometimes categorized among humanistic studies and sometimes among the social sciences. Allied with both traditions, historians seek an understanding of the past by analyzing societies and how they change over time. The Department of History offers instruction within the cultural, political, and economic frameworks that have formed the customary basis of historical studies, and it also has developed special emphases in social, cultural, political, and economic perspectives that allow instruction and research on such topics as the African-American experience, the environment, business and economy, technology and science, medicine, the environment, women’s history and gender studies, legal history and comparative social history. Courses in history, or a formal major or minor in history, traditionally have been attractive to students as preparation for a wide variety of career and professional interests, including teaching, law, government, journalism, and such public history activities as archival administration, historical museum administration, restoration and preservation of historic sites, and writing.

## Faculty

Carroll W. Pursell, Ph.D. (University of California, Berkeley)
Adeline Barry Davee Distinguished Professor and Chair
History of technology; U.S. science and technology policy

Molly W. Berger, Ph.D.
Instructor
History of technology; United States cultural history; nineteenth and twentieth centuries

John Grabowski, Ph.D. (Case Western Reserve University)
Kreiger-Miller Associate Professor in Applied History

David C. Hammack, Ph.D. (Columbia University)
Hiram C. Haydn Professor

American social and urban history; economic history

Elisabeth Koll, D.Phil. (Oxford University)
Assistant Professor
East Asian history; Chinese economic history

Kenneth F. Ledford, Ph.D. (Johns Hopkins University), J.D. (University of North Carolina)
Associate Professor; Secondary Appointment, School of Law
Modern German history; Modern European history; European legal history; history of the professions

## Graduate Certificate Program in Gerontology

University Center on Aging and Health
1420 Frances Payne Bolton School of Nursing
Phone 216-368-2692; Fax 216-368-6389
May L. Wykle, Director

The University Center on Aging and Health is dedicated to the premise that aging is a developmental process spanning the entire life cycle, and brings together social and behavioral sciences, health sciences, and the humanities to encourage teaching and research activities in every unit of the University.

The University Center sponsors a certificate program in gerontology for graduate and professional students and for those who already hold graduate degrees.

## Undergraduate Course

**GERO 397. Special Studies in Gerontology (1-3)**
Independent study. Limited to junior and senior majors and minors.

## Graduate Courses

**GERO 496. Public Policy and Aging (3)**
(See EPRI 408.) Cross-listed as EPRI 408.

**GERO 498. Seminar in Gerontological Studies (3)**
Major themes in gerontology. Seminar members choose a problem area, explore the relevant literature from a multi-disciplinary perspective, and develop a research project using knowledge gained through community observation and library exploration.

**GERO 601. Independent Study (1-3)**
For students enrolled in the graduate certificate program in gerontology.

## Minor

The minor consists of 15 credits, including at least two of the core gerontology courses (ANTH 304, COSI 345, PSCL 369, SOCI 369 and SOCI 396), and any three of the approved electives or remaining core courses.

## Sequence

A sequence in gerontological studies consists of 9 credit hours in three courses chosen from among the following courses: ANTH 304, COSI 345, PSCL 369, SOCI 369 and SOCI 496.

## Gerontology (GERO)
A.The regular major requires a minimum of 30 hours in history, and the teacher licensure major.

Major studies, and Women's studies.

Western and Asian studies, Environmental studies, French studies, German studies, International studies, American studies, American studies, and Environmental studies.

Undergraduate Program

The department offers these basic undergraduate history programs: the history major leading to the Bachelor of Arts degree, available in two options (the regular major, and the teacher licensure major); the history minor and sequence; and the Integrated Graduate Studies Program (IGS). The department encourages student participation in the Junior Year Abroad program. Students who elect a major, a minor, or a sequence in history must consult the departmental advisor each semester for guidance in planning their schedules. In addition, the Department of History and the Department of Philosophy together offer an undergraduate major in the history and philosophy of science and technology. The History Department also participates in, and contributes courses to, American studies, Asian studies, Environmental studies, French studies, German studies, International studies, and Women's studies.

Major

The history major may be elected in one of two formats: the regular major and the teacher licensure major.

A. The regular major requires a minimum of 30 hours in history courses, including HSTY 112, HSTY 113, HSTY 250 (Issues and Methods in History), and HSTY 398 (Senior Research Seminar), as well as six additional courses in history, agreed upon in consultation with the departmental advisor.

B. The teacher licensure major requires thirty hours of history, including the same four courses required for the regular major and a minimum of six semester hours in each of three focus areas: United States history, World/European studies, and Asian, African, Latin American studies. Candidates for teacher licensure (Integrated Social Studies, Adolescents and Young Adults) must also take courses in economics, political science, and sociology (9 hours), and 36 hours in education courses offered through Case Western Reserve and John Carroll University (see Education [EDUC and EDJC]) that includes student teaching. Students interested in pursuing this option would confer with the department's undergraduate advisor, Professor Kenneth Ledford.

Subject Area Requirements (39 credit hours): HSTY 112, 113, 250, 398; two of HSTY 152, 206, 253, 255, 256, 257, 260, 262, 266, 325, 353, 354, 355, 356, 358, 378; two of HSTY 151, 200, 211, 212, 221, 222, 223, 254, 308, 309, 310, 334, 335, 342; two of HSTY 131, 135, 258, 268, 280, 281, 282, 285, 382, 383; one of ECON 102 or 103 or POSC 260; one of SOCI 112A, 112B, 113A, 113B, 302, 310. (With advisor approval, Economics requirement may be met with HSTY 255, Sociology requirement may be met with HSTY 262 or HSTY 325, and Political Science requirement may be met with HSTY 256.)

The Department of History confers commencement honors in history to majors who successfully complete HSTY 399: Senior Honors Colloquium. Participation in this spring course is by invitation only, extended in fall of the senior year based upon outstanding academic achievement.

Minors and Sequences

A minor in history is available to all undergraduate students. It consists of 15 hours in history, including 112-113 (history core courses) and three additional courses, chosen in consultation with the departmental advisor; the courses must form a coherent field of historical inquiry. A 9-hour sequence is also available to all students in the Case School of Engineering. It includes HSTY 112 or 113 (history core courses), plus two additional courses chosen in consultation with the departmental advisor; the courses must form a coherent field of historical inquiry.

Integrated Graduate Studies

The Department of History participates in the Integrated Graduate Studies program. Interested students should note the general requirements and procedures of the Graduate School, but must also consult the departmental advisor about the specific requirements, guidelines, and opportunities for IGS in history.

Advanced Placement Credit

Students with Advanced Placement (AP) scores of 4 or better will receive three semester ours of college credit, applicable to the total number of credits required for graduation as well as to any major, minor, or sequence in history. AP credit may not be applied to the HSTY 112 and 113 core courses. Credit by way of AP examination in U.S. history is given for HSTY 256: American Political History, in European history for HSTY 212: Modern European History.

Graduate Programs

The Department of History offers both the M.A. and the Ph.D. in history, but it emphasizes its two focused Ph.D. programs, in Social History and Policy and in the History of Science, Technology, Environment and Medicine. In practice, these two programs are closely related. The department also joins with the Law School to offer an M.A. in History/J.D. double-degree program. Informally, students can combine graduate study in History with the certificate or degree programs of the Mandel Center for Nonprofit Organizations. All applicants for graduate degrees in history must submit transcripts from all previous undergraduate, graduate, and professional study, scores on the GRE aptitude test or a compa-
rable standardized test, and three letters of recommendation. The department recommends, but does not require, an undergraduate major in history. The M.A. in history requires 27 hours of course work, including 6 hours of carefully supervised work on a master’s thesis (a work of original research based on primary sources), and can be completed in as few as three semesters. It is possible to earn an M.A. in African American, Asian, or European History; the strengths of the department are in U.S. and European history. For the joint J.D./M.A. program, students must be admitted to both the history graduate and law schools, and they can complete their degrees during either three or one-half years or three years and two summers of study, completing a total of 106 hours (including double credits of up to nine hours). Students are admitted into the History Department’s graduate programs with or without a master’s or professional degree. Students who do not have a master’s degree in history may be required to complete that degree in the department before moving on to the Ph.D.; those who have earned graduate or professional degrees closely related to their Ph.D. programs may petition for direct admission to the Ph.D. program. Students who first complete their M.A. in history at Case Western Reserve must complete an additional 18 hours of course work, pass the qualifying exams required by their program of study, and prepare a Ph.D. dissertation while enrolling in at least 18 hours of supervised dissertation-writing work. Students who have completed their master’s-level work before coming to Case Western Reserve must complete at least 18 hours of course work before taking their qualifying exams.

Program in Social History and Policy

The Social History and Policy Program is designed to prepare students for careers either as analysts and administrators of social policy or as teachers and researchers in colleges and universities. The program defines social policy broadly to include not only welfare, family and juvenile matters, aging, health care, and medicine, but also education, urban history, environmental history, cultural policies regarding museums, libraries and similar agencies, and labor. The program recognizes that social policies are made and put into practice by private, nonprofit organizations and through legal institutions as well as through federal, state, and local legislatures and executives. Applicants for the Social History and Policy Ph.D. program must submit scores on the GRE aptitude test and three letters of recommendation. The program does not require an M.A. in history, and has admitted several students with J.D., M.S.W., library science, and other degrees, but it often requires students with limited backgrounds in U.S. history to take extra course work. More tightly structured than the traditional Ph.D., the Social History and Policy Program requires 18 hours of course work (and possibly additional hours to prepare for examinations); qualifying examinations in U.S. history and in the history of social policy; a cognate field; and a dissertation. The program also includes an option for the student to complete a policy-related internship; recent internships have been completed with the Cleveland Federation for Community planning, the Interchurch Council of Greater Cleveland, the Bureau of Jewish Education, the Sisters of Charity of St. Augustine, and the Hathaway Brown School. The program was established in 1988; students who have completed its requirements have accepted positions at social and hospital agencies in Cleveland, at the Educational Testing Service in Princeton, at the Universities of Notre Dame, of Dayton, and Idaho; at California State University, Los Angeles, Cleveland State and Kent State universities, at the Bank Street School of Education in New York City, and at Oberlin, Beloit, and Westminster of Pennsylvania colleges.

Program in the History of Science, Technology, Environment, and Medicine

The program in the History of Science, Technology, Environment and Medicine was established in 1961 as the first in the nation to emphasize the history of technology as well as the history of science. The program’s areas of particular strength include the social and cultural history of technology, both American and European, technology and science policy, the history of the physical sciences since the Renaissance, gender issues in technology and science, the history of medicine, and the history of the environment. The course of study for the Ph.D. in the History of Science, Technology, Environment and Medicine includes the M.A. requirements, written and oral qualifying examinations, and a dissertation. While most graduates of the program teach in universities, others work in museums, archives, or deal with science policy questions. The Department of History also offers a traditional Ph.D. program in U.S. history. For this program, which does not admit students every year, an M.A. in history is strongly recommended. This program requires 18 hours of course work beyond the M.A., comprehensive oral examinations in the general field (U.S. history from the colonial period to the present), in a major field (a period or subfield of U.S. history), and in two cognate fields, at least one of which is in a field other than U.S. history.

Facilities for Historical Research at the University

Case Western Reserve University, the other institutions in the University Circle neighborhood, and the Cleveland area in general offer excellent facilities for historical research. These facilities are especially strong in the fields of Social History and Policy and the history of medicine, health care, nonprofit organizations, technology, and science. The university library’s extensive collections in these fields are significantly augmented by the holdings of the nationally-ranked Allen Memorial Library in the history of medicine and health care, and of the equally distinguished Western Reserve Historical Society in regional economic, social, nonprofit, ethnic, African-American, and Jewish history. Both the Allen Library and the Western Reserve Historical Society library are adjacent to the campus. The Cleveland Public Library, just five miles from campus in downtown Cleveland, is the third largest public library in the U.S.; it maintains excellent research collections in Ohio, U.S., and British history, technology, and business. The University has also pioneered in the development of electronic connections to other libraries and to research resources in general; Ohio’s many colleges and universities have one of the nation’s leading interlibrary loan programs.

History (HSTY)

Undergraduate Courses

HSTY 112. Introduction to American History (3)
History of the United States from the first settlements to the present. Emphasis on themes such as political and social revolution, slavery and race relations, industrialism, and national cultures.

HSTY 113. Introduction to Modern World History (3)
The history of the nineteenth and twentieth centuries in global context. Emphasis on the forces that have created or shaped the modern world: industrialization and technological change; political ideas and movements such as nationalism; European imperialism and decolonization; and the interplay of cultural values.

HSTY 117. Introduction to American Studies (3)
(See AMST 117.) Cross-listed as AMST 117.
HSTY 133. Introduction to Chinese History and Civilization (3)
This course explains the continuities and discontinuities in the history of China by stressing the development and distinctive adaptations of cultural, religious, and political patterns from the origins of the Chinese civilization to the present. By focusing on major cultural, socio-economic, and political issues such as Confucianism, Buddhism, trade relations, imperialism, and intellectual discourse in the overall Asian context (with particular reference to Korea and Japan), we discuss the historical development of China and its situation on entering the 21st century. Taking into account the key historical events in this century, we examine the emergence of China as a modern nation-state and the fundamental transformation of Chinese society in the post-war period. Cross-listed as ASIA 133.

HSTY 134. Introduction to Japanese History and Civilization (3)
This course provides an introduction to various aspects of Japanese civilization, from its origins to the present. By focusing on major cultural, socio-economic, and political issues such as the adaptation and transformation of Confucianism, Buddhism, Shintoism, social structures, material culture, foreign relations, militarism, nationalism, and intellectual discourse in the overall Asian context (with particular reference to Korea and China), we discuss the historical development of Japan and the country’s position on entering the 21st century. We examine the emergence of Japan as a modern nation-state and the fundamental transformation of its society in the post-war period. Cross-listed as ASIA 134.

HSTY 135. Introduction to Modern African History (3)
A general introduction to major themes in modern African history, with an emphasis on the nineteenth and twentieth centuries. Topics include oral tradition and narrative, economic structure and dynamics, religious movements, colonialism, nationalism, and the dilemmas of independent African states.

HSTY 151. Technology in European Civilization (3)
The history of technology in ancient Mediterranean, medieval, and modern European society until the First World War. The course introduces students to the relationship between technology and its social, political, and cultural settings, and to the values invested in technology at significant historical moments. There will be visits to local industrial sites, architectural and engineering monuments, and the Cleveland Museum of Art.

HSTY 152. Technology in America (3)
Origins and significance of technological developments in American history, from the first settlements to the present. Emphasis on the social, cultural, political, and economic significance of technology in American history.

HSTY 196. Energy and Society (3)
(See PHYS 196.) Cross-listed as PHYS 196.

HSTY 200. The Ancient World (5)
Ancient Western history from the origins of civilization in Mesopotamia to the dissolution of the Roman Empire in the West. Cross-listed as CLSC 201.

HSTY 201. Science in Western Thought I (3)
The development of Western thinking about the universe and our relation to it, as part of culture, from pre-classical civilizations to the age of Newton.

HSTY 202. Science in Western Thought II (3)
The development of Western thinking about the universe and our relation to it, as part of culture, from Newton to the modern age.

HSTY 203. Natural Philosophy (3)
(See PHIL 203.) Cross-listed as PHIL 203.

HSTY 204. Introduction to the Nonprofit Sector (3)
The United States has by far the largest and most important “nonprofit sector” in the world, a sector consisting of voluntary non-governmental organizations that provide health care, education and social services as well as arts, religious, and advocacy activities. Using mostly primary sources, this course considers the significance of the nonprofit sector in the U.S., its advantages and disadvantages, its uses for different groups of Americans, and current trends. Students have the option of writing either a standard term paper, or a study of strategic challenges facing a contemporary nonprofit organization.

HSTY 207. Natural Philosophy II (3)
(See PHIL 204.) Cross-listed as PHIL 204.

HSTY 208. Social History of Crime (3)
This course explores the relationship between law and history in American society. It uses social history methodology to suggest new ways of understanding how the law works as a system of power to advance certain interests at the expense of less powerful groups. Emphasis is on issues of pressing concern to America’s poor and working class, including the death penalty, abortion, rape, the war on drugs, and the prison industry.

HSTY 209. Women in Industrial America 1820-1930 (3)
The history of American women from 1820 to 1930, set within the context of the United States’ transformation to an industrial nation. Explores the differing perspectives that race, class, and region bring to the changing nature of women’s work, their spatial and material world, efforts at national reform, and the struggle for women’s rights.

HSTY 210. Byzantine World 300-1453 (3)
Development of the Byzantine empire from the emperor Constantine’s conversion to Christianity and founding of the eastern capital at Constantinople to the fall of Constantinople to Turkish forces in 1453. Cross-listed as CLSC 210.

HSTY 211. The Medieval World, 300-1500 (3)
Medieval history and civilization from the fall of the Roman Empire to the age of the Renaissance. Interactions between medieval Europe and other Mediterranean and Eurasian cultures.

HSTY 212. Modern European History (3)
The history of Europe from the late eighteenth century to the present. Themes include political upheavals and movements, as well as industrial, social, intellectual, and cultural changes. This course provides a solid foundation for those wishing to take more specialized courses in European history.

HSTY 213. Earthquake, Flood, and Fire: Natural Disaster in History (3)
The wind blows, mobile homes take flight, and people die. Natural disasters are that simple. Or are they? This course employs a historical approach to penetrate the mythology of natural disaster, focusing on the human dimension behind these so-called natural acts. By peeling back the layers of obfuscation, deposited there by successive generations of city boosters and technocrats, we learn that there is nothing simple or natural behind hurricane, tornado, flood, and earthquake calamities.

HSTY 215. Europe in the 20th Century (3)
The twentieth century has seen stupendous transformations in the internal structures of European politics, economics, society, and culture and in Europe’s place in the world. This course traces Europe’s transition from a continent of sovereign nation-states or empires ruled by monarchs with starkly hierarchical social structures, through wars, revolution, dictatorships, destruction, division, and destitution, to a conflicted present. The contradictory combination of peace, freedom, and pluralism combined with cultural critique of the very consumer society that has reduced conflict challenges students’ linear notions of historical development.

HSTY 216. Vikings and Medieval Scandinavia (3)
A survey of the history of the Vikings and Medieval Scandinavia, covering approximately the eighth to the fifteenth centuries AD. Topics explored include: causes of the “outbreak” and cessation of Viking expeditions, the role of the Vikings as raiders and/or traders in Western Europe, the role of the Vikings in the emerging states of Russia, Iceland and medieval Scandinavian law, the historicity of the saga literature, and Viking descendents—Normans and “Rus.”

HSTY 217. History of Corporate America (3)
This course will explore the origins and evolution of big business’s role in American society. It is not a course about the history of corporations, but rather a course that examines how corporate entities have affected fundamental aspects of political, social, and economic life. It will deal with the period from the late nineteenth century to the present and cover topics as diverse as labor relations and advertising to media issues and lobbying. Our goal is to examine how a historical perspective can help us come to grips with topics of pressing importance to us as Americans today.
HSTY 221. Medieval and Tudor/Stuart England (3)
English history from Anglo-Saxon times through the Tudor and Stuart age; kings and kingship, the growth of Parliament, the common law, international politics, and England’s relations with Celtic Britain.

HSTY 222. History of Modern England (3)
Survey of English history, 1700-present, with some attention also to Wales, Scotland, and Ireland, as well as the effects of the British Empire “at home.” Themes include political change, the industrial revolution, nineteenth-century global power and twentieth-century decline, and the roles of gender, class, race, and region in British social and cultural history.

HSTY 223. The Rise and Decline of the British Empire (3)
This course traces the history of the British empire, the geographically largest and perhaps politically most powerful empire of the modern world. Begins with the eighteenth century and the loss of most of the British colonies in the Americas, traces through the height of the Empire in the late 19th century, and then follows its decline and the process of decolonization in the 20th century. Examines the British Empire in its military, political, economic, social, cultural, gendered and ideological facets.

HSTY 225. Evolution (3)
(See PHIL 225.) Cross-listed as PHIL 225.

HSTY 227. Culture and Computers (3)
This course explores ideas about the relationship between culture and computers. Topics range from the historical development of the internet to the process of shaping cyber-identities to representations of various computer worlds in film and fiction.

HSTY 230. Colonialism and Nationalism - The Indian Context (3)
Examines British rule in India between 1700 and 1947, focusing on the colonial policies, processes, and the national movement which led to Indian independence in 1947.

HSTY 231. India Since Independence (3)
The course focuses on society, (caste system, arranged marriages, religions), politics (genesis of Kashmir dispute, role of Nehru and Gandhi), and health systems (indigenous medical traditions) in India after its independence in 1947. It will also focus on how socio-political changes have shaped the existing institutions in India.

HSTY 232. Women in India (3)
Examines the changing position of women in India, as portrayed in Vedic customs, in British India, and in contemporary modern India. Cross-listed as WMST 252.

HSTY 240. The Body in History (3)
This course examines the changing experiences of human bodies in history. It shows how science and culture have shaped diverse human experiences which often appear immutable, including sexuality, eating, race, and sickness.

HSTY 250. Issues and Methods in History (3)
A methodological introduction to historical research. Students use a variety of approaches to interpret and study historical problems. Specific topics and instructors normally vary from year to year.

HSTY 253. Technology and American Culture (3)
American technology is a cultural phenomenon, a part of, rather than separate from, more general concerns. Examines technology through historical writings, literature, images, and both material and popular culture.

HSTY 254. The Holocaust (3)
(See RLGN 254.) Cross-listed as RLGN 254.

HSTY 255. Economic History of the United States (3)
The growth of the American economy from the colonial period to the present. Competing explanations of economic growth; significant attention to the political and legal environment in which the U.S. economy developed; ‘lessons’ of past experience for contemporary policy; some attention to inequality and the changing distribution of wealth and income. Cross-listed as ECON 255 and PLCY 255.

HSTY 256. American Political History (3)
From the origins of American politics in the colonial period to the present. The Revolution and Constitutional debate; presidential politics and leadership; voters and voting patterns; Congress and the courts. Emphasis both on the ideas that animated American politics and on the relation of politics to society.

HSTY 257. Immigrants in America (3)
Immigration to America has constantly reshaped the way the nation views itself. This course examines the overall history of immigration to the United States, but places that movement within a global context. It also pays particular attention to the roles that policy and technology have played in controlling or defining immigration to America.

HSTY 258. History of Southern Africa (3)
A survey of southern Africa from about 1600. Topics include the social structure of pre-colonial African societies, the beginnings of European settlement, the rise of Shaka, the discovery of minerals and the development of industry, Zimbabwe’s guerrilla war and independence, and the rise and apparent demise of apartheid.

HSTY 260. Slavery and Emancipation (3)
Begins with the African encounter with Europeans during the emergence of the modern slave trade. Students are introduced to the documents and secondary literature on the creation and maintenance of slavery, first in colonial America, and then in the United States. The course concludes with the destruction of slavery.

HSTY 261. African-American History 1865-1945 (3)
Examines the changing position of women in India, as portrayed in Vedic customs, in British India, and in contemporary modern India. Cross-listed as WMST 252.

HSTY 262. African-American History Since 1945 (3)
Examines the changing position of women in India, as portrayed in Vedic customs, in British India, and in contemporary modern India. Cross-listed as WMST 252.

HSTY 263. The Holocaust (3)
(See RLGN 254.) Cross-listed as RLGN 254.

HSTY 265. History of the Professions (3)
Professions are one of the central occupational structures of modern society. This course teaches about the historical context of the professions that many students seek to join. It covers the three classic “learned” professions of clergy, law, and medicine, and newer ones such as accounting, engineering, management, and nursing. It is comparative and interdisciplinary, examining the liberal, small-state, contexts of England and the United States, and the contrasting strong-state contexts of France, Germany, and Russia, applying theory from sociology, anthropology, and gender studies.

HSTY 266. The Engineer in America (3)
History, culture, politics, ethical considerations, and gender issues of the engineering profession in the United States.

HSTY 268. Colonialism in Africa (3)
Examines the immense social and cultural changes which took place in Africa as a result of colonial occupations, in the period roughly from 1880 to 1965. It is organized around three major rubrics which were central to the colonial experience: the spread of Christianity, economic forces which led to new forms of labor, and the growth of nationalist resistance.

HSTY 270. Introduction to Gender Studies (3)
This course introduces women and men students to the methods and concepts of gender studies, women’s studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, and art history. It is the required introductory course for students taking the women’s studies major. Cross-listed as WMST 201.

HSTY 272. Sports in America: From Play to Profit (3)
This course reviews the history of sports in America from the colonial period to the present. It gives particular attention to the evolution of sports as a major business and to the roles of gender, ethnicity, and race in the history of America sport, as well as to the emergence of sport as a major defining characteristic of America life and society.

HSTY 282. Modern China (3)
Beginning with the Opium Wars, we review the historical development of intellectual discourse, public reaction, and political protest in late Im-
perial and Republican China from the early 19th century to the communism revolution in 1949. In contrast to the conventional description of China from a Western point of view, this course tries to explain the emergence of modern China in the context of its intellectual, political, and socio-economic transformation as experienced by Chinese in the 19th and 20th century. By discussing the influence of the West, domestic rebellions, and political radicalism, we examine how the Chinese state and society interacted in search for modernization and reforms, how these reforms were continued during the Republican period, and to what extent historical patterns can be identified in China’s present-day development.

HSTY 284. Daily Life in Imperial China (3)
This course is an interdisciplinary study of Chinese society using methodological approaches from the fields of social cultural, economic, and art history. In order to explore the fabric of society in Imperial China (from the beginning to the early 20th century) in a creative, interactive way— including folk customs, life at the court, in city and countryside, religious activities, gender roles, material culture, consumption, entertainment, and social hierarchies—we use the excellent Chinese collection in the Cleveland Museum of Art and various visual aids such as slides and CD-ROMs in the classroom. Cross-listed as ASIA 284.

HSTY 285. Modern Japan (3)
This course introduces students to the many changes that characterize the social, political, economic, and intellectual history of modern Japan from the mid-19th century to the present. We discuss to what extent the Meiji state was built upon Japan’s “traditional” heritage, how modernization and Western influence were implemented in and perceived by society, and which factors led the government to adopt extreme imperialist and militarist policies in the early 20th century. Looking at the emergence of a new Japan after WWII, we focus on employment structures, mass culture, urbanization, gender roles, and social patterns in order to understand the transformation of modern Japanese society.

HSTY 302. Ancient Greece: Archaic, Classical, and Hellenistic Periods (3)
The rise of Hellenic thought and institutions from the eighth to the third centuries B.C., the rise of polis, the evolution of democracy at Athens, the crises of the Persian and Peloponnesian wars, fifth century historiography, the growth of individualism, and the revival of monarchy in the Hellenistic period. Cross-listed as CLSC 302.

HSTY 303. History of the Early Church: First Through Fourth Centuries (3)
Explores the development of the diverse traditions of Christianity in the Roman Empire from the first through the fourth centuries C.E. A variety of New Testament and extra-Biblical sources are to be examined in translation. Emphasis is placed on the place of Christianity in the larger Roman society, and the variety of early Christian ideals of salvation, the Church, and Church leadership. Cross-listed as CLSC 303.

HSTY 304. Ancient Rome: Republic and Empire (3)
Growth and development of the Roman state from the unification of Italy in the early third century B.C. to the establishment of the oriental despotism under Diocletian and Constantine. The growth of empire in the Putnic Wars, the uncertain steps toward an eastern hegemony, the crises in the Republic from the Gracchi to Caesar, the new regime of Augustus, the transformation of the leadership class in the early Empire, and the increasing dominance of the military over the civil structure. Cross-listed as CLSC 304.

HSTY 306. History Museums: Theory and Reality (3)
This course is an intensive summer internship (10 hours per week) at the Western Reserve Historical Society complemented by extensive readings in museum/archival theory and public historical perception. It is designed both to introduce students to museum/archival work and to compare theoretical concepts with actual museum situations. Interns will be assigned a specific project within one of the Society’s curatorial or administrative divisions but will have the opportunity to work on ancillary tasks throughout the Historical Society’s headquarters in University Circle. Prereq: Consent of department.

HSTY 307. Development of Chemistry and Chemical Engineering (3)
The development of chemical ideas; theories of matter, composition, structure, and reaction; the application of chemistry and chemical theory from antiquity to the 20th century; all considered in social context.

HSTY 308. Italian Renaissance 1350-1600 (3)
Political and cultural history of Renaissance Italy. Florence, Venice, Rome, and the development of Humanism. Extensive reading of major writers such as Machiavelli.

HSTY 309. Reformation Europe, 1500-1650 (3)
Origins and development of Protestantism, the Catholic Counter-Reformation, and the interaction between secular power and religious identity in Christian Europe. Cross-listed as RLGN 374.

HSTY 310. The French Revolutionary Era (3)
Causes, progress, and results of the internal transformation of France from 1789 to 1815; impact of revolutionary ideas on other European and non-European societies.

HSTY 311. Seminar: Modern American Historiography (3)
This seminar examines the approaches that professional historians of the United States have taken to the writing of American history in the past fifty years, with emphasis on changes in historical concerns, master debates among historians, and contemporary interests. Topics covered include national politics and government, economic development, social history, the history of ethnicity, race, and gender, and foreign policy and international relations. Each student will read widely and will prepare a series of reports on selected books and authors.

HSTY 312. European Legal History (3)
Examines the development of the legal systems of Central and Western Europe since the reception of Roman law. Focus will fall upon the alliance of Roman law and the absolutist state, the rise of bureaucratic absolutism, codification and the rise of liberal constitutional and legal thought, the Central European Rechtsstaat tradition, the historical school and legal positivism, the differing trajectories of development of bars in private practice, and the shape of modern European civil law systems, all in their social contexts.

HSTY 313. Women in Modern European History (3)
Examines modern European history from the perspective of women’s experiences. Considers how women’s productive and reproductive roles have changed, as well as changes in their political and legal rights, their social and cultural contexts, and their participation in historical movements and events.

HSTY 315. Heresy and Dissidence in the Middle Ages (3)
Survey of heretical individuals and groups in Western Europe from 500 - 1500 A.D., focusing on popular rather than academic heresies. The development of intolerance in medieval society and the problems of doing history from hostile sources will also be explored. Cross-listed as RLGN 315.

HSTY 318. History of Black Women in the U.S. (3)
Chronologically arranged around specific issues in black women’s history organizations, participation in community and political movements, labor experiences, and expressive culture. The course will use a variety of materials, including autobiography, literature, music, and film.

HSTY 319. The Crusades (3)
This course is a survey of the history of the idea of “crusade,” the expeditions of Western Europeans to the East known as crusades, the Muslim and Eastern Christian cultures against which these movements were directed, as well as the culture of the Latin East and other consequences of these crusades. Cross-listed as RLGN 319.

HSTY 321. Colonialism, Sex, Race, and Gender (3)
This course is an exploration of four extended historical episodes in which categories of race, gender and, inevitably, sexuality have interacted and shifted as a result of colonial encounters. In different parts of the globe and at different moments in the last three centuries, these encounters between expanding imperial cultures and indigenous cultures produced societies with racial and gender hierarchies, where sex was a site of colonial anxiety, exploitation and regulation.

HSTY 322. Feminist Theory, Women’s History, Gender History (3)
A reading seminar designed to expose students to current theory and methods in feminist history, as well as feminist scholarship more generally. It includes a variety of topics representative of interests and concerns shared by feminist historians, as well as a range of methodological approaches and theoretical debates. The course aims to impart a sense of the ways in which feminist theory has been applied to and has transformed historical scholarship. Cross-listed as WMST 322.
HSTY 325. U.S. Politics, Culture, and Society: 1787-1865 (3)
Explores politics, culture, and society in the United States between the War for Independence and the Civil War. Topics include the transformation of political ideology, the political process, capitalist development in cities, factories, and the countryside, and changing dynamics of class, race, and gender in both the North and South.

HSTY 332. European Diplomacy in the Age of Nationalism: 1789-1945 (3)
Presents a broad interpretation of the development of the international system in Europe between the French Revolution of 1789 and the end of the European era in 1945. It explains why and how the closed European state system at the beginning of the nineteenth century evolved into an international transcontinental system by the early twentieth century.

HSTY 334. History of 19th Century Germany (3)
Examines the political, social, economic, and cultural history of Germany from the late eighteenth century to 1914. Explores the intellectual and social background to the rise of German liberalism and nationalism, the struggle with bureaucratic absolutism, the revolutions of 1848, industrial capitalism and the emergence of a class society, unification under Bismarck, the role of the state, culture, religion, and changes of mentality, the development of mass politics, and the coming of World War I.

HSTY 335. History of 20th Century Germany (3)
Examines the tumultuous history of Germany from 1914 to the unification of the two Germanys in 1989-1990. From the totalizing and traumatic experience of World War I, through a failed revolution, the republican experiment of Weimar, the National Socialist dictatorship under Hitler and the divided Germany suspended between the superpowers, the newly unified democratic Federal Republic. Examines the ways in which Germans have tried to reconcile the state to their society, economy, and individual lives.

HSTY 342. Russia Since the Revolution (3)
Beginning with the background to the Russian Revolutions of 1905 and 1917, this course explores the rise and fall of the communist system of the Soviet Union. It examines the radical upheavals imposed upon the Russian and other peoples of the Soviet Union, the Stalinist autocracy, post-Stalinist attempts to make the system work, the superpower era, sclerosis and stagnation, glasnost and perestroika, coup and collapse.

HSTY 348. Political and Social Thought in the Machine Age (3)
Explores the responses of economist writers, philosophers, cultural critics, and public policy makers to changes in Western society wrought by industrialization, by focusing on their concerns with technological change. Cross-listed as POSC 348.

HSTY 351. Colonial America 1607-1763 (3)
The formative years of American society and culture. Slavery and racism, expansionism, regionalism, the modern family, pluralism, sense of mission, and republican ideology.

HSTY 352. The Creation of the American Republic: 1763-1815 (3)
The causes and consequences of the American Revolution, the formation of the American Republic, and the early years of the new nation. Federalism and republicanism as theories and in application, and the role of the Americans' experience in the age of democratic revolutions.

HSTY 353. Women in American History I (3)
The images and realities of women's social, political, and economic lives in early America. Uses primary documents and biographers to observe individuals and groups of women in relation to legal, religious, and social restrictions.

HSTY 354. Women in American History II (3)
With HSTY 353, forms a two-semester introduction to women's studies. The politics of suffrage and the modern woman's efforts to balance marriage, motherhood, and career. (HSTY 353 not a prerequisite.)

HSTY 355. Age of American Civil War 1815-80 (3)
This course examines the causes and consequences of the Civil War, focusing on the rise of sectionalism, the dynamics of conflict, and reconstruction. Heavy emphasis is placed on archival research in relevant first person accounts from the period.

HSTY 356. Industrial America: 1880-1940 (3)
The social, economic, and political adaptation of American society to the industrial age. The impact of industrialism on such recurrent historical problems as technological change, race relations, social reform, urbanization, and political participation.

HSTY 358. America Since 1940 (3)
A comprehensive introduction to the recent history of the United States, organized around changes in national policy and politics. Special emphasis on the impact of World War II and the Cold War; the expansion of the federal government through the Great Society and beyond; the Civil Rights and Women's Rights movements; challenges to the legitimacy of politics; and the efforts to maintain economic growth.

HSTY 359. Race in American Social and Cultural Thought (3)
Explores the social and cultural construction of race in American social thought. Topics for discussion range from race in the age of European exploration to slavery and the postbellum years, to 20th century cultural thought. In addition, the course addresses the ways in which racial thought has shaped American politics, social policy, and culture. The readings, lectures, discussions, and assignments stress the interrelated, but unique experiences of the various racial groups in the U.S.

HSTY 360. American Foreign Policy since 1900 (3)
The underlying economic, political, and cultural forces that influenced policy formation from the end of the Spanish-American War through the aftermath of the Vietnam War. The development and function of the national and international apparatus of foreign relations from the consular service, world court and cartels to the CIA, United Nations, and international corporations.

HSTY 362. American Social and Cultural History since 1865 (3)
History of the nationalization of new economic, political, social, scientific, and aesthetic ideas and their embodiment in the development of professions, social movements, and cultural institutions.

HSTY 364. City, Town, and Suburban American History (3)
Nearly all Americans now live in the big cities, suburbs, and nearby towns of large metropolitan regions; one hundred years ago most Americans lived in the countryside. This course explores the rise of cities and metropolitan regions as the settings for American life. It considers the timing of the urban and suburban movements, explanations for urbanization and suburbanization, and the changing character of city, suburban, and small town life. The course pays special attention to the consequences of urban and metropolitan growth for economic opportunity, for metropolitan government, for social life and conflict, and for cultural expression and cultural change.

HSTY 366. Science, Technology, and Government (3)
Traces the development and influence of federal technology and science policies from colonial times to the present, with emphasis on the 20th century. Cross-listed as POSC 365.

HSTY 368. Modern American Legal History (3)
Examines the workings of the modern American legal system from the Civil War to the present. Focus on the relationships between the law and social, economic, and professional change. Lectures, discussions, and analysis of legal documents.

HSTY 377. Nuclear Weapons and Arms Control (3)
National and international problems concerning nuclear weapons, and the past and present attempts both to control their spread and to prevent their use. Topics covered include the science and technology of fission and fusion warheads and delivery vehicles; history, domestic policies, and international relations concerning nuclear weapons; and arms control treaties and their verification. Cross-listed as POSC 375.

HSTY 378. Environmental History of North America (3)
Explores the way nature has shaped history as well as the ecological consequences of development. Focus is on the relationship between the natural and the cultural with special attention to such topics as economic growth, wilderness, disease, environmental justice, and the conquest of the American West.

HSTY 379. America in the '50s (3)
American life and culture in the decade of Elvis, Eisenhower, McCarthy and the beginnings of the Civil Rights Movement. Films, novels and recordings will supplement lectures and discussions on such topics as the Cold War, conformity, the role of women, television, the Korean War, and beatniks.
HSTY 381. City as a Classroom (3)
In this course, the city is the classroom. We will engage with the urban terrain. We will meet weekly at League Park Community Center in Hough, interact with community members, and interface—both literally and figuratively—with the city as a way to examine the linkages between historical, conceptual, and contemporary issues, with particular attention paid to race and class dynamics, inequality, and social justice. This course will have four intersecting components, primarily focusing on American cities since the 1930s: the social and physical construction of urban space, the built environment, life and culture in the city, and social movements and grassroots struggles.

HSTY 382. Chinese Business and Economic History (3)
This course explores China’s business and economic history from the opening of the treaty ports in the early 19th century to the post-war socialist economy, the market reforms in the 1980s and 1990s, and the most recent developments in the context of China’s social political transformation. One major focus of the course is a comparative approach to the issue of industrialization and the introduction of modern enterprises and economic structures into China. By examining the socio-economic background of Chinese business from family and personal networks to property rights, students learn about the institutional, cultural, and social aspects which are still relevant for business transactions and institutions in China today.

HSTY 383. The People’s Republic of China (3)
Now more than ever, the Chinese state and society are facing tremendous economic, social, and political challenges. This course presents an overview of the development of Chinese Communist theory and practice from 1949 to the present day. Among the topics covered are the Great Leap Forward, the Cultural Revolution, the economic reforms of the 1980s, the Tiananmen student protests, the Communist party’s crisis of legitimacy, the Taiwan problem, ecological challenges, the new socialist market economy, and current social developments from domestic migration to youth culture and new forms of nationalism. The class involves a mixture of lectures and discussion and draws on a combination of primary and secondary sources, including current news reports, films, documentaries, and fiction in translation. Cross-listed as POSC 368.

HSTY 390. Seminar: History and Philosophy of Science and Technology (3)
Required of majors in the History and Philosophy of Science and Technology.

HSTY 391. Food in History (3)
Food is inextricably interconnected with the development of agriculture and other technologies, with the rise and fall of empires, with increasing understanding of diet and nutrition, with laws and regulations, with the arts, with economic development and consumer culture, and with religious and ethnic identities. By examining selective and representative episodes pertaining to each of these topics, this course explores the global history of food, from the agricultural revolution of the neolithic era to the consumer revolution of the last generation.

HSTY 394. Seminar in Evolutionary Biology (3)
(See PHIL 394.) Cross-listed as PHIL 394.

HSTY 395. History of Medicine (3)
This course treats selected topics in the history of medicine, with an emphasis on social and cultural history. Focusing on the modern period, we examine illnesses, patients, and healers, with attention to the ways sickness and medicine touch larger questions of politics, social relations and identity.

HSTY 397. Undergraduate Tutorial (1-3)
Individual instruction with members of the history faculty. Prereq: 12 hours of History.

HSTY 398. Senior Research Seminar (3)
Training in the nature and methods of historical writing and research. Prereq: Majors only, Senior standing.

Graduate Courses

HSTY 400. Graduate Topical Seminar (3)
A rotating graduate seminar, offered every semester by a different faculty member. Each semester focuses on a topic of central historiographical or methodological importance.

HSTY 402. Survey of the History of Science (3)
A graduate-level historiographic review of the history of the sciences from the seventeenth century to the present.

HSTY 404. Introduction to the Nonprofit Sector (3)
(See HSTY 204.)

HSTY 406. History Museums: Theory and Reality (3)
(See HSTY 306.)

HSTY 410. Seminar: Early American Historiography (3)
This seminar examines the historiography of early America. It is designed to acquaint history doctoral students with the major themes, methods, and scholars of American history from the seventeenth century to the mid-nineteenth century. Students will be expected to read and report on major works in the field.

HSTY 411. Seminar: Modern American Historiography (3)
(See HSTY 311.)

HSTY 422. Feminist Theory, Women’s History, Gender History (3)
(See HSTY 322.) Cross-listed as WMST 422.

HSTY 451. Seminar in the History of European Technology (3)
A graduate-level research seminar on the history of European technology from the Industrial Revolution to the present. Special emphasis is on cultural history of technology with a transatlantic view. The themes of the seminar vary from year to year, but include: communications, industrialization, control, cultural and intellectual approaches to the history of technology. Required work includes a research paper based on original sources.

HSTY 452. Readings in the History of American Technology (3)
A graduate-level review of the history of American technology.

HSTY 470. History and Cultural Studies (3)
This course explores the uses of cultural and critical theory by historians, in particular relevant developments in anthropology, literary criticism, and philosophy. Topics include collective memory, the social construction of knowledge, theories of narrativity, the concept of post-modernity, and the historical formations of class, race, gender, and nation.

HSTY 475. Nuclear Weapons and Arms Control (3)
(See HSTY 377.) Cross-listed as POSC 475.

HSTY 477. Modern Policy History of the United States (3)
This course offers a historical perspective on policy and policy making in the United States since the late nineteenth century. It emphasizes the increasing role of the federal government, the persisting importance of the states, the significance of the courts, the revolutionary impact of the women’s and civil rights movements, and the consequences of the growth and transformation of the American economy. Each student selects a policy area for detailed exploration; students often choose topics related to civil rights, women’s rights, health care, environmental reform, non-profit and non-governmental organizations, the arts, and education, but other topics are also appropriate. Prereq: Consent of department for undergrads.

HSTY 480. Public Policy and Aging (3)
(See EPBI 408.) Cross-listed as EPBI 408.

HSTY 481. City as a Classroom (3)
(See HSTY 381.)

HSTY 494. Seminar in Evolutionary Biology (3)
(See PHIL 494.) Cross-listed as PHIL 494.

HSTY 495. History of Medicine (3)
(See HSTY 395.)

HSTY 497. Graduate Independent Study (1-3)
Independent reading and research programs with individual members of the faculty.

HSTY 601. Independent Studies (1-18)
(Credit as arranged.)

HSTY 611. Introduction to Historiography (3)
Required seminar for all M.A. and Ph.D. students. Introduces students to historiographical and methodological issues.

HSTY 651. Thesis M.A. (1-18)
(Credit as arranged.)
History and Philosophy of Science

207 Mather House
Phone 216-368-2614; Fax 216-368-4681
Alan Rocke, Director

Program Faculty
Alan J. Rocke, Ph.D. (University of Wisconsin, Madison)
   * Henry Eldridge Bourne Professor of History and Director
James M. Edmonson, Ph.D. (University of Delaware)
   * Director, Dittrick Medical History Center, and Adjunct Associate Professor
Miriam R. Levin, Ph.D. (University of Massachusetts)
   * Associate Professor of History
Colin McCarty, Ph.D. (Case Western Reserve University)
   * Associate Professor of Philosophy
Patricia Princehouse, M.A. (Yale University)
   * Lecturer in Philosophy
Caroll W. Pursell, Ph.D. (University of California)
   * Adeline Barry Davee Distinguished Professor of History
Jonathan Sadowsky, Ph.D. (Johns Hopkins University)
   * Associate Professor of History

Undergraduate Program
The Department of Philosophy and the Department of History together offer an undergraduate major in the history and philosophy of science. The purpose of the major is to develop a humanistic understanding of the nature and development of science through the combined use of philosophical and historical methods. The major provides a foundation for graduate study in a range of academic disciplines and for careers in medicine, business, medicine, law, public policy, and science journalism. It also may be profitably combined with a program in one of the sciences. Within the major, a student may seek an emphasis on philosophy of science, physical science, or biological and medically related science.

Major
The history and philosophy of science and technology major requires 30 credit hours from courses in philosophy and in history of science and technology. Required are PHIL 101, 204, and 302; HSTY 151 and 202; HSTY/PHIL 203; HSTY/PHIL 390; and three electives approved by the major advisor.

Minor
The minor in History and Philosophy of Science consists of HSTY 202, PHIL/HSTY 203, and PHIL 204, plus two electives approved by the major advisor. Students who major in the history and philosophy of science and technology are not permitted to take a second major in philosophy or to minor in philosophy.

International Studies

111 Mather House
Phone 216-368-2425; Fax 216-368-4681
Vincent E. McHale, Director (vem@po.cwru.edu)

International studies is a multi-disciplinary program leading to the B.A. degree. Study in the program provides students with the ability to read beyond the headlines, to see world events in terms of how they got to be that way, how they fit into broader issues and systems, and how one might imagine their place in shaping the future. To attain this goal, students are introduced to the methods of conceptualizing international and global issues, as well as to study of a society other than their own. They will learn to think critically about contending and complementary methods and theories, developing an appreciation for both traditional disciplinary approaches and newer cross-disciplinary approaches. Students also will acquire skills that will allow them to recognize and deal with complexity; communicative and analytical skills in a language other than English (or other than their native language); and skills in statistics, in computer-based global analysis, or in negotiation.

It is strongly recommended that all international studies students participate in at least one of several off-campus programs which will facilitate the international perspective; junior year abroad, summer internships in Washington, D.C., or professional practicum-type work experiences in Cleveland which involve an international context. It also is recommended that students have a solid foundation in economics. In addition to forming the groundwork for an evolving understanding of and lifelong engagement with the modern world, a background in international studies provides excellent, practical preparation for careers that deal with the emerging needs of our world. International studies majors go on to careers in international marketing and management, diplomatic service, health, law, social services, and journalism, as well as careers within the academic disciplines. The professional schools of business, medicine, nursing, law, and applied social sciences at Case Western Reserve all have significant international foci, and our students can explore careers in these areas during their undergraduate years. The skills, analytic abilities, and critical approaches of international studies should equip students as well for new employment patterns which may not fit into existing career descriptions.

International Studies Steering Committee
Vincent E. McHale, Ph.D. (Pennsylvania State University)
   * Professor and Chair, Political Science; Director, International Studies Program
   * Comparative politics; Europe; political sociology; methodology
Bo A. Carlsson, Ph.D. (Stanford University)
   * William E. Umstad Professor of Economics
   * Managerial economics; industrial economics
William E. Deal, Ph.D. (Harvard University)
   * Severance Associate Professor of the History of Religion
   * Religions of China and Japan; Asian civilizations
Elisabeth Köll, D.Phil. (Oxford University)
   * Assistant Professor of History; Director, Asian Studies Program
   * East Asian history; Chinese economic history; recent China
Kenneth F. Ledford, Ph.D. (Johns Hopkins University), J.D. (University of North Carolina)
   * Associate Professor of History; Secondary appointment, School of Law; Director, German Studies Program
   * Modern German history; European social history; German and European legal history
Mihajlo D. Mesarovic, Ph.D. (Serbian Academy of Science)
   * Cady Staley Professor of Systems Engineering
   * Large-scale systems theory; multilevel systems; world and regional modeling

Undergraduate Program
The major in international studies requires a minimum of 33 credit hours taken from the list of approved topical and area studies courses, plus satisfaction of a language competency.
requirement. Each student will prepare a program of study, indicating specific course selections to meet the six area requirements below, which must be approved by a faculty advisor drawn from the steering committee membership. Students also should discuss the choice of their minor or a second major with their advisor. Among the courses chosen should be at least one course which involves the development of skills in computer applications, economic analysis, statistics, or other quantitative methods. Normally no more than two courses taken for international studies credit may count simultaneously toward a minor or another major. Courses taken to satisfy the language competency requirement are exempted from this rule, and several international studies courses contribute to the completion of the Arts and Sciences General Education Requirements.

1. Multi-disciplinary foundations (required courses, 12 credit hours): An introduction to four major disciplinary understandings of society and culture, principles of economics, change over time, and interactions among nations, simultaneously exposing students to a variety of world societies and issues. International studies majors will be expected to have completed the multi-disciplinary foundations courses at the University before embarking on a study abroad program. These courses are:
   - ANTH 102 Being Human: An Introduction to Social and Cultural Anthropology (3)
   - ECON 102 Principles of Microeconomics (3)
   - HSTY 113 Introduction to Modern World History (3)
   - POSC 272 Introduction to International Relations (3)

2. Area Focus (6 credit hours): Two courses that concentrate on a single geographic or culture area. Examples include: Africa, North America, East Asia, Europe, Latin America, and the Middle East.

3. Topical Focus (6 credit hours): A related pair of courses to constitute a discrete perspective on global issues and to foster an appreciation for complexity through study of particular world issues and the methods appropriate to them. Examples include pairs of courses dealing with ethnicity, international health, international economics, global and environmental analysis, or international relations. Cross-disciplinary approaches are encouraged.

4. Elective Area or Topical Courses (6 credit hours): Two additional courses within the topical and area studies course listings, providing an opportunity to experiment or to tailor the program toward particular interests in international or global issues, methodology, or other cultures.

5. Senior Colloquium (required course, 3 credit hours): The integration of prior topical and area foci in a colloquium (INTL 398) taken in the fall semester of the senior year, involving the writing of a substantial research paper. Selection of the topic and the research and writing are under supervision of a faculty tutor. Peer evaluation will be attained through regular sessions, supervised by the colloquium coordinator, at which students present their initial concepts, outlines, research, and drafts. Open only to seniors majoring in international studies. Prereq: Consent of program coordinator and program prospectus form.

INTL 396. International Independent Study (1-3)
Study of a topic within the scope of international studies. The student must complete a prospectus form, approved and signed by the supervising faculty member, no later than the second week of classes. The prospectus must outline the goals of the project and the research methodology to be used and is part of the basis for grading. Open to juniors and seniors majoring in international studies. Prereq: Consent of program coordinator and program prospectus form.

INTL 398. International Senior Colloquium (3)
Individual work with a faculty tutor leading to the writing of a major research paper. Regular class sessions are supervised by the colloquium coordinator in which students present their initial concepts, outlines, research, and drafts. Open only to seniors majoring in international studies. Prereq: Consent of colloquium coordinator.

International Studies (INTL)

Undergraduate Courses

Approved Courses

The International Studies Steering Committee currently recognizes over 150 courses from which the student may choose to satisfy the area and topical foci requirements. Course lists are available from the program advisors. Additional courses may be selected on the basis of individual student interest, or the discretion of the faculty advisor. Courses also may be selected from within existing area studies programs:

- American Studies Program
- Asian Studies Program
- French Studies Program
- German Studies Program
- Japanese Studies Program

International Studies (INTL)

Undergraduate Courses

INTL 396. International Independent Study (1-3)
Study of a topic within the scope of international studies. The student must complete a prospectus form, approved and signed by the supervising faculty member, no later than the second week of classes. The prospectus must outline the goals of the project and the research methodology to be used and is part of the basis for grading. Open to juniors and seniors majoring in international studies. Prereq: Consent of program coordinator and program prospectus form.

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Individual work with a faculty tutor leading to the writing of a major research paper. Regular class sessions are supervised by the colloquium coordinator in which students present their initial concepts, outlines, research, and drafts. Open only to seniors majoring in international studies. Prereq: Consent of colloquium coordinator.

Department of Mathematics

220 Yost Hall
Phone 216-368-2880; Fax 216-368-5163
James C. Alexander, Chair

The Department of Mathematics offers a variety of programs leading to both undergraduate (Bachelor of Arts and Bachelor of Science in Mathematics and Bachelor of Science in Applied Mathematics) and graduate (Master of Science and Doctor of Philosophy) degrees. Prospects for employment in mathematics are good. Because of the central role of mathematics in the physical and social sciences, in engineering, and in business, there should be continuing demand for mathematicians. Applied mathematicians are in demand in industry and government. A student with an undergraduate major in mathematics, including some computer science, and with some concentrated work in an allied field, has excellent career opportunities. There is a strong demand for high school teachers in mathematics. The bachelor's degree in mathematics furnishes a strong background for graduate study in many areas (e.g., computer science, medicine, law, economics, etc.). The master's degree is sufficient for many areas of non-academic employment. The Ph.D. is necessary for college teaching.

The Math Tutoring Center, located in Yost 321A, provides a place within the Mathematics Department where students could work together and receive help as needed. Along with individual assistance, the Math Tutoring Center also conducts supplemental instruction sessions for Math 121, 122, 125 and 126. In these sessions, upperclassmen work with small groups of students on the class material.
Faculty
James C. Alexander, Ph.D. (Johns Hopkins University)
Levi Kerr Professor and Chair
Dynamics, applied mathematics
Alejandro D. de Acosta, Ph.D. (University of California, Berkeley)
Professor
Probability, stochastic processes
Christopher Bulte, M.S. (Case Western Reserve University)
Instructor
Teaching of mathematics
Daniel Calvert, Ph.D. (University of North Carolina)
Associate Professor
Numerical linear algebra, numerical methods for image processing, orthogonal polynomials and quadrature rules, large-scale eigenvalue computations.
David Guranic, Ph.D. (Hebrew University, Jerusalem, Israel)
Professor
Mathematical physics, differential equations; geophysical modeling; harmonic analysis
Michael G. Hurley, Ph.D. (Northwestern University)
Professor
Differentiable dynamical systems
Steven H. Izen, Ph.D. (Massachusetts Institute of Technology)
Associate Professor
Mathematics of imaging; image reconstruction
Yuriy Kondratyev, Ph.D. (Kiev University)
Professor
Continuum mechanics, mathematics of physics
Peter Kotelenez, Ph.D. (Universitat Bremen)
Professor
Probability theory, stochastic processes, particle systems
Joel Langer, Ph.D. (University of California, Santa Cruz)
Professor
Differential geometry; calculus of variations
Dong Hoon Lee, Ph.D. (Tulane University)
Professor
Lie groups and algebraic groups
Marshall J. Leitman, Ph.D. (Brown University)
Professor
Integral equations; continuum physics
David A. Singer, Ph.D. (University of Pennsylvania)
Professor
Riemannian geometry; differential topology
Stanislaw J. Szarek, Ph.D. (Mathematical Institute, Polish Academy of Science)
Professor
Functional analysis
Elisabeth Werner, Ph.D. (Universite Pierre et Marie Curie, Paris IV)
Associate Professor
Functional analysis, convexity
Ta-Sun Wu, Ph.D. (Tulane University)
Professor
Group Theory

Associate Faculty
Colin McLarty, Ph.D. (Case Western Reserve University)
Associate Professor of Philosophy
Logic, philosophy of mathematics

Adjunct Faculty
Marvin E. Goldstein, Ph.D. (University of Michigan)
Adjunct Professor; Chief Scientist, NASA-Lewis Research Center
Fluid mechanics, heat transfer

Undergraduate Programs
A Bachelor of Arts degree in mathematics, a Bachelor of Science in mathematics, and a Bachelor of Science in applied mathematics degrees are available to students at Case Western Reserve University. All undergraduate mathematics degrees are based on a four-course sequence in calculus and differential equations and a five-course Mathematics Core in analysis and algebra.

Degree Requirements
Bachelor of Arts Degree in Mathematics
(1) Mathematics Requirements
The B.A. degree in Mathematics requires at least 38 hours of mathematics courses, including
(a) MATH 121, 122, 223, and 224, or an equivalent sequence;
(b) Core Mathematics for the B.A.
(i) MATH 307, 308, 321, 322
(ii) at least one of MATH 324, 425;
(c) Three approved technical electives (9 credit hours), no more than one of which can be from outside the department.
(2) Non-mathematics Requirements
A 3-credit hour course in computer science (ENGR 131 or other approved course).

Teaching Certification
High school teaching certification is available in the B.A. program in mathematics through a joint program with John Carroll University. The requirements are:
(a) Completion of the B.A. program in mathematics, including MATH 150, MATH 304, and STAT 312 as the three approved technical electives.
(b) The completion of a special minor in education. Students interested in this program should contact the director of teacher licensure for further information about eligibility and requirements.

Bachelor of Science in Mathematics Degree
(1) Mathematics Requirements
The B.S. degree in Mathematics requires at least 50 hours of mathematics courses, including
(a) MATH 121, 122, 223, and 224, or an equivalent sequence;
(b) Core Mathematics for the B.S. in Mathematics
(i) MATH 307, 308, 321, 322
(ii) at least one of MATH 324, 425;
(c) 21 hours (normally seven courses) of approved technical electives, no more than 9 hours of which may be from outside the department.
(2) Non-mathematics Requirements
The B.S. degree in mathematics requires the following non-mathematics courses:
(a) PHYS 121, 122, 221, or an equivalent sequence.
(b) A two-course science sequence from the following list of physical sciences: ASTR 201-202, CHEM 105-106, CHEM 111-ENGR 145, GEOL 110 and either 115 or 210.
(c) A 3-credit hour course in Computer Science (ENGR 131 or other approved course).
(d) An approved science lab (usually 2 credit hours). (BIOC 314, BIOL 111, CHEM 113, GEOL 119, PHYS 203 are appropriate.)

Bachelor of Science in Mathematics and Physics
Students with strong interests in both Mathematics and Physics may be interested in the joint Bachelor of Science degree in Mathematics and Physics, which is described under the Department of Physics in this Bulletin.
**Bachelor of Science in Applied Mathematics Degree**

The B.S. degree in Applied Mathematics requires at least 50 hours of mathematics and related subjects, in addition to a professional core that is specific to the area of application in which the student is interested. A student in this degree program must design a program of study (called a “track”) in consultation with his or her academic advisor. This program of study must explicitly list the technical electives and the professional core in the area of application. Some of the tracks offer the possibility of an integrated five year study leading to a B.S. in Applied Mathematics and an M.S. in the area of application. Currently there are four such tracks: computing and information science; operations research; systems engineering - systems; systems engineering - control theory. The general academic requirements for Integrated B.S./M.S. programs must be followed. (Since the graduate courses required for the M.S. degree are determined by the respective department, each student in the dual-degree program should have a secondary advisor in that department, starting no later than the junior year, and such consult with this advisor concerning requirements for the M.S. degree.)

1. **Mathematics Requirements**
   - (a) MATH 121, 122, 223, and 224, or an equivalent sequence;
   - (b) Core Mathematics for Applied Mathematics
     - (i) MATH 304, 307, 308, 321, 322
     - (ii) at least one of MATH 324, 425;
   - (c) Technical Electives
     18 credit hours (normally six courses) of technical electives as follows:
     - (i) Four approved courses, specific to the area of application in which the student is interested. (Lists of pre-approved courses for the four B.S./M.S. tracks are listed below.)
     - (ii) Two other courses of MATH at the 500 level or higher, except 470, 471.

   Listed below are specific technical electives of the four B.S./M.S. tracks.

2. **Computing and Information Sciences Track**
   - Four of the following courses, of which at least two must be MATH courses. At least one numerical analysis course must be chosen. MATH 410, MATH/ECES 343, MATH 413/OPRE 514, MATH 431, PHIL 306, ECES 454, or another course with approval of the Department (note: at this writing, both new MATH and ECES courses are in development and some of these courses may be appropriate).

3. **Operations Research Track**
   - Four of the following courses, at least two of which must be MATH courses. MATH 431, MATH 423, MATH 491, MATH 492, MATH 495, MATH 487, MATH 489, STAT 403, STAT 406, STAT 408, STAT 484.

4. **Systems Engineering - Control Theory Track**
   - Four of the following MATH courses. 401, 402, 410, 413, 415, 423, 428, 431, 435, 436, 445, 465, 491.

5. **Systems Engineering - Systems Track**
   - Four of the following MATH courses 401, 410, 413, 423, 431, 435, 445, 476, 491, 495.

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**Bachelor of Arts Degree**

**Major in Mathematics**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Freshman Year</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
<td>(4)</td>
<td></td>
</tr>
<tr>
<td>GER Course</td>
<td>(3-4)</td>
<td></td>
</tr>
<tr>
<td>GER Course</td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3)</td>
<td></td>
</tr>
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<td>PHED 101 Physical Education Activities</td>
<td>(0)</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>Fall</td>
<td>Junior Year</td>
</tr>
<tr>
<td>MATH 122 Calculus for Science and Engineering II</td>
<td>(4)</td>
<td></td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>MATH 150 Mathematics from a Mathematician's Perspective</td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>GER Course</td>
<td>(3-4)</td>
<td></td>
</tr>
<tr>
<td>GER Course</td>
<td>(3)</td>
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</tr>
<tr>
<td>Electives</td>
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</tr>
<tr>
<td>PHED 102 Physical Education Activities</td>
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</tr>
<tr>
<td>Sophomore Year</td>
<td>Fall</td>
<td>Junior Year</td>
</tr>
<tr>
<td>MATH 223 Calculus for Science and Engineering III</td>
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<td>MATH 307 Abstract and Linear Algebra I</td>
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<tr>
<td>GER Course</td>
<td>(3)</td>
<td></td>
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<tr>
<td>Course in selected minor held</td>
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</tr>
<tr>
<td>Electives</td>
<td>(6)</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>Fall</td>
<td>Junior Year</td>
</tr>
<tr>
<td>MATH 224 Elementary Differential Equations</td>
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<td>MATH 308 Abstract and Linear Algebra II</td>
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<td>GER Course</td>
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<tr>
<td>Electives</td>
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</table>
Bachelor of Science in Applied Mathematics

Freshman Year

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<th>Class-Lab-Credit Hours</th>
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<tr>
<td>Fall</td>
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<tr>
<td>Open elective or humanities/social science ............... (3-0)\textsuperscript{b}</td>
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<tr>
<td>GER: Science Sequence I ........................................ (3-0)\textsuperscript{d}</td>
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<tr>
<td>Approved Science Laboratory ................................... (1-3-2)\textsuperscript{c}</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I .......... (4-0-4)</td>
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<tr>
<td>ENGL 150 Expository Writing .................................. (3-0-3)</td>
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<tr>
<td>PHED 100 Physical Education Activities .................... (0-3-0)</td>
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<tr>
<td>Total ........................................................................... (14-6-15)</td>
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<tr>
<td>Spring</td>
</tr>
<tr>
<td>Humanities/social science or open elective ............... (3-0)\textsuperscript{b}</td>
</tr>
<tr>
<td>GER: Science Sequence II (3-0-3)\textsuperscript{d}</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming ................. (2-2-3)</td>
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<tr>
<td>MATH 122 Calculus for Science and Engineering II ........ (4-0-4)</td>
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<tr>
<td>PHYS 121 General Physics I ..................................... (4-0-4)\textsuperscript{f}</td>
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<tr>
<td>PHED 100 Physical Education Activities .................... (0-3-0)</td>
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<tr>
<td>Total ........................................................................... (17-3-17)</td>
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Sophomore Year

<table>
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<th>Class-Lab-Credit Hours</th>
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<tr>
<td>Fall</td>
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<tr>
<td>GER: Humanities or Social Science Sequence I (3-0-3)</td>
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<tr>
<td>PHYS 122 General Physics II .................................... (4-0-4)\textsuperscript{c}</td>
</tr>
<tr>
<td>MATH 223 Calculus for Science and Engineering III (3-0-3)</td>
</tr>
<tr>
<td>MATH 304 Discrete Mathematics (3-0-3)</td>
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<tr>
<td>Technical elective</td>
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<td>Total .............................................................. (16-0-17)</td>
</tr>
<tr>
<td>Spring</td>
</tr>
<tr>
<td>GER: Humanities or Social Science Sequence II ........... (3-0-3)</td>
</tr>
<tr>
<td>PHYS 221 General Physics III .................................. (3-0-3)\textsuperscript{c}</td>
</tr>
<tr>
<td>MATH 224 Elementary Differential Equations ............... (3-0-3)</td>
</tr>
<tr>
<td>Technical elective</td>
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<tr>
<td>Technical elective</td>
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<tr>
<td>Total ........................................................................... (15-0-16)</td>
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</table>

Junior Year

<table>
<thead>
<tr>
<th>Class-Lab-Credit Hours</th>
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<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>GER: Humanities or Social Science Sequence III .......... (3-0-3)</td>
</tr>
<tr>
<td>MATH 307 Abstract and Linear Algebra I ..................... (3-0-3)</td>
</tr>
<tr>
<td>MATH 321 Fundamentals of Analysis I ........................ (3-0-3)</td>
</tr>
<tr>
<td>Technical elective</td>
</tr>
<tr>
<td>Open elective</td>
</tr>
<tr>
<td>Total .............................................................. (15-0-15)</td>
</tr>
<tr>
<td>Spring</td>
</tr>
<tr>
<td>GER: Humanities or Social Science Sequence IV .......... (3-0-3)</td>
</tr>
<tr>
<td>MATH 308 Abstract and Linear Algebra II .................... (3-0-3)</td>
</tr>
<tr>
<td>MATH 322 Fundamentals of Analysis II ....................... (3-0-3)</td>
</tr>
<tr>
<td>MATH 324 Introduction to Complex Analysis ............... (3-0-3)</td>
</tr>
<tr>
<td>or MATH 425 Complex Analysis I ................................ (3-0-3)</td>
</tr>
<tr>
<td>Open elective</td>
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<tr>
<td>Total .............................................................. (15-0-15)</td>
</tr>
</tbody>
</table>

Senior Year

<table>
<thead>
<tr>
<th>Class-Lab-Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>GER: Humanities or social science elective ............... (3-0-3)</td>
</tr>
<tr>
<td>Technical elective</td>
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<tr>
<td>Technical elective</td>
</tr>
<tr>
<td>Open elective</td>
</tr>
<tr>
<td>Total .............................................................. (15-0-15)</td>
</tr>
<tr>
<td>Spring</td>
</tr>
<tr>
<td>GER: Humanities or social science elective ............... (3-0-3)</td>
</tr>
<tr>
<td>Technical elective</td>
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<tr>
<td>Technical elective</td>
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<td>Technical elective</td>
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<tr>
<td>Technical elective</td>
</tr>
<tr>
<td>Total .............................................................. (15-0-15)</td>
</tr>
</tbody>
</table>

Total hours to graduate: Between 125-128 depending on option.

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a. A suitable open elective is MATH 150, Mathematics from a Mathematician’s Perspective. This course must be taken during the FRESHMAN year to count toward the 50 hours requirement for mathematics courses.

b. One of these courses must be a humanities/social science elective.

c. Selected students may be invited to take the honors sequence, PHYS 123, 124, 223, in place of PHYS 121, 122, 221.

d. These two courses must be one of the following sequences: ASTR 201-202, CHEM 105-106, CHEM 107-108, GEOL 110 and either 115 or 210.

e. BIOC 314, BIOL 111, CHEM 113, GEOL 119, PHYS 203 are appropriate.
Non-Major Undergraduate Programs

Minor in Mathematics - All Undergraduates

A minor in mathematics is available to all University undergraduates. It consists of 17 credit hours of approved course work in mathematics. No more than two courses can be used to satisfy both minor requirements and the requirements of the student’s major field (meaning departmental degree requirements, including departmental technical electives and common course requirements of the student’s school). The 17 hours must be from among the following MATH courses: 121 or 123 or 125, 122, or 124 or 126, 223 or 227, 224 or 228, 150, 201, 301, 302, 303, 304, 307, 308, 321, 322, 323, 324, 331, 338, 343, 345, 380, or any 400-level MATH course (only one of 201, 308).

High School Teaching Licensure

This program is described in the description of the mathematics B.A. degree given above.

<table>
<thead>
<tr>
<th>Bachelor of Science in Mathematics Degree</th>
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</thead>
<tbody>
<tr>
<td><strong>Freshman Year</strong></td>
</tr>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>Open elective or humanities/social science</td>
</tr>
<tr>
<td>GER: Science Sequence I</td>
</tr>
<tr>
<td>CMPS 131 Elementary Computer Programming</td>
</tr>
<tr>
<td>MATH 121 Calculus for Science and Engineering</td>
</tr>
<tr>
<td>ENGL 150 Expository Writing</td>
</tr>
<tr>
<td>PHED 101 Physical Education Activities</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Spring</td>
</tr>
<tr>
<td>Humanities/social science or open elective</td>
</tr>
<tr>
<td>GER: Science Sequence II</td>
</tr>
<tr>
<td>Approved Science Laboratory</td>
</tr>
<tr>
<td>MATH 122 Calculus for Science and Engineering</td>
</tr>
<tr>
<td>PHYS 121 General Physics I</td>
</tr>
<tr>
<td>PHED 102 Physical Education Activities</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

| Sophomore Year                           | **Class-Lab-Credit Hours** |
| Fall                                     | (3-0-3)                  |
| GER: Humanities or Social Science Sequence I | (3-0-3)               |
| MATH 223 Calculus for Science and Engineering III | (3-0-3)             |
| MATH 307 Abstract and Linear Algebra I    | (3-0-3)                  |
| PHYS 122 General Physics II              | (4-0-4)                  |
| Open elective                            | (3-0-3)                  |
| Total                                     | (16-0-16)                |
| Spring                                   | (3-0-3)                  |
| GER: Humanities or Social Science Sequence II | (3-0-3)               |
| MATH 224 Elementary Differential Equations | (3-0-3)                 |
| MATH 308 Abstract and Linear Algebra II   | (3-0-3)                  |
| PHYS 221 General Physics III             | (3-0-3)                  |
| Approved elective                        | (3-0-3)                  |
| Total                                     | (15-0-15)                |

| Junior Year                              | **Class-Lab-Credit Hours** |
| Fall                                     | (3-0-3)                  |
| GER: Humanities or Social Science Sequence III | (3-0-3)      |
| MATH 321 Fundamentals of Analysis I       | (3-0-3)                  |
| Approved elective                        | (3-0-3)                  |
| Approved elective                        | (3-0-3)                  |
| Open elective                            | (3-0-3)                  |
| Total                                     | (15-0-15)                |
| Spring                                   | (3-0-3)                  |
| GER: Humanities or Social Science Sequence IV | (3-0-3)            |
| MATH 322 Fundamentals of Analysis II      | (3-0-3)                  |
| MATH 324 Introduction to Complex Analysis | (3-0-3)                  |
| or MATH 425 Complex Analysis I            | (3-0-3)                  |
| Open elective                            | (3-0-3)                  |
| Open elective                            | (3-0-3)                  |
| Total                                     | (15-0-15)                |

| Senior Year                              | **Class-Lab-Credit Hours** |
| Fall                                     | (3-0-3)                  |
| GER: Humanities or social science elective | (3-0-3)               |
| Approved elective                        | (3-0-3)                  |
| Approved elective                        | (3-0-3)                  |
| Open elective                            | (3-0-3)                  |
| Open elective                            | (3-0-3)                  |
| Total                                     | (18-0-18)                |
| Spring                                   | (3-0-3)                  |
| GER: Humanities or social science elective | (3-0-3)               |
| Approved elective                        | (3-0-3)                  |
| Approved elective                        | (3-0-3)                  |
| Open elective                            | (3-0-3)                  |
| Open elective                            | (3-0-3)                  |
| Total                                     | (15-0-15)                |

Hours required for graduation: 126.

a. A suitable open elective is MATH 150. Mathematics from a Mathematician’s Perspective. This course must be taken during the FRESHMAN year to count towards the 50 hours requirement for mathematics courses.
b. One of these courses must be a humanities/social science elective.
c. Selected students may be invited to take the honors sequence, PHYS 123, 124, 223, in place of PHYS 121, 122, 221.
d. These two courses must be one of the following sequences: ASTR 201-202, CHEM 105-106, CHEM 107-108, GEOL 110 and one of GEOL 115, 210.
e. BIOC 314, BIOL 111, CHEM 113, GEOL 119, PHYS 203 are appropriate.
Graduate Programs

The department offers programs leading to the Master of Science and Doctor of Philosophy degrees. At the master’s level there are two degrees: the degree of Master of Science in Mathematics and the degree of Master of Science in Applied Mathematics.

Doctor of Philosophy and Master of Science in Mathematics

The Ph.D. program is designed for students who intend to pursue a career in either pure or applied mathematics. The candidate must pass qualifying examinations in approved subjects; demonstrate a reading knowledge of an approved foreign language; and must present a doctoral dissertation representing significant original research. Candidates for the M.S. degree must complete 27 semester hours of approved courses and successfully pass a comprehensive examination. Throughout the student’s graduate career in the department, his or her work will be closely supervised by a faculty advisor.

Research and Teaching

The Department of Mathematics at Case Western Reserve University is an active center for mathematical research. Faculty conduct research in algebra, applied mathematics, analysis, geometry and topology, and probability.

Mathematics (MATH)

Undergraduate Courses

MATH 110. Introduction to Mathematical Communication and Software (1)

MATH 120. Elementary Functions and Analytic Geometry (3)
Polynomial, rational, exponential, logarithmic, and trigonometric functions (emphasis on computation, graphing, and location of roots) straight lines and conic sections. Primarily a precalculus course for the student without a good background in trigonometric functions and graphing and/or analytic geometry. Not open to students with credit for MATH 121 or MATH 125. Prereq: Three and one half years of high school mathematics.

MATH 121. Calculus for Science and Engineering I (4)
Functions, analytic geometry of lines and polynomials, limits, derivatives of algebraic and trigonometric functions. Definite integral, antiderivatives, fundamental theorem of calculus, change of variables. Prereq: Three and one half years of high school mathematics.

MATH 122. Calculus for Science and Engineering II (4)
Continuation of MATH 121. Exponentials and logarithms, growth and decay, inverse trigonometric functions, related rates, basic techniques of integration, area and volume, polar coordinates, parametric equations. Taylor polynomials and Taylor’s theorem. Prereq: MATH 121.

MATH 123. Calculus I (4)
Limits, continuity, derivatives of algebraic and transcendental functions, including applications, basic properties of integration. Techniques of integration and applications. Prereq: Placement by the department.

MATH 124. Calculus II (4)

MATH 125. Mathematics I (4)
Discrete and continuous probability; differential and integral calculus of one variable; graphing, related rates, maxima and minima. Integration techniques, numerical methods, volumes, areas. Applications to the physical, life, and social sciences. Students planning to take more than two semesters of introductory mathematics should take MATH 121. Prereq: Three and one half years of high school mathematics.

MATH 126. Mathematics II (4)

MATH 150. Mathematics from a Mathematician’s Perspective (3)
An interesting and accessible mathematical topic not covered in the standard curriculum is developed. Students are exposed to methods of mathematical reasoning and historical progression of mathematical concepts. Introduction to the way mathematicians work and their attitude toward their profession. Should be taken in freshman year to count toward a major in mathematics. Prereq: Three and one half years of high school mathematics.

MATH 201. Introduction to Linear Algebra (3)
Matrix operations, systems of linear equations, vector spaces, subspaces, bases and linear independence. Eigenvalues and eigenvectors, diagonalization of matrices, linear transformations, determinants. Less theoretical than MATH 307. May not be taken for credit by mathematics majors. Only one of MATH 201 or MATH 307 may be taken for credit. Prereq: MATH 120 or MATH 126.

MATH 223. Calculus for Science and Engineering III (3)

MATH 224. Elementary Differential Equations (3)

MATH 227. Calculus III (3)

MATH 228. Differential Equations (3)
Elementary ordinary differential equations: first order equations; linear systems; applications; numerical methods of solution. Prereq: MATH 227. Only one of MATH 201 or MATH 307 may be taken for credit. Prereq: MATH 120 or MATH 126.

MATH 234. Differential Equations and Dynamical Systems (3)
An introductory course in discrete and continuous dynamics (difference and differential equations). One dimensional differential equations; dynamics; linear equations, separable equations; numerical methods. Systems of differential equations in two dimensions: dynamics of autonomous systems, numerical methods, solution of constant coefficient linear systems, with and without forcing. Laplace transforms and convolution. Discrete dynamics; introduction to chaos, numerical methods as difference equations. Linear difference equations in one and two dimensions, z-transform, convolution. Prereq: MATH 223.

MATH 301. Undergraduate Reading Course (1-3)
Students must obtain the approval of a supervising professor before registration. More than one credit hour must be approved by the undergraduate committee of the department.

MATH 302. Problem Solving Seminar (1)
A seminar devoted to methods of solving problems in various areas of mathematics. Content varies. Students may take this course for credit up to four times.

MATH 303. Elementary Number Theory (3)
Primes and divisibility, theory of congruencies, and number theoretic functions. Diophantine equations, quadratic residue theory, and other topics determined by student interest. Emphasis on problem solving (formulating conjectures and justifying them). Prereq: MATH 122.
MATH 304. Discrete Mathematics (3)
A general introduction to basic mathematical terminology and the techniques of abstract mathematics in the context of discrete mathematics. Topics introduced are mathematical reasoning, Boolean connectives, deduction, mathematical induction, sets, functions and relations, algorithms, graphs, combinatorial reasoning. Prereq: MATH 122 or MATH 126.

MATH 307. Introduction to Abstract Algebra I (3)
First semester of an integrated, two-semester theoretical course in abstract and linear algebra, studied on an axiomatic basis. The major algebraic structures studied are groups, rings, fields, modules, vector spaces, and inner product spaces. Topics include homomorphisms and quotient structures, the theory of polynomials, canonical forms for linear transformations and the principal axis theorem. This course is required of all students majoring in mathematics. Only one of MATH 201 or MATH 307 may be taken for credit. Prereq: MATH 122.

MATH 308. Introduction to Abstract Algebra II (3)

MATH 321. Fundamentals of Analysis I (3)
Abstract mathematical reasoning in the context of analysis in Euclidean space. Introduction to formal reasoning, sets and functions, and the number systems. Sequences and series; Cauchy sequences and convergence. Required for all mathematics majors. Prereq: MATH 223.

MATH 322. Fundamentals of Analysis II (3)

MATH 323. Advanced Calculus (3)

MATH 324. Introduction to Complex Analysis (3)

MATH 327. Convexity and Optimization (3)
Introduction to the theory of convex sets and functions and to the extremum problems in areas of mathematics where convexity plays a role. Among the topics discussed are basic properties of convex sets (extreme points, facial structure of polytopes), separation theorems, duality and polars, properties of convex functions, minima and maxima of convex functions over convex set, various optimization problems. Prereq: MATH 223 or consent.

MATH 330. Scientific Computing: Fundamentals and Applications (3)
An introductory survey to Scientific Computing, from principles to applications. Topics include accuracy and efficiency, conditioning and stability, numerical solution of linear and nonlinear systems, optimization, interpolation, quadrature rules, numerical solutions of ODEs and PDEs. Coreq: MATH 224.

MATH 338. Introduction to Dynamical Systems (3)
Nonlinear discrete dynamical systems in one and two dimensions. Chaotic dynamics, elementary bifurcation theory, hyperbolicity, symbolic dynamics, structural stability, stable manifold theory. Prereq: MATH 223.

MATH 343. Theoretical Computer Science (3)
Introduction to mathematical logic, different classes of automata and their correspondence to different classes of formal languages, recursive functions and computability, assertions and program verification, denotational semantics. MATH/EECS 343 and MATH 410 cannot both be taken for credit. Prereq: MATH 304 and EECS 340. Cross-listed as EECS 345.

MATH 345. Introduction to Applied Mathematics (3)

MATH 350. Domain Theoretic Methods for Artificial Intelligence (3)

MATH 363. Knot Theory (3)
An introduction to the mathematical theory of knots and links, with emphasis on the modern combinatorial methods. Reidemeister moves on link projections, ambient and regular isotopies, linking number, tricolorability, rational tangles, braids, torus knots, seifert surfaces and genus, the knot polynomials (bracket, X, Jones, Alexander, HOMFLY), crossing numbers of alternating knots and amphicheirality. Connections to theoretical physics, molecular biology, and other scientific applications will be pursued in term projects, as appropriate to the background and interests of the students. Prereq: MATH 222.

MATH 380. Introduction to Probability (3)

MATH 381. Introduction to Mathematical Methods in Finance (3)

MATH 399. Special Topics (3)
Special Topics in Mathematics

Graduate Courses

MATH 401. Abstract Algebra I (3)
Basic properties of groups, rings, modules and fields. Isomorphism theorems for groups; Sylow theorems; nil potency and solvability of groups; Jordan-Holder theorem; Gauss lemma and Eisenstein's criterion; finitely generated modules over principal ideal domains with applications to abelian groups and canonical forms for matrices; categories and functors; tensor product of modules, bilinear and quadratic forms; field extensions; fundamental theorem of Galois theory, solving equations by radicals. Prereq: MATH 308.

MATH 402. Abstract Algebra II (3)
A continuation of MATH 401. Prereq: MATH 401.

MATH 406. Mathematical Logic and Model Theory (3)

MATH 408. Introduction to Cryptology (3)
Introduction to the mathematical theory of secure communication. Topics include: classical cryptographic systems; one-way and trapdoor func-
tions: RSA, DSA, and other public key systems; Primality and Factorization algorithms; birthday problem and other attack methods; elliptic curve cryptosystems; introduction to complexity theory; other topics as time permits. Prereq: MATH 305.

MATH 410. Automata and Formal Languages (3)
Finite automata, Turing and Post machines, and pushdown automata. The languages generated, accepted, and decided by these machines. Closure properties. Decidability and undecidability. Regular expressions. Right linear, unrestricted, and context-free grammars. MATH 410 and MATH/EECS 343 cannot both be taken for credit. Prereq: MATH 304. Cross-listed as EECS 440.

MATH 413. Graph Theory (3)
Building blocks of a graph, trees, connectedness, transversability connectedness, transversability, matching, coverings, planarity, and NP-complete problems; various applications and algorithms. Prereq: MATH 201 or MATH 308.

MATH 415. Group Representation Theory (3)
Representation and character theory of finite groups and certain (infinite) compact groups. Fundamental concepts and methods of the theory together with examples which are useful, particularly in quantum chemistry or physics. Suitable for undergraduates and graduates who have some acquaintance with linear algebra and group theory. Prereq: MATH 308.

MATH 421. Fundamentals of Analysis I (3)
(See MATH 321.) Additional work required. (May not be taken for credit by graduate students in the Department of Mathematics.) Coreq: MATH 323.

MATH 422. Fundamentals of Analysis II (3)
(See MATH 322.) Additional work required. (May not be taken for credit by graduate students in the Department of Mathematics.) Prereq: MATH 321.

MATH 423. Introduction to Real Analysis I (3)

MATH 424. Introduction to Real Analysis II (3)

MATH 425. Complex Analysis I (3)
Analytic functions. Integration over paths in the complex plane. Index of a point with respect to a closed path; Cauchy’s theorem and Cauchy’s integral formula; power series representation; open mapping theorem; singularities; Laurent expansion; residue calculus; harmonic functions; Poisson’s formula; Riemann mapping theorem. More theoretical and at a higher level than MATH 324. Prereq: MATH 322.

MATH 427. Convexity and Optimization (3)
(See MATH 327.) Cross-listed as OPRE 427.

MATH 428. Fourier Analysis (3)

MATH 431. Introduction to Numerical Analysis I (3)
Numerical linear algebra for scientists and engineers. Matrix and vector norms, computer arithmetic, conditioning and stability, orthogonality.

Least squares problems: QR factorization, normal equations and Singular Value Decomposition. Direct solution of linear system: Gaussian elimination and Cholesky factorization. Eigenvalues and eigenvectors: the QR algorithm, Rayleigh quotient, inverse iteration. Introduction to iterative methods. Students will be introduced to MATLAB. Prereq: MATH 201 or MATH 308.

MATH 432. Numerical Differential Equations (3)

MATH 433. Numerical Solutions of Nonlinear Systems and Optimization (3)
The course provides an introduction to numerical solution methods for systems of nonlinear equations and optimization problems. The course is suitable for upper-undergraduate and graduate students with some background in calculus and linear algebra. Knowledge of numerical linear algebra is helpful. Among the topics which will be covered in the course are Nonlinear systems in one variables; Newton’s method for nonlinear equations and unconstrained minimization; Quasi-Newton methods; Global convergence of Newton’s methods and line searches; Trust region approach; Secant methods; Nonlinear least squares. Prereq: MATH 223, MATH 201, MATH 451 or permission.

MATH 434. Optimization of Dynamic Systems (3)

MATH 445. Introduction to Partial Differential Equations (3)
Continuation of MATH 445. Linear and nonlinear partial differential equations, with emphasis on applications. Variational methods; asymptotic and perturbation methods; regular and singular perturbations; boundary layer, multiple scales, method of geometric optics and stationary phase. Applications to fluid dynamics, elasticity; optics; wave propagation. Topics depend upon instructor and may vary from year to year. Appropriate for seniors and graduate students in science, engineering and mathematics. Prereq: MATH 201 and MATH 224.

MATH 448. Applied Partial Differential Equations (3)
Continuation of MATH 445. Linear and nonlinear partial differential equations, with emphasis on applications. Variational methods; asymptotic and perturbation methods; regular and singular perturbations; boundary layer, multiple scales, method of geometric optics and stationary phase. Applications to fluid dynamics, elasticity; optics; wave propagation. Topics depend upon instructor and may vary from year to year. Appropriate for seniors and graduate students in science, engineering and mathematics. Prereq: MATH 445.

MATH 450. Domain Theoretic Methods for Artificial Intelligence (3)

MATH 452. Continuum Mechanics (3)

MATH 460. Mathematics and the Imaginative (3)
This course explores mathematical ideas in geometry, algebra, and combinatorics relating to content areas in the secondary school curriculum. The course is structured around a series of problems and projects not generally covered in the undergraduate curriculum. This course is de-
signed for present and future mathematics teachers in secondary schools. It is offered as an intensive, three-week seminar. Requirements for the class include daily reading assignments and problems taken from the readings. Considerable time will be devoted to group work. Each student will be required to prepare a report and make a 30-minute presentation to the class on a topic relevant to the materials developed in the course.

**MATH 461. Introduction to Topology (3)**


**MATH 462. Algebraic Topology (3)**

The fundamental group and covering spaces; van Kampen’s theorem. Higher homotopy groups; long-exact sequence of a pair. Homology theory; chain complexes; short and long exact sequences; Mayer-Vietoris sequence. Homology of surfaces and complexes; applications. Prereq: MATH 461.

**MATH 465. Differential Geometry (3)**

Manifolds and differential geometry. Vector fields; Riemannian metrics; curvature; intrinsic and extrinsic geometry of surfaces and curves; structural equations of Riemannian geometry; the Gauss-Bonnet theorem. Prereq: MATH 321.

**MATH 467. Differentiable Manifolds (3)**

Differentiable manifolds and structures on manifolds. Tangent and cotangent bundle; vector fields; differential forms; tensor calculus; integration and Stokes’ theorem. May include Hamiltonian systems and their formulation on manifolds; symplectic structures; connections and curvature; foliations and integrability. Prereq: MATH 322.

**MATH 469. Calculus of Variations (3)**

Examples of variational problems; variation of a functional; linear spaces; Frechet derivative; Euler Lagrange equations; Lagrange multipliers; Hamiltonian formulation; canonical coordinates; Noether’s theorem; second variation; conjugate points; direct methods. Other topics such as existence and regularity of solutions; Sobolev spaces; depending on audience. Prereq: MATH 224.

**MATH 471. Advanced Engineering Mathematics (3)**


**MATH 475. Mathematics of Imaging in Industry and Medicine (3)**

The mathematics of image reconstruction; properties of radon transform, relation to Fourier transform; inversion methods, including convolution, backprojection, rho-filtered layergram, algebraic reconstruction technique (ART), and orthogonal polynomial expansions. Reconstruction from fan beam geometry limited angle techniques used in NMR; survey of applications. Prereq: PHYS 431 and MATH 345 or MATH 471.

**MATH 487. Stochastic Processes in Engineering and Science (3)**


**MATH 491. Probability I (3)**


**MATH 492. Probability II (3)**


**MATH 495. Combinatorics (3)**


**MATH 499. Special Topics (3)**

Special topics in mathematics.

**MATH 501. Topics in Algebra (3)**

Selected topics from fields, rings, and modules. Prereq: MATH 402.

**MATH 527. Functional Analysis (3)**

Selected topics in Functional Analysis. Prereq: MATH 424 and MATH 425.

**MATH 563. Topology Seminar (1-3)**

Continuing seminar on areas of current interest in topology and geometry. Topics may include: minimal submanifolds; hyperbolic geometry and diffeomorphisms of surfaces; global analysis; discrete dynamical systems; gauge theory; symplectic geometry; closed geodesics. May be taken more than once for credit.

**MATH 601. Reading and Research Problems (1-18)**

Presentation of individual research, discussion, and investigation of research papers in a specialized field of mathematics.

**MATH 651. Thesis (M.S.) (1-18)**

**MATH 701. Dissertation (Ph.D.) (1-18)**

**MATH 702. Appointed Dissertation Fellow (9)**

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Department of Modern Languages and Literatures

Chinese
Comparative Literature
French
German
Hebrew
Italian
Japanese
Russian
Spanish

201 Guilford House
Phone 216-368-3071; Fax 216-368-2216
Marie Lathers, Chair

Faculty
Marie Lathers, Ph.D. (Brown University)

**Treuhaft Professor of French and Comparative Literature, Chair of the Department**

Women and the visual arts; Nineteenth—twentieth-century French literature and the arts (painting, sculpture, photography, film); Gender, science, and technology; Feminist theory

David P. Benseler, Ph.D. (University of Oregon)

**Émile B. de Saucé Professor of Modern Languages**

German literature, emphasis on eighteenth- and nineteenth-century drama and prose; folklore and tales; modern German culture; methods and bibliography; history of the profession.
Programs

The Department of Modern Languages and Literatures offers courses of study leading to the Bachelor of Arts with a major or minor in comparative literature, French, German, Japanese, and Spanish. In addition, course work or a minor is available in Chinese, Hebrew, Italian, and Russian. Unless an individual General Bulletin description indicates otherwise, all courses on the 200 level and higher in modern languages and literatures are taught primarily in the language being learned. In addition to class meetings, language resource center attendance is an integral part of all elementary and intermediate language courses taught by the department. At the graduate level, the Master of Arts degree may also be earned as detailed below. Career opportunities exist in college and university teaching, translation and interpretation, diplomatic and other government service, and business, and are often enhanced by a double major, one of which is a modern language.

Teacher Licensure Option

A program leading to Teacher Licensure in French (K-12) is also available. Students participating in the teacher licensure program complete a 45-47 semester hour major in French, including course work in French language, culture, and literature, and a 35-hour sequence in professional education. Course work in French begins in the freshman year with a language course appropriate to the student's proficiency level and continues until the student has completed a range of upper-level courses and has met the goals of the program. Students are strongly urged to complete some of their course work in a French-speaking country and are assisted in identifying opportunities for study abroad. Interested students should contact Professor Marie Lathers. The professional education component (see Education [EDUC & EDJC] for overview and course requirements) begins with a sequence taken on campus, followed by 23 semester hours at John Carroll University, culminating in the student teaching requirements.

Subject Area Requirements (select from):

* Required only for students who begin their French Major at the Intermediate Level.
**Students at the Intermediate (200) Level select five courses (15 credit hours); students entering the program at the Advanced (300) Level select seven courses (21 credit hours).

Departmental Objectives

The department (DMLL) offers students key components of a liberal arts education by helping them learn additional languages, compare literatures, and study cultures. Students become informed citizens of a diverse world, individuals who are able to compete in and enjoy a wide variety of linguistic and global contexts. We encourage students both to embark on a new language and also to build on their prior knowledge. The department enjoys strong interdisciplinary ties with Asian Studies, French Studies, German Studies, International Studies, and Women's Studies (all described elsewhere in this Bulletin). The department is proud of its German Program Abroad, "The Munich Experience" (offered every two years) and its program in France, "The Bordeaux Experience."

The principal objectives of the department are: 1) to prepare students for lifelong learning in an increasingly multilingual, multicultural world by enabling them to learn to understand, speak, read, and write the language(s) of their choice; 2) to teach selected world cultures and their literatures, both in the original...
language(s) and in translation; 3) to encourage students to study abroad in order to reinforce and strengthen their language skills and to acquire new cultural perspectives and appreciation; 4) to prepare students for graduate study in a number of disciplines; 5) to work as closely as possible with other University departments to provide their majors with useful ancillary skills in languages, literatures, and cultures.

Placement Procedure
Students with prior experience in French, German, and or Spanish, however gained (e.g. in high school with or without AP courses, at another institution, via study abroad, etc.), must take a placement examination before the first week of the semester in which they enroll in one of those languages. Placement depends both on examination results and on consultation with individual faculty members. For exact information on placement testing, please contact, Professor Peter Yang, Director of the Language Resource Center.

Undergraduate Programs

Major in Comparative Literature
Majors in comparative literature must complete the following requirements.
1) One sequence: CMPL 211-212, CMPL 290-291, or ENGL 200 and one of those CMPL courses;
2) Language (minimum of four hours): 202 in any language taught in the department. 3) Electives in literature (24 hours): these are to be selected with the approval of the student’s advisor from CMPL, ENGL, JAPN, LITR, FRCH, GRMN, and SPAN offerings. At least 21 hours of electives must be at the 300-level or above, including four 300-level courses in FRCH, GRMN, JAPN, or SPAN as available.

Minor In Comparative Literature (Bachelor of Arts)
Requirements include five 200 and 300 courses in CMPL, including at least CMPL 211-212, CMPL 290-290, or a combination of one of those courses and ENGL 200. Total hours required for the minor: 15.

Major in French, German, Japanese Studies, or Spanish (30-32 hours)
Majors in French, German, Japanese Studies, and Spanish are expected: 1) to acquire the ability to understand, speak, read, and write the language(s) of their choice; 2) to develop a sound understanding of their cultures and literatures. The major in French, German, Japanese Studies, or Spanish consists of 30-32 hours of course work and will vary based on students’ background in the language. Individual counseling and placement tests are provided by the department.

For students placed into the 200-level: 201-202 and eight courses at the 300-level taught in the target language; (or six 300-level courses, plus two CMPL or other related courses).

Related courses are those outside the DMLL offerings which are closely related to French, German, Japanese, Spanish, or Latin American culture as well as those inside DMLL offered in another language or literature. For students placed into the 300-level: ten 300-level courses taught in the language; (or eight 300-level courses plus two CMPL courses or other related courses.)

Minors in Modern Languages (CHIN, FRCH, GRMN, ITAL, JAPN, RUSN, SPAN: 15-19 hours)
The academic policy of Case Western Reserve University is to award credit for a 101 course in any language only upon completion of 102 in that language.
For students placed at the introductory level (no previous knowledge of the language): 101, 102, 201, 202 and one 300-level course.
For students placed at the 200-level or higher: five courses at the 200 and 300 levels.
Hebrew language courses may count toward the minor in Judaic Studies.

Undergraduate Honors in Modern Languages and Literatures
The Departmental Honors Program is for especially talented and dedicated majors. Requirements for Honors in Modern Languages and Literatures are: 1) a grade point average of at least 3.5 in the major; 2) an honors thesis (six semester hours of CMPL, FRCH, GRMN, JAPN, or SPAN 398 or 399 beyond the 30-32 hours required for the major) devoted to the investigation of a literary, linguistic, or cultural topic. The thesis must be read and approved by two readers and will be accepted for honors only if it achieves a grade of B or better. Students who qualify receive their degree “with Honors in Modern Languages and Literatures.” A registration form for students electing Honors in Modern Languages and Literatures is available in the departmental office.

Integrated Graduate Studies Program
The Department of Modern Languages and Literatures participates in the Integrated Graduate Studies Program, which makes it possible to complete both a B.A. and an M.A. in Modern Languages and Literatures within about five years of full-time study. The department particularly recommends the program to qualified students who are interested in seeking admission to highly-competitive professional schools or Ph.D. programs. Interested students should note the general requirements and the admission procedures listed elsewhere in this publication.

Graduate Programs
The department offers the Master of Arts degree in French, German, and Spanish and is authorized for doctoral studies as well. The Master of Arts in comparative literature is administered jointly by the Department of English and the Department of Modern Languages and Literatures. Engineering Core Requirements
Three courses in sequence beginning on the 100-level in any language; or, 201, 202, and one 300-level course in the same language; or, 202 and two 300-level courses in the same language; or three 300-level courses in the same language.

Chinese Courses (CHIN)

CHIN 101. Elementary Chinese I (4)
(Credit for CHIN 101 only upon completion of CHIN 102.) Introductory course in speaking, understanding, reading and writing Chinese. Students are expected to achieve control of the sound system and basic sentence patterns of standard Mandarin Chinese. The course emphasizes speaking and aural comprehension.

CHIN 102. Elementary Chinese II (4)
Continuation of CHIN 101.
CHIN 201. Intermediate Chinese I (4)
Emphasizes basic structures of standard Mandarin Chinese; helps students improve reading, writing, listening and speaking abilities. Chinese culture, society, and people introduced through supplementary materials and activities. Prereq: CHIN 102 or equivalent.

CHIN 202. Intermediate Chinese II (4)
Continuation of CHIN 201. Students must attend Language Resource Center in addition to class meetings. Prereq: CHIN 201.

CHIN 301. Advanced Chinese I (4)
Students work to achieve fluency in listening, speaking, reading and writing. Students must attend Language Resource Center in addition to class meetings. Prereq: CHIN 202 or equivalent.

CHIN 302. Advanced Chinese II (4)
Continuation of CHIN 301.

CHIN 303. Topics in Chinese (3)

CHIN 304. Topics in Chinese (3)

CHIN 399. Independent Studies (1-3)
Directed study for those students who have progressed beyond available course offerings. Prereq: Permission of department.

Comparative Literature Courses (CMPL)

Undergraduate

CMPL 190. Introduction to Comparative Lit (3)
An introduction to one or more theoretical approaches to literature, combined with practical applications.

CMPL 211. Great Books: Middle Ages to 1600 (3)
St. Augustine; concentration on Dante and major texts of the Renaissance, such as Boccaccio, Machiavelli, Rabelais, Erasmus, and Montaigne.

CMPL 212. Great Books: 1600 to Present (3)
Readings of major authors, such as Behn, Voltaire, Goethe, and selected writers and thinkers from the 17th century to the present.

CMPL 215. Japanese Popular Culture (3)
This course highlights salient aspects of modern Japanese popular culture as expressed in animation, comics and literature. The works examined include films by Hayao Miyazaki, writings by Kenji Miyazawa and Banana Yoshimoto. The course introduces students to essential aspects of modern Japanese popular culture and sensibility. Cross-listed as JAPN 215.

CMPL 228. Theater History I (3)
Prereq: THTR 123 and THTR 124.

CMPL 229. Theater History II (3)
Modern periods in Western theater history, from the sixteenth century to the turn of the twentieth. This course investigates materials, texts, and artifacts of theaters from the Renaissance to the Modern era. Cross-listed as THTR 229.

CMPL 230. Asian Cinema and Drama (3)
Introduction to major Asian film directors and major traditional theatrical schools of India, Java/Bali, China and Japan. Focus on the influence of traditional dramatic forms on contemporary film directors. Development of skills in cross-cultural analysis and comparative aesthetics. Cross-listed as ASIA 230.

CMPL 240. Modern Japanese Literature in Translation (3)
(See JAPN 240.) Cross-listed as JAPN 240.

CMPL 241. Classical Japanese Literature in Translation (3)
Readings, in English translation, of classical Japanese poetry, essays, narratives, and drama to illustrate essential aspects of Japanese culture and sensibility before the Meiji Restoration (1868). Lectures explore the sociohistorical contexts and the character of major literary genres; discussions focus on interpreting the central images of human value within each period. Japanese sensibilities compared/contrasted with those of Western and other cultures. Cross-listed as JAPN 241.

CMPL 275. Postcolonial Francophone Literature (3)
Study of literary and cinematic works from the postcolonial Francophone world. Includes examination of the issue of identity (individual, cultural, national) and of the ways these works negotiate their respective cultural and colonial legacies. May include writers such as Beyala, ben Jelloun, Conde, Ba, Cesaire, and Khatibi.

CMPL 290. Masterpieces of Continental Fiction (3)
Major works of fiction from the 19th century and earlier. Cross-listed as ENGL 290.

CMPL 291. Masterpieces of Modern Fiction (3)
Major works of fiction of the 20th century. Cross-listed as ENGL 291.

CMPL 300. Turning-points in Modern Culture (3)
Focus on major west European cities as catalysts and reflectors of cultural and historical change; in-depth study of theory and practice using literature, music, painting, and philosophy: e.g., Vienna at the Turn of the Century; Berlin and the Weimar Republic; Paris at the Turn of the Century.

CMPL 314. Love Poetry from Sappho to Shakespeare (3)
Introduction to the love poetry of ancient Greece and Rome and its impact on the later European tradition in such poets as Petrarch, Chaucer, and Shakespeare. Readings will focus especially on questions of generic convention, audience expectation, and the social setting of love poetry in the different ages under consideration. No knowledge of the original languages required. Cross-listed as CLSC 314.

CMPL 315. Utopia and Utopianism (3)
Sir Thomas More’s Utopia (1515) inaugurated a literary genre depicting the ideal community. This class traces this genre from More to recent science fiction (Pierce, Calvino, Butler), pausing to consider the writings of the “Utopian socialists” (Saint Simon, Fourier).

CMPL 330. Studies in Fiction: The Novella (3)
Development of the novella since Boccaccio and Cervantes; emphasis on 19th and 20th century German and Russian authors (Goethe, Mann, Kafka, Dostoevsky, Tolstoy, Chekhov, and others); some French, Spanish, and Italian novellas. Taught in English, with additional instruction for students reading texts in the original language.

CMPL 338. Trends in Recent Fiction (3)
Readings, in English translation, of contemporary fiction from around the world; analysis and comparison of recent literary trends in various national settings.

CMPL 341. Japanese Women Writers (3)
Contributions of women writers to the literature of pre-modern and modern Japan; investigations of how their works exemplify and diverge from “mainstream” literary practices. Emphasis on the social and cultural contexts of the texts. Cross-listed as JAPN 341.

CMPL 361. Modern Japanese Novels and the West (3)
Comparing a selection of modern Japanese novels with their western counterparts, this course will clarify Japan’s premodern sensibility and its transformation after the Meiji Restoration (1868). Comparisons will focus on a group of interrelated themes such as modernity/modernism, alienation, innocence, death, male-female relationships, and Nature. All readings are in English translation. No prior training in Japanese language or culture required.

CMPL 368A. Introduction to Film Studies (3)
(See ENGL 368A.) Cross-listed as ENGL 368A.

CMPL 368C. Topics in Film (3)
Individual topics in film, such as a particular national cinema, images of women in film, film comedy, New Wave film, literature and film. Maximum 12 credits. Prereq: ENGL 150. Cross-listed as ENGL 368C.

CMPL 371. Philosophy and Literature (3)
Affinities and tensions between philosophy and literature and issues that arise in their interface. Topics include: philosophical use of literary devices; literary use of philosophical ideas; literary philosophy and philosophical literature; and hermeneutics of literature and philosophy. Readings in philosophy and literature from both traditional and contemporary sources. Team-taught by faculty of the philosophy and literature departments. Cross-listed as PHIL 370.
CMPL 390. Topics in Comparative Lit (3)
In-depth examination of specific critical and literary theories and of their relevance for literature and culture studies. Authors, works and instructor may vary.

CMPL 399. Independent Studies (1-3)
For qualified students with special interests and commitments that are not fully addressed in regular courses. Directed readings and meetings with instructor as arranged. Prereq: Consent of department.

Graduate

CMPL 430. Studies in Fiction: The Novella (3)
(See CMPL 330.)

CMPL 438. Trends in Recent Fiction (3)
(See CMPL 338.)

CMPL 490. Topics in Comparative Lit (3)
In-depth examination of specific critical and literary theories and of their relevance for literature and culture studies. Authors, works and instructor may vary.

CMPL 590. Seminar in Comparative Literature (3)
Comparative study of at least two cultures or literary traditions. Topics vary depending on student and instructor interests; may include French and American film, Spanish and French postcolonial literature, French and British romanticism. Taught in English. Prereq: Graduate standing.

CMPL 595. Independent Studies (1-3)
For qualified graduate students with special interests and commitments that are not fully addressed in regular courses. Directed readings and meetings. Prereq: Graduate standing. Coreq: Consent of department.

CMPL 601. Independent Study (1-18)
Prereq: Consent of department.

French Courses (FRCH)

Undergraduate

FRCH 101. Elementary French I (4)
(Credit for FRCH 101 only upon completion of FRCH 102.) Emphasizes conversational skills. Students expected to achieve control of sound system and basic sentence structures of French. Students must attend Language Resource Center in addition to scheduled class meetings.

FRCH 102. Elementary French II (3)

FRCH 201. Intermediate French I (4)
Intensive review of grammar and usage through readings, discussions and other activities that emphasize contemporary French life. Students must attend Language Resource Center in addition to scheduled class meetings. Prereq: FRCH 102 or equivalent.

FRCH 202. Intermediate French II (4)
A continuation of FRCH 201, the course focuses on the acquisition of intermediate-level skills in language and culture while providing insights into the nature of language. Participation in multi-media activities in Language Resource Center is a requirement. Prereq: FRCH 201 or equivalent.

FRCH 308. Supervised Study in France (3)
Three-week immersion learning experience living and studying in France, specifically in Bordeaux. Students devote three hours per day to formal study of the French language and its culture while taking advantage of the numerous cultural institutions of the city and the surrounding countryside. Prereq: FRCH 202.

FRCH 310. Advanced Composition and Reading (3)
An initiation to the literature of Francophone expression with a focus on close reading. Students engage in the discussion of authentic, unabridged literary texts of compelling interest and progressive length and learn how to express their ideas both orally and in written form. Prereq: FRCH 202.

FRCH 311. Advanced Conversation I (3)
Designed to enhance pronunciation, speaking and listening comprehension through the discussion of French literature and media for children. Required for Teacher candidates. Prereq: FRCH 202 or equivalent.

FRCH 312. Advanced Conversation II (3)
A functional approach to conversation. Students work to develop fluency in spoken French using current colloquial vocabulary and focusing on current issues. Practice in using speech appropriate to a variety of situations, including public debates. Prereq: FRCH 202.

FRCH 314. Translation Techniques (3)
Contrastive grammar analysis and stylistics are used to foster linguistic awareness and to introduce students to the methods and skills of translation. Prereq: FRCH 202 or equivalent.

FRCH 315. Business French (3)
Business French is an upper-level course with a focus on the economic life of France and other Francophone countries. Students gain knowledge of the economic structures and the business organization of Francophone countries as they enhance the linguistic skills used in professional communication. Prereq: FRCH 202.

FRCH 316. Contemporary France (3)
A study of contemporary France, this course features discussions and lectures on a variety of topics (geography, political and social life, contemporary culture) to develop factual knowledge about France and a sound understanding of current issues as presented in the media. Prereq: FRCH 202.

FRCH 317. French Cinema (3)
An exploration of contemporary France, its images and values as presented in French films of the last ten years. French press reviews are used for discussion. A unique linguistic and cultural immersion. Taught in French. Prereq: FRCH 202.

FRCH 318. The Origins of France (3)
Examination through texts, films, and other media of major historical, intellectual, and artistic influences that have shaped the evolution of French civilization. Students will attempt to identify the values and myths that have contributed to the formation of modern France and continue to influence French actions. Prereq: FRCH 202.

FRCH 319. Modern France (3)
A study of France’s political, social and cultural history from the French Revolution to World War II with emphasis on events, movements and people that shaped Modern France. Highly recommended for students of Nineteenth- and Twentieth-Century French Literature. Prereq: FRCH 202.

FRCH 320. Introduction to French Literature (3)

FRCH 321. French Literature to 1600 (3)
Faith. Honor. Politics. An exploration of these issues in French literature from 900 to 1600 in the context of the development of narrative, lyric and theater as an expression of culture and thought. Prereq: Any 300-level FRCH course.

FRCH 331. Seventeenth-Century French Literature (3)
The Age of Classicism, from Descartes to Mme. de Lafayette. Emphasis on Baroque literature and Classical drama. Authors, works and topics may vary. One 300-level French course suggested prerequisite. Prereq: Any 300-level FRCH course.

FRCH 341. Eighteenth-Century French Literature (3)
Le siecle des Lumières in representative texts of the Enlightenment and pre-Romanticism. Authors, works and topics vary. Prereq: Any 300-level FRCH course.

FRCH 351. Nineteenth-Century French Literature (3)
Romanticism, realism and naturalism in the novel and the drama. Authors, works and topics vary. Prereq: Any 300-level FRCH course.

FRCH 361. Twentieth-Century French Literature (3)
Study of representative novelists (e.g., Proust, Gide, Colette, Sartre, Beauvoir) and playwrights (e.g., Claudel, Beckett, Genet) in historical context. Authors, works and topics vary. Prereq: Any 300-level FRCH course.

FRCH 371. Topics in French Poetry (3)
Nineteenth- and twentieth-century poetry. Topics include French romanticism, symbolism and surrealism. Prereq: Any 300-level FRCH course.
FRCH 372. Topics in French Drama (3)
A topical approach to issues and problems specific to drama. Plays, playwrights, aesthetic theories and historical periods studied in this course may vary. Prereq: Any 300-level FRCH course.

FRCH 373. The Novel and the Novella (3)
A study of narrative fiction focused on either the analysis of a particular genre (the novel, the short story) or a particular type of novel (e.g., psychological novel, realist novel, detective novel); the tale (the fantastic tale, the fairytale) or novella. Prereq: Any 300-level FRCH course.

FRCH 374. Major Writers and Literary Movements (3)
In-depth study of the work of a major writer, cineast, or intellectual figure; or of a significant literary, intellectual or artistic movement. Approaches, content, and instructor will vary. Prereq: Any 300-level FRCH course.

FRCH 375. Francophone Literature (3)
An examination of Francophone literature focused on the problematic of identity within the colonial and post-colonial context. Writers and works may vary. Prereq: Any 300-level FRCH course.

FRCH 376. Women Writers (3)
Examination of literary texts by French women writers; emphasizes women’s important contributions to French literature. Critical essays are also studied to address women’s relation to literature and to evaluate its importance from historical and theoretical perspectives. Prereq: Any 300-level FRCH course.

FRCH 377. Special Topics (3)
The special topics course is designed to respond to students’ and faculty’s interest in specific themes or issues not otherwise covered in the curriculum. Approaches, content and instructor will vary. Prereq: Any 300-level FRCH course.

FRCH 398. Honors Thesis (3)
Prereq: Permission of department.

FRCH 399. Directed Reading (1-3)
For students who wish to work independently on a topic, literary or non-literary, in French. Prereq: Permission of department.

Graduate

FRCH 421. French Literature to 1600 (3)
(See FRCH 321.)

FRCH 431. Seventeenth-Century French Literature (3)
(See FRCH 331.)

FRCH 441. Eighteenth-Century French Literature (3)
(See FRCH 341.)

FRCH 451. Nineteenth-Century French Literature (3)
(See FRCH 351.)

FRCH 461. Twentieth-Century French Literature (3)
(See FRCH 361.)

FRCH 471. Topics in French Poetry (3)
(See FRCH 371.)

FRCH 472. Topics in French Drama (3)
(See FRCH 372.)

FRCH 473. The Novel and the Novella (3)
(See FRCH 373.)

FRCH 474. Major Writers and Literary Movements (3)
(See FRCH 374.)

FRCH 475. Francophone Literature (3)
(See FRCH 375.)

FRCH 476. Women Writers (3)
(See FRCH 376.)

FRCH 477. Special Topics (3)
(See FRCH 377.)

FRCH 590. Seminar: Topics in Modern Literature and Culture (3)
French literature and culture since the Revolution of 1789. Topics vary depending on student and instructor interests; may include realism and naturalism, Proust, contemporary film, Paris, feminist theory. Prereq: Graduate standing.

FRCH 595. Independent Research (1-3)
Graded independent work on a literary topic arranged individually with the instructor. Prereq: Graduate standing.

FRCH 601. Independent Studies (1-18)
For individual students or larger groups with special interests. Prereq: Consent of department.

German Courses (GRMN)

Undergraduate

GRMN 101. Elementary German I (4)
(Credit for GRMN 101 only upon completion of GRMN 102.) Introductory course emphasizing conversational skills. Students achieve control of sound system and basic sentence structures of spoken and written German. Students must attend the Language Resource Center in addition to class meetings.

GRMN 102. Elementary German II (4)
Continuation of GRMN 101, emphasizing conversational skills. Prereq: GRMN 101 or equivalent.

GRMN 201. Intermediate German I (4)
Emphasizes both language and culture and is taught in German. Review of grammar and usage of German while studying texts and videotapes which focus on contemporary life in Germany. Prereq: GRMN 102 or equivalent.

GRMN 202. Intermediate German II (4)
Continuation of GRMN 201; conducted in German. Study of texts and videotapes which focus on contemporary life in Germany. Prereq: GRMN 201 or equivalent.

GRMN 208. The Munich Experience: Intermediate Level (3)
A semester seminar class, conducted in German, which culminates with a three-week immersion learning experience spent living and studying in Munich. Students reside with German families, study German daily in a formal setting, and practice comprehension, speaking, reading, and writing. Regular visits to museums, galleries, and cultural events; first-hand observation of history, life, and architecture of a major cultural center; day trips to cultural phenomena and events in the German countryside. Prereq: GRMN 201 or equivalent.

GRMN 303. German Culture and Civilization (3)
Examines aspects of contemporary Germany, including political and social systems and cultural life through study of texts, films, and other media. Prereq: GRMN 202.

GRMN 308. The Munich Experience: Spring Course/Summer Study Advanced Level (3)
A semester seminar class, conducted in German, which culminates with a three-week immersion learning experience spent living and studying in Munich. Students reside with German families, study German daily in a formal setting, and practice comprehension, speaking, reading, and writing. Regular visits to museums, galleries, and cultural events; first-hand observation of history, life, and architecture of a major cultural center; day trips to cultural phenomena and events in the German countryside. Prereq: GRMN 202 or equivalent.

GRMN 310. Advanced Composition and Reading (3)
An advanced-level skills course focusing on reading and writing for students who have already studied intermediate German. Develops abilities to read authentic, unabridged texts and also to produce increasingly sophisticated expository compositions in German. Read contemporary newspaper and magazine articles; practice composition skills by composing objective summaries, reviews, precis, letters, e-mail, short creative texts, and other miscellaneous written forms. Readings increase progressively in length and vary in genre. Includes instruction on use of English and German-language research tools. German-German dictionaries, and study guides. Concludes with a short, sophisticated literary work, such as Fontane’s Effi Briest or Mann’s Death in Venice. Satisfies prerequisite for upper-level Germanics seminars or may be taken simultaneously with an upper-level course (521 or higher); taught in German. Prereq: GRMN 202 or equivalent.
GRMN 311. Advanced Conversation (3)
Students work to improve fluency in spoken German. Topics include contemporary issues; current vocabulary is stressed. Students practice using speech appropriate to various situations. Prereq: GRMN 202 or equivalent.

GRMN 312. German Proficiency Through Drama (3)
Focus on reading, enacting, and discussing of authentic dramatic texts. Readings begin with single scenes and progress to full length radio plays and theater plays which gradually increase in linguistic difficulty and complexity of central themes. Although we will pay attention to the cultural and theatrical milieus from which each play arose, we will focus on the dramatic text as literature and as a text written for performance. Elements of drama, such as dialogue, character and dramatic structure, as well as the genres of tragedy, comedy, and tragicomedy are introduced. Prereq: GRMN 202 or equivalent.

GRMN 313. Introduction to German Literature (3)
Introduction to German literature and the cultural issues it addresses. Prereq: GRMN 202 or equivalent.

GRMN 320. Studies in Narrative (3)
This course examines representative prose works (tales, novellas, short novels, letters, and essays) chosen to present reactions and impressions to social and aesthetic conditions in German-speaking countries and to introduce students to different styles and varieties of German prose. Prereq: One 300-level GRMN course.

GRMN 326. Witches, Weddings, and Wolves (3)
Intensive study of German Folk Tales as collected and altered by the Brothers Grimm. The Maerchen as both children’s and adult literature. Prereq: One 300-level GRMN course.

GRMN 330. The German Novelle (3)
Study of exemplary short prose fiction by authors from the eighteenth to the twentieth century. Continues development of communicative ability in German; introduces students to German literature’s arguably richest genre. Prereq: GRMN 202 or equivalent.

GRMN 331. Topics in German Cinema (3)
Overview of German Cinema from the beginning to the present. Film selection representative of major directors, major periods (such as expressionism or The New German Cinema), particular themes from different historical perspectives, and literature in film. All films are in German. Taught in German. Prereq: GRMN 202 and one GRMN 300-level course or equivalent.

GRMN 340. German Drama (3)
Overview of German drama from the beginning to the present. Explores German plays by applying different disciplinary approaches such as historical, cultural, and literary analyses. All plays are in German. Taught in German. Prereq: GRMN 202 or equivalent.

GRMN 350. German Lyric (3)
This course presents a detailed study of German lyric through the frequent writing of critical papers and literary analysis of the formal elements of poetry: rhyme schemes, diction, meter, figures of speech. The poems selected cover a variety of styles, a range of historical periods, and a sampling of authors. Readings and discussions in German. Prereq: One 300-level GRMN course.

GRMN 360. Major Authors of German Literature (3)
Concentrates on a specific author or small group of authors within an aesthetic or historical context, for example: Goethe, Heine, Bachmann, Junges Deutschland, or die Grupe 47. Examines the breadth of themes and styles and may include literary, philosophical, biographical, and other kinds of texts. Readings and discussions in German. Prereq: One 300-level GRMN course.

GRMN 366. From Lessing to Young Goethe (3)
Theory and literature of the mid-eighteenth century. Focus on the works of Lessing, young Goethe and young Schiller and the writers of the Storm and Stress. Prereq: GRMN 202 or equivalent.

GRMN 367. German Classicism/Romanticism (3)
Selected works of Goethe, Schiller, Hoelderlin, von Kleist, and others. Prereq: GRMN 202.

GRMN 370. Literary Periods (3)
Overview of German literary periods from the beginning to the present. Explores German literary works in all three major genres from the historical, social, and literary perspectives. All works are in German. Taught in German. Prereq: One 300-level GRMN course.

GRMN 375. 19th-Century German Literature (3)
Major works chosen to present prominent themes and problems and/or important developments within the period; topic varies. Prereq: GRMN 202.

GRMN 380. 20th-Century German Literature I (3)
Study of major works chosen to present themes and problems in naturalism, expressionism, and other important literary and cultural developments within the period before World War II. Prereq: GRMN 202 or equivalent.

GRMN 381. Advanced German Culture Studies (3)
Exploration of the culture of the arts, political culture, and the cultural self-expression of the German-speaking countries from their beginnings to the present. Focus: The cultural changes within certain historical periods. Examination of particular aspects such as culture as mass deception in fascist Germany and the GDR, the reflection of contemporary culture in literature and cinema, problems of cultural identity and multiculturalism, and the role of postmodern culture industry and the critical discourse today. Taught in German. Prereq: One 300-level GRMN course.

GRMN 386. 20th-Century German Literature II (3)
Post World War II German literary and cultural developments. Focus on efforts to come to grips with German history from 1933 to German reunification. Prereq: GRMN 202.

GRMN 395. Special Topics (3)
Special topics in German literature, literary criticism, and culture. Prereq: GRMN 202 or equivalent.

GRMN 398. Senior Thesis (3)
An elective which involves the writing of a substantial research paper in German. Exceptional papers may be considered for departmental honors. Prereq: Senior status and consent of department.

GRMN 399. Independent Study in German (1-3)
For majors and advanced students under special circumstances. Prereq: Consent of department.

Graduate

GRMN 405. Literature and Life in Contemporary German-Speaking Countries (3)
Exploration and analysis of selected German, Austrian, and Swiss writers and of the critical and popular media around them. Focus on representative examples of various genres: drama, fiction, autobiographical prose, interviews, lyric poetry; selections from Spiegel, FAZ, Zeit, and other major representatives of the media. Prereq: GRMN 202.

GRMN 408. Supervised Study in Germany (3)
(See GRMN 308.)

GRMN 415. The Female Self: German Women Writers (3)
Intensive study of several German women authors whose writing seeks to delineate a female self. An ultimate objective of the course is to debate the gender-specific approach asking whether women write differently than men and whether we read women authors differently than we do men.

GRMN 426. Witches, Weddings, and Wolves (3)
(See GRMN 326.)

GRMN 430. The German Novelle (3)
(See GRMN 330.)

GRMN 446. From Lessing to Young Goethe (3)
(See GRMN 366.)

GRMN 467. German Classicism/Romanticism (3)
(See GRMN 367.)

GRMN 475. 19th-Century German Literature (3)
(See GRMN 375.)
Continuation of JAPN 201. Students learn an additional 100 to 125 kanji aural comprehension, speaking, reading, and writing abilities and learn further study of fundamental structures of Japanese. Students improve JAPN 201. Intermediate Japanese I (4) 

Prereq: JAPN 101.

Continuation of JAPN 101. Emphasizes aural comprehension, speaking, reading, and writing. Students learn approximately 100 new kanji characters and are expected to achieve control of the sound system and basic sentence structure of the language. Emphasizes aural comprehension and speaking. The situational and functional approach of the course facilitates progress towards advanced-level fluency in Italian. Prereq: ITAL 101 or equivalent.

ITAL 311. Conversation in Italian (3) 

Focus on improving linguistic skills acquired in elementary Italian and on mastering short narratives. Review of Italian grammar and usage through reading, conversation, and media. Language laboratory attendance required in addition to scheduled class meetings. Prereq: ITAL 201.

ITAL 399. Independent Studies (1-3) 

For students under special circumstances. Prereq: Permission of department.

JAPN 215. Japanese Popular Culture (3) 
(See CMPL 215.) Cross-listed as CMPL 215.

JAPN 240. Modern Japanese Literature in Translation (3) 
Focus on the major genres of modern Japanese literature, including poetry, short story, and novel (Shosetsu). No knowledge of Japanese language or history is assumed. Lectures, readings, and discussions are in English. Films and slides complement course readings. Cross-listed as CMPL 240.

JAPN 241. Classical Japanese Literature in Translation (3) 
Readings, in English translation, of classical Japanese poetry, essays, narratives, and drama to illustrate essential aspects of Japanese culture and sensibility before the Meiji Restoration (1868). Lectures explore the sociohistorical contexts and the character of major literary genres; discussions focus on interpreting the central images of human value within each period. Japanese sensibilities compared/contrasted with those of Western and other cultures. Cross-listed as CMPL 241.

JAPN 301. Advanced Japanese I (4) 
Emphasizes conversational proficiency and reading. Students must attend the language lab in addition to class meetings. Prereq: JAPN 202 or permission.

JAPN 302. Advanced Japanese II (4) 
Continuation of JAPN 301; emphasizes conversational proficiency and reading. Japanese life and culture introduced through supplemental materials and activities. Students must attend the language lab in addition to regular scheduled class meetings. Prereq: JAPN 301 or permission.

JAPN 303. Topics in Japanese I (3) 
Students in this course will work with authentic materials to improve proficiency in Japanese. Subject matter varies but emphasis is on contemporary culture of Japan. Prereq: JAPN 302 or permission.

JAPN 341. Japanese Women Writers (3) 
Contributions of women writers to the literature of pre-modern and modern Japan; investigations of how their works exemplify and diverge from "mainstream" literary practices. Emphasis on the social and cultural contexts of the texts. Cross-listed as CMPL 341.

JAPN 350. Contemporary Japanese Texts (3) 
Stress on development of sophisticated communication skills in Japanese. Reading and discussion of various texts in the original, such as comics (manga), video scripts, essays, news scripts, and literary works. Enhancement of writing and aural/oral proficiency through presentations, listening drills, viewing of videos, and classroom discussion. Prereq: JAPN 302 or permission.

JAPN 351. Japanese in Cultural Context (3) 
Focus on the major genres of modern Japanese literature, including poetry, short story, and novel (Shosetsu). No knowledge of Japanese language or history is assumed. Lectures, readings, and discussions are in English. Films and slides complement course readings. Cross-listed as CMPL 215.

JAPN 352. Classics of Modern Japanese Literature (3) 
Reading and analysis of selected Japanese writers and the critical and popular media around them. Focus on continued development of skills from JAPN 350 and on representative examples of various genres; drama, fiction, autobiographical prose, interview, lyric poetry and the press. Prereq: JAPN 350 or permission.

JAPN 398. Senior Colloquium (3) 
A capstone course for the Japanese Studies major. Involves the writing of a substantial research paper in Japanese or English. Exceptional papers may be considered for honors. Prereq: Permission of department.

JAPN 399. Independent Studies (1-3) 
Directed study for students who have progressed beyond available course offerings. Prereq: Permission of department.

Italian Courses (ITAL) 

ITAL 101. Elementary Italian I (4) 
(Credit for ITAL 101 only upon completion of ITAL 102.) Introductory course; stress on mastery of the sound system and basic sentence structure of spoken and written Italian.

ITAL 102. Elementary Italian II (4) 
Continuation of ITAL 101; attendance in the language laboratory is required in addition to scheduled class meetings. Prereq: ITAL 101 or equivalent.

ITAL 201. Review and Progress in Italian (4) 
Emphasizes language and culture. Review of Italian grammar and usage while studying written forms. Language laboratory attendance required in addition to scheduled class meetings. Prereq: ITAL 102.

ITAL 202. Read and Discuss Italian Texts (4) 
Focus on improving linguistic skills acquired in elementary Italian and on mastering short narratives. Review of Italian grammar and usage through reading, conversation, and media. Language laboratory attendance required in addition to scheduled class meetings. Prereq: ITAL 201.

ITAL 311. Conversation in Italian (3) 
Solely focused on oral communication, ITAL 311 is designed to enhance aural comprehension skills in Italian. Using audiovisual materials, students acquire the skills necessary to understand conversations between native-speakers and to emulate them. The situational and functional approach of the course facilitates progress towards advanced-level fluency in Italian. Prereq: ITAL 202 or equivalent.

ITAL 399. Independent Studies (1-3) 
For students under special circumstances. Prereq: Permission of department.

Japanese Courses (JAPN) 

(See also CMPL) 

JAPN 101. Elementary Japanese I (4) 
(Credit for JAPN 101 only upon completion of JAPN 102.) Introduction to understanding, speaking, reading, and writing Japanese. Students learn to read and write hiragana and katakana syllabaries and 50 kanji characters. Students expected to achieve control of the sound system and basic structure of the language. Emphasizes aural comprehension and speaking.

JAPN 102. Elementary Japanese II (4) 
Continuation of JAPN 101. Emphasizes aural comprehension, speaking, reading, and writing. Students learn approximately 100 new kanji characters. Prereq: JAPN 101.

JAPN 201. Intermediate Japanese I (4) 
Further study of fundamental structures of Japanese. Students improve aural comprehension, speaking, reading, and writing abilities and learn approximately 100 new characters. Prereq: JAPN 202 or equivalent.

JAPN 202. Intermediate Japanese II (4) 
Continuation of JAPN 201. Students learn an additional 100 to 125 kanji characters. With the completion of JAPN 201 - 202, students should have control of the fundamentals of modern Japanese and a firm foundation in the writing system. Prereq: JAPN 201.
RUSN 201. Intermediate Russian (4)
Furthers students’ ability in four basic language skills: understanding, speaking, reading and writing; expands knowledge of Russian grammar and vocabulary. Prereq: RUSN 102.

RUSN 202. Introduction to Contemporary Civilization (4)
Continuation of RUSN 201; introduces contemporary Russian culture through readings and discussion. Prereq: RUSN 201.

RUSN 311. Advanced Conversation (3)
Students work to improve fluency in spoken Russian. Topics of conversation include aspects of contemporary civilization; current vocabulary is stressed. Prereq: RUSN 202.

RUSN 318. Studies in Russian Civilization (3)
Examination of major historical, intellectual, and artistic influences that have shaped the evolution of Russian civilization. Students attempt to identify major influences on the formation of modern Russia. Prereq: RUSN 202.

RUSN 319. Life in Modern Russia (3)
Examines aspects of life in modern Russia, between the 1917 Revolution and the present, including political and social systems and cultural life through the study of texts, films and other media. Prereq: RUSN 202.

RUSN 320. Introduction to Russian Literature (3)
Introduction to major literary movements, principal writers, and outstanding works of Russian literary works. Prereq: RUSN 202 or equivalent.

RUSN 399. Independent Study (1-3)
Prereq: Permission of the department.

Spanish Courses (SPAN)

Undergraduate

SPAN 101. Elementary Spanish I (4)
(Credit for SPAN 101 only upon completion of SPAN 102.) Introductory course emphasizing conversational skills. Students achieve control of the sound system and basic sentence structures of spoken and written Spanish. Students must attend the Language Resource Center in addition to class meetings.

SPAN 102. Elementary Spanish II (4)
Continuation of SPAN 101, emphasizing conversational skills. Prereq: SPAN 101.

SPAN 103. Basic Conversational Spanish (5)

SPAN 201. Intermediate Spanish (4)
Intensive review of grammar and usage through readings, discussions, and other activities. Prereq: SPAN 102.

SPAN 202. Introduction to Contemporary Civilization (4)
Introduction to contemporary Hispanic civilization. Continues grammar review of SPAN 201 with an emphasis on subjunctive mood. Students will study texts and cultural documents which focus on contemporary life in Hispanic countries. Prereq: SPAN 201.

SPAN 301. Practice of Translation (3)
Students learn necessary skills and techniques for solving linguistic problems in translation. Texts with a variety of contents including articles from current press, will be translated from English into Spanish and occasionally from Spanish into English. Prereq: SPAN 202.

SPAN 302. Latin American Cultural Conflicts (3)
Evolution of Latin American socioeconomic characteristics and artistic production up to the present. Class discussions of diverse literary works, social research essays, and testimonials focus on conflicting elements in class structures, ethnicity, and urban modernization as well as family ethos, religious trends, cultural identity, and educational problems. Prereq: SPAN 202.

SPAN 304. Studies in Civilization (3)
Major historical, intellectual and artistic influences that have shaped the evolution of Spanish civilization. Prereq: SPAN 202.

SPAN 310. Advanced Composition and Reading (3)
Designed to facilitate the transition between lower and upper division courses in Spanish, and focus upon the simultaneous development of the reading and writing skills expected of students in all advanced Spanish courses. Prereq: SPAN 202.

SPAN 311. Advanced Spanish Conversation (3)
Engages students in conversation so that they develop oral proficiency. Short essays and newspaper articles dealing with everyday activities, socio-cultural roles and experiences, and self-awareness and life goals discussed; some literary materials discussed. Prereq: SPAN 202.

SPAN 313. Introduction to Readings in Spanish Literature (3)
Introduction to major literary movements and outstanding works of Spanish literature. Prereq: SPAN 202.

SPAN 322. Latin American Short Story (3)
The history and development of the Latin American short story from the nineteenth century to the present. Intertextuality, rise of the Nuevo Cuento, and major characteristics of the works. Male and female authors. Prereq: SPAN 202.

SPAN 326. The Fantastic in Latin American Prose (3)
Introduction to a distinctive trend in contemporary Latin American literature, the prose portrayal of the “fantastic,” a new narrative mode in Latin America. Critical examination of selected texts reveals new concepts of space and time and an increasing complexity of structure and style, one which juxtaposes and analyzes fantasy and reality. Prereq: SPAN 202.

SPAN 336. Chicana/o Literature (3)
An introduction to Chicana/o literature written after 1943. Literary history, clarification of linguistic terminology, and an examination of the cultural components of each work. Readings, discussions, and lectures in Spanish.

SPAN 339. Latin American Poetic Revolt (3)
Introduction to most important poets in contemporary Latin America, a region home to a significant number of eminent poets, including Nobel Laureates from Chile, Gabriela Mistral and Pablo Neruda. The course focuses on detailed textual analysis of pivotal works, combined with historical-literary perspective, so students gain insight into the diverse styles and tendencies that reflect the tumultuous history of poetry’s development in a relentless search for a Latin American cultural identity. Prereq: SPAN 202.

SPAN 340. Contemporary Latin-American Narrative (3)
Students explore the most significant narrative techniques since 1945 in Latin American fiction: Borges, Cortazar, Garcia Marquez, Vargas Llosa, Isabel Allende. Prereq: SPAN 202.

SPAN 342. Latin American Feminist Voices (3)
Examination of the awakening of feminist and feminist consciousness in the literary production of Latin American women writers, particularly from the 1920s to the present. Close attention paid to the dominant themes of love and dependency, imagination as evasion, alienation and rebellion; sexuality and power; the search for identity and the self-preservation of subjectivity. Readings include prose, poetry, and dramatic texts of female Latin American writers contributing to the emerging of feminist ideologies and the mapping of feminist identities. Prereq: SPAN 202.

SPAN 343. The New Drama in Latin America (3)
Representative works of contemporary Latin American drama. Critical examination of selected dramatic works of twentieth-century Latin America provides students insight into the nature of drama and into the structural and stylistic strategies utilized by Latin American dramatists to create the “new theater,” one which is closely related to Latin American political history. Prereq: SPAN 202.

SPAN 350. Spanish Fiction (3)
Narrative masterpieces from Cervantes and the picaresque (El Lazarillo) to the short stories and novels of 19th and 20th century authors. Prereq: SPAN 202.

SPAN 351. Spanish Generation of 1898 (3)
The course studies the so-called second Golden Age of Spanish literature. The Generation of 1898 rebelled at the end of the XIX Century against the “Restauracion,” an inefficient and corrupt political system. To find a solution to a period of economic and cultural decadence, it demanded “Europeanization.” Though these writers failed to produce any immediate political change, they succeeded in replacing the old Spanish rhetoric and in creating a superb expression of the new spirit. Prereq: SPAN 202.
The Department of Music is committed to creating the best possible educational opportunities and professional programs in music. The department’s aim is to offer superior programs that balance humanistic knowledge of music with excellence in performance. Individual professional interests are encouraged and promoted. To foster this aim, the Department of Music has established major degree programs in music and music education and has collaborated with the Cleveland Institute of Music in a Joint Music Program.

### Faculty

Georgia J. Cowart, Ph.D. (Rutgers University)
**Associate Professor and Chair**

17th and 18th centuries

William I. Bauer, Ph.D. (Kent State University)
**Assistant Professor**

Music education; research; technology; music teacher preparation

Gary M. Ciepluch, Ph.D. (University of Wisconsin, Madison)
**Associate Professor**

Director of bands; conducting

Mary E. Davis, Ph.D. (Harvard University)
**Robson Assistant Professor**

20th century; piano music; world music

Ross W. Duffin, D.M.A. (Stanford University)
**Fynette H. Kulas Professor**

Medieval; Renaissance; Baroque; performance practices; Collegium Musicum

Robert E. Dunn, Ph.D. (Northwestern University)
**Associate Professor; Director, Music Education**

Music education; music listening, general and vocal music

Stephen E. Hefling, Ph.D. (Yale University)
**Professor**

18th and 19th centuries; chamber music; analysis

Kathleen A. Horvath, Ph.D. (Ohio State University)
**Assistant Professor**

Music education; string education and pedagogy

Quentin W. Quereau, Ph.D. (Yale University)
**Associate Professor**

Medieval; Renaissance; opera; art song

### Associate Faculty

Cleveland Institute of Music Academic Faculty Offering

Courses for University Students

Alan Bise
Paul Blakemore
Margaret Brouwer
David Brown
Jo Anne Caputo
Eric Charnofsky
Jeanette Davis
David Gilson
Mark George
Marshall Griffith
Dean Guy
Thomas Knab
Steven Kohn
Richard Nelson
Lisa Rainsong
Nadia Tarnawsky
Jim Yates

**Artist Faculty of the Cleveland Institute of Music**

(Consult the current CIM catalog)

### Degree Offerings and Areas of Concentration

### Areas of Degree Offerings

Music education (Bachelor of Science, Master of Arts, Doctor of Philosophy)

Early music performance practices (Master of Arts, Doctor of Philosophy, Doctor of Musical Arts)

Music (within the context of liberal arts; see subsequent list of concentrations) (Bachelor of Arts)

Music history and literature (Master of Arts)

Musicology (Doctor of Philosophy)
Concentrations within the Bachelor of Arts in Music are:
Music history and literature
Music theory
Early music performance practices
Performance
General musicianship (particularly suitable for students interested in music as part of a double major or double degree)
Audio recording technology

Students interested in these programs should apply to the University with the understanding that many courses in music performance, music theory, and related studies will be taken at the Cleveland Institute of Music.

CIM Joint Music Program

The Cleveland Institute of Music and Case Western Reserve University participate in an integrated music program at both the undergraduate and the graduate levels. Students at either institution have the benefit of pursuing studies at both schools, thus enjoying the intimacy and intense specialization of a professional conservatory, together with access to the resources of a major university. Both institutions share a campus setting in University Circle. Severance Hall (home of the Cleveland Orchestra), the Cleveland Museum of Art, the Cleveland Music School Settlement, and several other cultural organizations are within a short walking distance of both schools.

The Cleveland Institute of Music concentrates on the education of students whose professional interests include the following:
• Performance (Bachelor of Music, Master of Music, and Doctor of Musical Arts)
• Composition (Bachelor of Music, Master of Music, and Doctor of Musical Arts)
• Eurhythmics (Bachelor of Music)
• Music theory (Bachelor of Music)
• Audio recording (Bachelor of Music)
• Piano accompanying (Master of Music, Doctor of Musical Arts)
• Suzuki Pedagogy (Master of Music)

Students who are interested in these majors in the context of intensive conservatory training should matriculate at the Cleveland Institute of Music with the understanding that courses in music history, music education, and the liberal arts will be taken at the University. Contact the Admissions Officer, Cleveland Institute of Music, 11021 East Boulevard, Cleveland, Ohio 44106, for a description of programs and the appropriate admissions materials.

Departmental Specialties

The Department of Music is distinctive in offering special areas of concentration to the student on both the undergraduate and the graduate level.

Early Music Performance Practices

One such area of special interest is early music performance practices, where musical research in early music, instruments, and performance problems is directly applied to performance. The supporting performance organizations are the Case Western Reserve University Collegium Musicum and Baroque Orchestra, which are devoted to the performance of early music on authentic reproductions of Medieval, Renaissance, and Baroque instruments. Faculty, staff and visiting artists provide professional instruction and coaching. The Collegium Musicum and Baroque Orchestra use the Kulas Collection of Historical Instruments.

Music Education

Music education programs at Case Western Reserve University are committed to the idea that excellence in teaching follows excellence in musicianship, scholarship, and professional development. In both the undergraduate and graduate programs, the faculty stresses practical and philosophical foundations regarding music in education. This nationally recognized music education program specializes in research in music education, music teaching and learning, music technology, string pedagogy, and wind conducting and literature. The department’s nationally-prominent faculty are active in their respective professional organizations and as guest clinicians, conductors, lecturers, and authors. The mission of the Music Education Program is to prepare committed, knowledgeable, and creative professional music educators who will develop into leaders, teachers, and outstanding musicians in the field of music education.

Undergraduate Programs

Students who wish to major in music must pass a performance audition on an acceptable instrument or in voice and take a music theory placement test. Arrangements for this audition and test must be made directly with the department. Once admitted as a music major, students are required each semester to participate in one or more of the University musical organizations and to attend recital class. Performance juries are required during each semester that the music major is enrolled in applied music instruction.

Double Major and Double Degree Opportunities

The department encourages qualified students to consider a double major in music and another subject. As many as 1/3 to 1/2 of music majors are pursuing a double major. Typical combinations include the Bachelor of Arts in music with theater, English, classics, psychology, sociology, and the natural sciences. Once the Arts & Sciences General Education Requirements (39 hours) have been met, a B.A. student can add another major by meeting the course and hour requirements found in this bulletin under the appropriate department. In most cases, it is possible to finish a double major with music in four years.

It is also possible to receive two degrees, although this usually takes five years. Typical combinations of double degrees include the Bachelor of Arts in music with the Bachelor of Science in Engineering, or the Bachelor of Science in Music Education with the Bachelor of Music degree from the Cleveland Institute of Music. All admissions requirements must be met for each school, and course and hour requirements for each degree must be fulfilled. Students interested in double degrees should declare their intent as early as possible and receive advice from faculty about both degrees.

Bachelor of Arts in Music

The Bachelor of Arts degree in music is concerned with studies in music and the liberal arts. This degree program stresses an essentially humanistic orientation. It is not intended to lead a student toward a professional career in performance.

Approximately one half of the total 120 semester credit hours necessary for the degree is devoted to music study, with the remaining credit devoted to the General Education Requirements (39 hours), a possible minor program, and a liberal selection of elective courses. This arrangement differs from student to student. The department offers several concentrations within the music portion of the degree (described below). Core music courses for these programs are: (1) Music theory: MUSC 107, 108, 207, 208
and the stress on the liberal arts, students are also able to pursue management. Because of the humanistic orientation of the degree professional programs such as those in medicine, law, and publically upon graduation. Graduates of the other concentrations are prepared to enter professional positions in that field immedi-

**Music History and Literature**

- Additional Applied Music study at the 300 level (3); MUSC 393, Introduction to Early Music Performance Practices (3); Two electives from music literature courses at the 300 level (6); Foreign language (6)

**Music Theory**

- Additional Applied Music study at the 300 level (3); MUSC 311, 312, Counterpoint I and II (4); One elective from music literature courses at the 300 level (3)

**Early Music Performance Practices**

- Additional Applied Music study at the 300 level (3); MUSC 393, Introduction to Early Music Performance Practices (3); MUSC 394, Seminar in Early Music Performance Practices (3); One elective from music literature courses at the 300 level (3); Foreign language (6)

**Performance**

- Additional Applied Music study at the 300 and 400 levels (9); One elective from music literature courses at the 300 level (3); Foreign language (6)

**General Musicianship**

- One elective from music literature courses at the 300 level (3)

**Audio Recording Technology**

- MUSC 151B, 251B, Audio internship (4 sem. of each req.) (4); MUSC 385, 386, Advanced Recording Techniques I and II (2,2); MUSC 387, 388, Multi-track Recording Techniques I and II (2,2); MUSC 391, MUSC 392, Recording Studio Maintenance I and II (1,1); MUSC 350B, Junior Audio Recording Thesis (3); MUSC 351C, Senior Audio Recording Thesis (6); MUSC 399C, Acoustics of Music (1 credit hr., taken 3 times) (3); MUSC 451, Recording Studio Internship (Commercial) (4)

A Minor in Electronics is available from the Electrical Engineering and Computer Science Department. A five-year, double degree program is also available where the student earns a B.A. in music/audio and a B.S. in an elective field of engineering. See double-degree section above.

**Career Opportunities within the Bachelor of Arts Degree**

Students choosing the audio recording technology concentration are prepared to enter professional positions in that field immediately upon graduation. Graduates of the other concentrations are prepared to enter programs of advanced study in music or in other professional programs such as those in medicine, law, and management. Because of the humanistic orientation of the degree and the stress on the liberal arts, students are also able to pursue careers in a wide assortment of fields such as communications, publications, business, and arts criticism.

**Bachelor of Science in Music Education**

The program in Music Education, which leads to the Bachelor of Science degree, requires a total of 121 credits and is designed to educate professional teachers of music education for public and private schools who are also competent, creative musicians. The program meets all requirements of the Ohio Board of Education to qualify its University-recommended students for PreK-12 Music Specialist Licensure to teach music in the public schools of Ohio and over 40 reciprocating states. Our music education graduates have had a 100% rate of placement for more than a decade. Music education students benefit from a wide range of instrumental, vocal, and general classroom methods courses. As an additional part of the program, students benefit from plentiful “hands-on” experiences by teaching sample lessons and conducting rehearsals in actual teaching situations. Requirements for the Bachelor of Science in Music Education degree:

**Music, Music Education and Education Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Music (primary and secondary areas) ............................</td>
<td>15</td>
</tr>
<tr>
<td>Music Theory (MUSC 107, 108, 207, 208, 318) ..................................</td>
<td>19</td>
</tr>
<tr>
<td>Music History (MUSC 321, 322 and 336) .....................................</td>
<td>9</td>
</tr>
<tr>
<td>Elements of Conducting (MUSC 275) ..........................................</td>
<td>2</td>
</tr>
<tr>
<td>Advanced Conducting (MUSC 276) ..................................................</td>
<td>2</td>
</tr>
<tr>
<td>Arranging for Voices and Instruments (MUSC 310) ............................</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to Education (EDUC 301) .......................................</td>
<td>2</td>
</tr>
<tr>
<td>Educational Psychology (EDUC 304) ............................................</td>
<td>3</td>
</tr>
<tr>
<td>Foundations of Music Education (MUSC 241) ..................................</td>
<td>3</td>
</tr>
<tr>
<td>General Music Methods A or B (MUSC 341 or 342) ............................</td>
<td>3</td>
</tr>
<tr>
<td>Technology Assisted Music Teaching (MUSC 343) ................................</td>
<td>3</td>
</tr>
<tr>
<td>Instrumental Music Methods and Materials (MUSC 377) ........................</td>
<td>3</td>
</tr>
<tr>
<td>Choral Methods and Materials (MUSC 378) .....................................</td>
<td>3</td>
</tr>
<tr>
<td>Electives from various instrument pedagogy classes (1 credit for each class)</td>
<td>5</td>
</tr>
<tr>
<td>Practice Teaching in Music (MUSC 390) ....................................</td>
<td>12</td>
</tr>
<tr>
<td>Recital class (APMU 011, every semester) ..................................</td>
<td>0</td>
</tr>
<tr>
<td>Primary Ensemble ......................................................................</td>
<td>7</td>
</tr>
<tr>
<td>Secondary Ensemble ...............................................................</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL .........................................................................................</td>
<td>97</td>
</tr>
</tbody>
</table>

**Courses to fulfill graduation requirements and the general requirements of the Ohio Department of Education:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ENGL 150 ..................................................................................</td>
<td>3</td>
</tr>
<tr>
<td>GER: Mathematics .......................................................................</td>
<td>3</td>
</tr>
<tr>
<td>GER: Natural Sciences ..................................................................</td>
<td>3</td>
</tr>
<tr>
<td>GER: Science and Society, or Natural Science ................................</td>
<td>3</td>
</tr>
<tr>
<td>GER: History, Philosophy or Religion ........................................</td>
<td>3</td>
</tr>
<tr>
<td>GER: Literature/ Language ................................................................</td>
<td>3</td>
</tr>
<tr>
<td>GER: Global and Cultural Diversity ...........................................</td>
<td>3</td>
</tr>
<tr>
<td>Eurhythmics I and II (MUSC 153, 154) (Counts as PE requirement) ........</td>
<td>0</td>
</tr>
<tr>
<td>General Psychology I (PSCL101) .............................................</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL .......................................................................................</td>
<td>24</td>
</tr>
<tr>
<td>TOTAL HOURS FOR THE DEGREE ..................................................</td>
<td>121</td>
</tr>
</tbody>
</table>

**Additional Requirements:**

- Participation in assigned musical ensemble every semester of major, except during student teaching
- Participation in additional musical ensemble for one year
- Recital Class attendance and performance every year of major, except during student teaching
Admission, Retention, and Advanced Standing in Music Education

Students must pass an interview with the music education faculty to be admitted into the program. Evaluations will take place after each methods course to monitor student progress. Students who expect to meet licensure requirements must apply for Advanced Standing by the end of their sophomore year. To apply, students must submit to the music education faculty information about grade point average, personal goals, and self-analysis of performance in the program up to the point of evaluation. Music education faculty may (1) accept a student for advanced standing; (2) accept student with reservation, with a remedial plan; or (3) reject a student and recommend a career change.

To enter student teaching, requirements are a 2.5 cumulative University grade point average, a 3.0 cumulative G.P.A. average in professional education courses, and a total of 300 contact hours of clinical/field-based experience acquired in a variety of settings as required by the State of Ohio. Fingerprinting for a criminal background check by the Ohio Bureau of Criminal Identification is required. For students who have not lived in Ohio consecutively for the past five years, a background check through the Federal Bureau of Investigation is also required.

To be recommended by the university’s director of teacher licensure for State Teacher Licensure, a 3.0 cumulative G.P.A. must be maintained in all professional education courses. An overall G.P.A. of 2.5 must be maintained. The Ohio Department of Education required passing scores on the Praxis II Principles of Learning and Teaching, and Music Content Knowledge exams in addition to the requirements stated above. Completion of the Bachelor of Science degree exists separately from the assurance that the State of Ohio Music Teacher License will be awarded. Additional information on this program is available in the office of the director of teacher licensure.

Minor

A minor in music requires five courses, two in music theory (generally MUSC 103, 104), two in music history (either MUSC 221 and MUSC 222, or MUSC 321 and MUSC 322), and one other, which may be in applied music. A minor in music education may be devised in consultation with a music education advisor. The department welcomes students’ initiative in the development of minor programs suited to their needs.

Sequences for students in the Engineering Core

A sequence requires three courses. The department welcomes students’ initiatives in developing sequences suited to their needs. The following are sample sequences:

Music and its theory
- MUSC 103, 104, 222
- MUSC 221, 103, 104

Music and its history
- MUSC 103, 104, and 321 or 322
- MUSC 221, 103, 222

Music and computers
- MUSC 103, 104, 308
- MUSC 221, 103, 308

Music history and jazz
- MUSC 103 or 104, 222, 229
- MUSC 221, 222, 229

Music and performance
- MUSC 103, 221, APMU
- MUSC 103 or 104, 222, APMU

Electives for Non-Music Majors

Electives designed for students not majoring in music are MUSC 103, 104, 221, 222, and 229. MUSC 308 is designed for music majors but is open to non-music majors with the permission of the instructor. MUSC 221 and 222 are offered as courses which satisfy the Arts portion of the GER. APMU 380, 382, 583, and 385 are available, normally by audition. Individual instruction in piano, harpsichord, organ, voice, violin, and all other orchestral instruments is available with consent of the department.

See further information under Applied Music.

Departmental Honors

Departmental Honors Programs for the Bachelor of Arts and Bachelor of Science degrees have the following admission and completion requirements:

Bachelor of Arts Students

Admission to honors status:
1. Second-semester sophomore or junior standing
2. Overall grade point average of 3.2, with music grade point average no lower than overall grade point average
3. Evidence of strong interest in becoming a teacher and of originality in teaching
4. Nomination by a faculty member and acceptance by the music faculty

Program description—successful completion of the following:
1. Final overall grade point average of 3.2
2. Project in research or performance (to be arranged with each student)
3. MUSC 399, Undergraduate Independent Studies or MUSC 390, Undergraduate Seminar in Music for three credits

Bachelor of Science Students

Admission to honors status:
1. Junior or Senior standing
2. Overall grade point average of 3.2 and music grade point average of 3.2
3. Evidence of strong interest in becoming a teacher and of originality in teaching
4. Nomination by a faculty member and acceptance by the music faculty

Program description—successful completion of the following:
1. Final overall grade point average of 3.2
2. Special project in teaching methods and materials. Students register for MUSC 399, Undergraduate Independent Studies.

Graduate Programs

The following graduate degree programs, administered by the University, are offered as part of the Joint Music Program with the Cleveland Institute of Music. General descriptions are given here; however, complete information on all degrees is available from the department. Admission to each degree follows established guidelines of the School of Graduate Studies. Scores from the Graduate Record Examination are required for programs in Music History, Musicology, and Early Music Performance Practices, and an audition is necessary for students interested in the Early Music Performance Practices programs.

Master of Arts Degree

The Master of Arts degree is offered in the fields of music history and music education. Within music history, students may choose concentrations in music history and literature or in early music.
performance practices. Master’s degree candidates in music education may also choose to add State of Ohio teaching licensure.

**Double Degree Opportunity**

One possibility exists for a double master’s degree between the Department of Music (M.A. in Music History) and the Mandel Center for Nonprofit Organizations (M.N.O.). This program reduces the combined requirements of both programs to 60 credit hours, including practicums with local arts organizations. The program results in two separate master’s degrees. All admissions requirements must be met for each school, including an undergraduate degree in music, a diagnostic examination in music history and theory, the Graduate Management Aptitude Test (GMAT), a sample essay, as well as references, transcripts, etc. Prospective students should contact both schools for advice from faculty and admissions information.

**Master of Arts in Music History**

The concentration in music history and literature emphasizes research, history, literature, and the theory of music. The early music performance practices program presupposes the same strong liberal arts training as the music history and literature concentration plus a strong performance interest and background. Research and its application to music performance are stressed. Within the 30 hours required for either concentration, the following are minimum requirements: history-literature, 9 hours; research, 6 hours; theory-analysis, 3 hours.

Remaining hours are more freely elected with advisor’s approval, but 9 hours of applied music are required for performance practices students. Ensemble participation is required for performance practices students but does not earn credit hours toward the degree. Examinations include initial placement tests in history and theory; a reading test in German or French, and final written and oral examinations. In addition, performance practices students must audition as part of the admissions process and must present a lecture-recital near the completion of the degree program. At least 18 credit hours must be at the 400 level or higher.

**Master of Arts in Music Education**

This degree is built on a set of foundation courses in philosophy, curriculum, psychology, research, evaluation, and musicianship. Additional courses and independent studies enable students to tailor programs to their interests and needs. Students may pursue one of three degree options. Persons in Plan A write a thesis based on original research and defend the thesis in an oral examination. Persons in Plan B complete a comprehensive examination in music education. Applicants for plans A or B should have a bachelor’s degree in music education, a good undergraduate academic record, and at least one year of successful music teaching experience, usually in the public schools.

Persons seeking teacher licensure credentials pursue Plan C. The program includes a core of graduate music education courses, graduate music courses, undergraduate music methods courses, and one semester of practice teaching. Applicants for Plan C should have a bachelor’s degree in music (B.A. or B.M.), a good undergraduate academic record, and some prior experience in working with children. The regulations in the B.S. program regarding advanced standing, grade point averages, and the Praxis II Exam apply to graduate students in Plan C as well. Foundation courses for all master’s degrees in music education include a music education core of philosophy, curriculum, and research (12 hours); a music core of history, theory (3-9 hours), and performance (0-6 hours); and electives (0-9 hours). Persons in Plan A receive 6 credit hours for thesis research. A comprehensive written examination at the conclusion of course work is required for persons in Plan B. A comprehensive oral exam at the conclusion of course work is required for persons in Plan C. A minimum of 30 credit hours is required for Plans A and B. Plan C combines music education methods courses (10 hours), general education courses (6 hours), the graduate music education core (12 hours), the graduate music core (9 hours), and practice teaching (12 hours). The music education advisor may allow certain music education and general education courses taken as an undergraduate to count towards the degree requirements. (Plan C requires a minimum of 49 hours.)

**Doctor of Philosophy Degree**

The Doctor of Philosophy degree is offered in two fields: musicology, with concentrations in music history and early music performance practices; and music education.

**Doctor of Philosophy in Musicology**

This doctorate is granted in recognition of superior scholarly ability and attainment. Award of the degree is based not only on computation of time or enumeration of courses, but also upon distinguished work. Highly qualified applicants may enter this program directly upon completion of a bachelor’s degree.

All programs are formulated to suit the individual needs of the student and require the consent of the advisor. A minimum of 48 hours (36 for students with a master’s degree) of course work, seminars, and tutorials is required. The last 36 hours (24 for students with masters degree) must be completed at the University.

For performance practices students, course work distribution is as follows: applied music, 9-12 hours (6-9 with master’s degree); course work, 36-39 hours (27-30 with master’s degree).

For other musicology students, private lessons at the 400 level, although not required, may be counted to a maximum of six credits at the discretion of the advisor. Examinations include initial placement tests in history, theory, and an audition for performance practices students; reading tests in German and one other foreign language; qualifying examinations in history and theory prior to admission to candidacy; and a general examination with history, theory, style analysis, and oral sections. Upon completion of the dissertation, an oral defense is held. In addition, performance practices students must audition as part of the admissions process and must present a lecture-recital in conjunction with the dissertation. The candidate must teach a college-level course in music history and literature (or early music performance practices) under the supervision of a faculty member, or have had the equivalent experience before the dissertation is completed.

Normally all performance practices students will participate in the Collegium Musicum or Baroque Orchestra during each semester in which they are on campus. Credit hours obtained for this participation are not applicable toward the degree.

**Doctor of Philosophy in Music Education**

The doctorate in music education is offered to persons who have shown a strong and continuing dedication to music teaching and scholarship. Applicants must have completed three years of full-time music teaching, usually in the public schools. The degree is designed to prepare professionals to assume positions of leadership in elementary, secondary, and collegiate instruction. Prior to graduation, doctoral students demonstrate competency in teaching, research, and musicianship. Every effort will be made to
plan a program based on individual student needs and interests while maintaining standards of musical and scholarly excellence. Electives, therefore, will be chosen in consultation with a major advisor in order to ensure a balance between individual interests and traditional graduate expectations.

A total of 54 credit hours is required for the doctoral degree beyond the master's level.

A typical division would be:

• Music education: philosophy, psychology, curriculum, research, measurement (15 hours)
• Music: theory, history, performance (9-15)
• Non-music electives: psychology, art, education, sociology, others (0-3)
• Seminars and special readings (6-12)
• Dissertation (18)

Examinations include placement exams in music history and theory; and a final general examination prior to beginning work on the dissertation. Upon completion of the dissertation, an oral defense is held. The dissertation topic is chosen by the student in consultation with the faculty.

Doctor of Musical Arts in Early Music

This doctorate is granted in recognition of outstanding performing ability in early music combined with superior scholarly ability in the field of early music performance practices. All programs are formulated to suit the needs of the individual student and require the consent of the major advisor. A minimum of 24 hours (after the master's degree) of course work, seminars, and tutorials is required. Ensemble participation is required but does not earn credit hours toward the degree.

Examinations include a performance audition; initial placement tests in history and theory; reading tests in German and one other foreign language; an advisory examination after one year of full-time study and a comprehensive examination with history, theory, performance practices, and oral sections. Three juried recitals are required, each to be accompanied by a research document and preceded by a short lecture. Exceptional students may be admitted to a combined M.A./D.M.A. degree program in early music.

Special Facilities

Kulas Music Library

Kulas Music Library, a branch of the University Library, is located on the first floor of Haydn Hall, the home of the Department of Music. The library contains approximately 40,000 music scores, books on music, sound recordings, videos, bound periodical volumes, and microforms. Particularly strong are the collections in historical musicology and early music performance practice. Equipment is available in the library in order to listen to or view the sound recording and video collections. The music library participates in the OhioLINK consortium of academic libraries, which shares a central on-line catalog and liberal interlibrary lending policies. Access to interlibrary loan from libraries outside of Ohio is also available. The music library is connected to CWRU/net, the University's fiber optic network, which provides access to many online databases. The collections and services of the Kulas Music Library are available to all University students, whether or not they are music majors. Music majors at the University also have access to the library of the Cleveland Institute of Music, which collects performing materials for solo and chamber music of all kinds and scores for large orchestral, vocal, and dramatic works, as well as selected musicological works.

Center for Music and Technology

The department supports a computer laboratory/resource center devoted to furthering the use of technology in music. The Center for Music and Technology houses Macintosh-based music workstations that are linked by CWRU/net, the University's vast fiber optic network system and gateway to the Internet. This state-of-the-art network allows extremely fast access to a multitude of resources both on and off campus. Using CWRU/net, students working in the center are able to access computers and databases as well as share ideas and research with colleagues around the world. Through the use of MIDI (Musical Instrument Digital Interface) keyboards, users may explore computer-assisted composition and sequencing, music synthesis and sampling, and computer-generated music calligraphy. By supporting the most current music copying software, the center provides a resource for the production of professional typeset-quality scores and papers by faculty and students. The center works closely with faculty in providing support facilities for the department's technology-related courses. For example, students enrolled in Computers and Music use the center to explore sequencing, MIDI communication, and musical score production. Designed to meet the specific needs of music students and faculty, the center supports an array of non-musical software including word processing, database, and graphics applications. As the department becomes increasingly technology-oriented, and CWRU/net is increasingly utilized by the faculty in their curricula, the Center for Music & Technology plays an ever increasing role by providing technical support and a necessary focal point for the interchange of ideas and creative solutions.

Kulas Collection of Historical Instruments

The Department of Music maintains an impressive collection of modern reproductions of medieval, Renaissance, and baroque instruments. The instruments are used by the Collegium Musicum and the department's program in Early Music Performance Practices. The collection includes recorders, crumhorns, shawms, sackbuts, cornetti, viols, and baroque strings and woodwinds.

Music Education Resource Center

The department provides a resource center for music education students to prepare educational materials and research projects. The center contains a variety of audio-visual media, including a library of education-oriented music software. Students may borrow items from a large collection of music textbooks, educational recordings, testing materials, vocal and instrumental books, curriculum guides, and classroom instruments.

The Music Education & Technology Software Registry (MET) is a collection of over 90 music software packages designed for all ages of learners and for a wide range of musical tasks. This workstation is available to all music students and area music teachers so they can use and evaluate most of the music software that is commercially marketed today. Use of the MET is encouraged, and sometimes required, for many of the projects and assignments in courses throughout the music education curriculum.

Applied Music

Private Instruction

The Department of Music offers private instruction on Renaissance and Baroque instruments, as well as the usual orchestral instruments, piano, and voice. Students have the unique opportunity to study with outstanding teachers, many of whom are faculty.
at the Cleveland Institute of Music. Students interested in private instruction should come to the department prior to registration in order to complete the Applied Music Permit form and to learn of further details.

Private lessons carrying credit are available to all University students. Permission for study, level of study, and amount of credit are determined by the faculty of the Department of Music in consultation with the Cleveland Institute of Music. Charges for private lessons are covered by the University tuition rate for undergraduate music and music education majors only; all other students pay an additional fee. The amount of the fee depends on the faculty involved and the length of the lessons. The minimum is $300 per semester and can be substantially higher. Students normally earn 1.5 or 3 semester hours of credit for private instruction based on either half-hour or hour lessons. All Master of Arts and Doctor of Philosophy degree students in the department must satisfy the applied music requirements specified in their degree requirements. Graduate students who anticipate private lesson instruction in their programs should consult an advisor before registration. Students register for individual applied music instruction in courses titled Principal Performance Area and Secondary Performance Area.

Ensembles
A number of music ensembles are available within the Joint Music Program. These ensembles are available to qualified University students. Entrance into ensembles may also be subject to space limitations. Students may elect to earn one credit per semester for participation. Auditions for ensembles are held during the first week of classes of each semester. Dates and times are available from the department.

Undergraduate Courses
Courses in musical interpretation and practical understanding are offered under the APMU classification. Those courses which have a direct programmatic role in University degree programs are provided with descriptions. Consult the catalog of the Cleveland Institute of Music for additional offerings in this classification. CIM courses other than applied music lessons are open only to music and music education majors.

Music (MUSC)

Undergraduate Courses

MUSC 003. Pre-conservatory Theory (3)
Development of security in knowledge and skills related to basic materials of musical structure (scales, key signatures, intervals, triads, etc.); general introduction to literature of Western music. Preparation for MUSC 101/105. Credit not applicable toward fulfillment of degree requirements in music major.

MUSC 088. Composition Seminar (0)

MUSC 101. Harmony-Keyboard I (2)
Scales, intervals, triads, seventh chords, and their inversions. Harmonization of melodies and basses, chorale study, modulation, analysis. Creative use of material. Correlated and taken concurrently with MUSC 105 and 106. Both aspects of the course must be passed in order to complete requirements.

MUSC 102. Harmony-Keyboard II (2)
(See MUSC 101.)

MUSC 103. Theory I (3)
Music theory for the nonmusic major. Intervals, scales, rhythmic drill, sight singing, eartraining, keyboard work, and harmony through inversions of triads and seventh chords. Not open to music majors.

MUSC 104. Theory II (3)
(See MUSC 103.) Prereq: MUSC 103 or consent of department.

MUSC 105. Sightsinging-Eartraining I (2)
Aural and vocal study of isolated and contextual rhythmic patterns, scales, intervals, triads, seventh chords, and traditional and contemporary songs in treble and bass clefs. Correlated and taken concurrently with MUSC 101 and 102. Both aspects of the course must be passed in order to complete requirements.

MUSC 106. Sightsinging-Eartraining II (2)
(See MUSC 105.)

MUSC 107. Theory for Music Majors I (4)
This course is the first of four semesters of music theory requirements for music majors. It will include the study of harmony, analysis, eartraining, and keyboard skills. Prereq: Placement exam through department.

MUSC 108. Theory for Music Majors II (4)
This course is the second of four semesters of music theory for music majors. It includes further study of harmony, analysis, eartraining, sight singing, and keyboard. Prereq: MUSC 107 or placement exam through department.

MUSC 151B. CWRU Audio Internship I (1)
Development of recording engineering skills through professional level work in the Harkness audio service. Prereq: Open only to audio recording majors.

MUSC 153. Eurhythmics II (0)
Physical expression of rhythm in which large bodily movements form the reference for rhythmic analysis. Study of pulse, meter, patterns, cross rhythms, improvisation, rhythmic canons, and bodily coordination emphasizing proper tension and relaxation.

MUSC 154. Eurhythmics II (0)
(See MUSC 153.)

MUSC 201. Harmony-Keyboard III (2)
Continuation of MUSC 101 and 102. Chromatically altered triads and 7th chords; 9th, 11th, and 13th. Neapolitan and augmented 6th chords, regular and irregular solutions. Correlated and taken concurrently with MUSC 205 and 206. Both aspects of the course must be passed in order to complete requirements. Prereq: MUSC 102 or placement examination.

MUSC 202. Harmony-Keyboard IV (2)
(See MUSC 201.) Prereq: MUSC 102 or placement examination.

MUSC 205. Sightsinging-Eartraining III (2)
Aural and vocal study using alto and tenor clefs, in addition to treble and bass. Correlated and taken concurrently with MUSC 201 and 202. Both aspects of the course must be passed in order to complete requirements. Prereq: MUSC 106 or placement examination.

MUSC 206. Sightsinging-Eartraining IV (2)
(See MUSC 205.) Prereq: MUSC 205 or placement examination.

MUSC 207. Theory for Music Majors III (4)
This course is the third of four semesters of music theory for music majors. Continued study of harmony, analysis, eartraining, sight singing, and keyboard, including use of dissonance and chromaticism, diatonic modulation. Prereq: MUSC 108 or placement exam through department.

MUSC 208. Theory for Music Majors IV (4)
This course is the fourth of four semesters of music theory for music majors. Continued study of harmony, analysis, eartraining, sight singing, and keyboard. Use of dissonance and chromaticism, chromatic voice leading technique. Prereq: MUSC 207 or placement exam through department.

MUSC 221. Introduction to Music: Listening Experience I (3)
A flexible approach to the study of the materials and literature of music. Aural and analytical skills primarily for classical music.

MUSC 222. Introduction to Music: Listening Experience II (3)
Application of the skills developed in MUSC 221 to the understanding of historical and stylistic content of Western music. Focus is on particular works in context with the era of composition. Prereq: MUSC 221 or consent of department.

MUSC 229. History and Styles of Jazz (3)
Musical styles and structures of jazz and American popular music since 1900. Prereq: MUSC 221.
MUSC 241. Foundations of Music Education (3)
Application of philosophical, historical, and psychological principles to music instruction. Examines various philosophical approaches to music education, and each student analyzes his/her personal philosophy of music education. Approaches to music teaching and learning, the processes involved in lesson planning, and student motivation. The importance of active learning is discussed and demonstrated, and a diversity of learning styles are examined. Examines learners of all ages and a variety of cultural backgrounds, and deals with developmental stages and musical abilities from beginners to professionals. The Ohio Competency-Based Arts Model and the National Standards are introduced. Clinical/Field experiences required.

MUSC 251B. CWRU Audio Internship II (0)
Professional level work in the Case Western Reserve University Harkness audio service.

MUSC 253. Eurhythmics III (0)
Continuation of MUSC 154. Material of increased difficulty as well as study of syncopation, rhythmic counterpoint, and conducting movements.

MUSC 254. Eurhythmics IV (0)
(See MUSC 253.)

MUSC 271. Choral Conducting I (1)
Study of the techniques of choral conducting and a general survey of choral literature.

MUSC 273. Orchestral Conducting I (1)
Study of orchestral scores, covering elements of style, form, and interpretation. Development of baton technique through conducting of small instrumental ensembles.

MUSC 274. Orchestral Conducting II (1)
(See MUSC 273.)

MUSC 275. Elements of Conducting (2)
This course is designed to develop the physical tools, and philosophical and aesthetic ideologies necessary for students to conduct in an effective and appropriate manner. Students develop baton technique through systematic physical pattern exercises, and class and field conducting experiences (elementary through adult). Observations and written evaluations of Cleveland Orchestra rehearsals and concerts, along with video analysis/self-evaluation of personal conducting experiences are among the activities required in this course. Topics and content include: philosophical foundations for the conductor; considerations for selecting repertoire and creating a supportive learning environment; rehearsal techniques; planning for the rehearsal and record keeping; rehearsal management; group motivation; score analysis and preparation; participation in professional activities; effective use of technology for the conductor; and national, state, and professional standards. Clinical/Field experiences (all ages) required.

MUSC 276. Advanced Conducting (2)
This course continues in-depth development of the physical tools, and philosophical and aesthetic ideologies presented in MUSC 275. Students develop baton techniques (with experiences in complex and changing time signatures) through systematic physical/pattern exercises, along with continuous evaluations, from their class and field conducting experiences (elementary through adult), observations and written evaluations of Cleveland Orchestra Rehearsals and Concerts, written critiques from historically significant Master Conductors (from videos in the University’s Music Library), along with video analysis of personal class and field conducting, are among the activities required in this course. Topics and content include: philosophical foundations for the conductor, considerations for selecting repertoire and creating a supportive learning environment; rehearsal techniques; planning for the rehearsal and record keeping; rehearsal management; group motivation; score analysis and preparation; participation in professional activities; effective use of technology for the conductor; and national and state standards. Clinical/Field experiences (all ages) required.

MUSC 301. Introduction to Analysis of 20th Century (2)
A study of compositional techniques as used in selected works by major 20th century composers. Prereq: MUSC 202 and MUSC 206.

MUSC 305. Sightsinging-Eartraining V (3)
Continuing emphasis on the development of aural and vocal skills in all clefs, with particular attention to contemporary music, and increased emphasis on performance at sight of a wide range of literature. Prereq: MUSC 206.

MUSC 308. Computers and Music (3)
Emphasis on development of music notation and sequencing skills with some attention to word-processing and graphics. Introduction to data management and page layout software. Designed primarily for music majors but also open to non-majors with sufficient background in music theory. Use of the University’s software library, CWRU/Net and the music department’s Center for Music and Technology. No formal training in computers required. Prereq: Music majors only.

MUSC 310. Instrumentation and Choral Arrangement (3)
Techniques of writing and arranging for instruments of the band and orchestra and voice. Study of scoring problems for school instrumental and vocal groups of all ages and abilities.

MUSC 311. 16th Century Counterpoint (2)
Sixteenth century modal counterpoint. Exercises in the five species. Writing of short compositions and motets in two, three and four voices. Prereq: MUSC 202 or MUSC 206.

MUSC 312. 18th Century Counterpoint (2)
Eighteenth century tonal counterpoint. Analysis and writing of inventions in two parts, and fugues in three and four parts. Prereq: MUSC 202 or MUSC 206.

MUSC 315. Orchestration I (2)
The problems and techniques of scoring for strings and woodwinds, for brasses and percussion. Transcriptions and scoring for diverse combinations from chamber group to full orchestra.

MUSC 316. Orchestration II (2)
(See MUSC 315.)

MUSC 318. Form and Analysis (3)
Aural and visual analysis of structural and stylistic features of 16th through 20th century music. Prereq: MUSC 202 or MUSC 206.

MUSC 321. History of Western Music I (3)
Developments in Western music from Early Christian times to the present, especially great periods and composers. Reference to life and thought; illustrated lectures; style analysis. Prescribed listening and reading. Prereq: MUSC 102 or MUSC 106.

MUSC 322. History of Western Music II (3)
(See MUSC 321.) Prereq: MUSC 102 or MUSC 106.

MUSC 323. Piano Literature (3)
Chronological survey of keyboard literature from the 17th century to the present. Detailed analysis of representative works; study and comparison of keyboard styles. Prereq: MUSC 202 or MUSC 322.

MUSC 324. Chamber Music Literature (3)
Chronological survey of important chamber literature. Analysis of representative sonatas, trios, quartets, and large ensembles. Prereq: MUSC 202 or MUSC 322.

MUSC 326. Symphonic Literature (3)
Representative masterworks of symphonic literature. Analysis and discussion of essential details, form, style, and instrumentation. Prereq: MUSC 202 or MUSC 322.

MUSC 327. Vocal Literature (3)

MUSC 328. Opera Literature (3)
Historical development of opera from the 17th century to the present. Detailed analysis of representative works. Prereq: MUSC 322.

MUSC 329. Jazz and American Popular Music Literature (3)
Musical styles and structures of jazz and American popular music; emphasis on music since 1900. Prereq: MUSC 202 or MUSC 322.

MUSC 336. History of Western Music III (3)
Music of the twentieth century, covering history, analysis, and aesthetic issues. Prereq: MUSC 322.
MUSC 337. Music Cultures of the World: Music of Asia and Africa (3)
A one-semester introduction to musics of Asia and Africa, focusing on the relationship of musical traditions and practices to culture and society. Prereq: MUSC 106.

MUSC 338. Music Cultures of the World II: Music of the Americas (3)
Introduction to selected multicultural musics of North America and Latin America, focusing on the relationship of musical traditions and practices to culture and society. Prereq: MUSC 106.

MUSC 341. General Music Methods A (3)
General Music A introduces student to methods and materials for planning and implementing general music experiences for all ages, with concentration on PreK through sixth grade children. Topics of the course include: multiple meanings of music for children; characteristics/needs of children, especially adolescents and young adults; creating a supportive learning environment; theories of music learning and teaching; learning styles and collaborative learning; assorted teaching methods, rhythm, pitch, listening, movement, performing, composing; curriculum design; technology for music instruction; multicultural music; music for exceptional children; integrating music with the arts and other curricula; motivation and classroom management; lesson planning and record keeping; developing a personal philosophy of music education; national, state, and professional standards; and assessment. Clinical/Field experiences (Clinical-all ages; Field-focus on PreK through elementary) required.

MUSC 342. General Music Methods B (3)
General Music B provides a more in-depth exploration of general music methods and materials for all ages, with concentration in grades 7 through adults. Topics of the course include: characteristics/needs of children, especially adolescents and young adults; creating a supportive learning environment through curriculum planning and design; instructional planning, implementation, and record keeping; involving students in moving, performing, creating and listening experiences with music, including individual and collaborative learning; music for exceptional children; using technology for music instruction; developing a personal philosophy of music education; teaching the arts together and integrating music into the school curriculum; multicultural musical experiences; motivation and classroom management; national, state, and professional standards; and assessments. Clinical/Field experiences (Clinical-all ages; Field-focus on middle school through adult) required.

MUSC 343. Technology-Assisted Music Teaching and Learning (3)
Fundamental concepts and skills for using technology in music teaching and learning. This project oriented class will develop knowledge and competencies related to electronic musical instruments, MIDI sequencing, music notation software, computer-assisted instruction, digital media, the Internet, information processing, computer systems, and lab management as they relate to music education in K-12 schools. Prereq: MUSC 241.

MUSC 350B. Junior Recording Techniques Thesis (3)
MUSC 351C. Senior Recording Techniques Thesis (6)
MUSC 353. Eurythmics V (1)
MUSC 354. Eurythmics VI (1)
MUSC 363. Principles of String Playing and Teaching I (2)
This course is designed to give an overview of historical pedagogy and its relationship to contemporary teaching practice. Students will survey teaching methodologies in relation to the foundational elements of performance technique for their instrument and investigate how to impart this information in an instructional setting. All students enrolled in the course will have the opportunity to teach students in a supervised situation and implement the concepts covered in class. Prereq: Consent of department.

MUSC 364. Principles of String Playing and Teaching II (2)
This course is a continuation of MUSC 363/463 and will foster further integration of the application of pedagogy to the teaching environment by the development of a conceptual rubric for instruction. This will include: expanding teaching strategies for a specific instructional environment or element of technique; principles of delivery; picking repertoire; diagnostic evaluation and assessment; and the creation of a personal style of teaching and reflection. Prereq: Consent of department.

MUSC 365. Eurythmics Pedagogy I (2)
Investigation of objectives and methods for teaching children. Preparation of lesson plans, motivation, and development of physical skills. Observation and student teaching of children’s classes.

MUSC 366. Eurythmics Pedagogy II (2)
(See MUSC 365.) Prereq: MUSC 365.

MUSC 367. Eurythmics Pedagogy III (2)
Practice teaching; discussion of problems in class organization, interdisciplinary integration; application of Dalcroze principles to the teaching of adults. A comprehensive paper illustrative of application of Dalcroze principles in music education and the arts must be submitted and approved for completion of pedagogy requirements.

MUSC 368. Eurythmics Pedagogy IV (2)
(See MUSC 367.) Prereq: MUSC 367.

MUSC 377. Instrumental Methods and Materials (3)
This course acquaints students with effective ways to develop, organize and maintain a successful instrumental program for any age group, based on a comprehensive instrumental music education model. Students are given a “womb to tomb” view of the instrumentalists’ development, including physiological development and age appropriate instrumental expectations. Topics and content include: philosophical basis for music education; considerations for selecting repertoire including multicultural music; rehearsal techniques; assessment and record keeping; planning for the rehearsal; recruitment, auditioning, and placement; motivation and classroom management; team teaching and collaborative learning; managing an instrumental program; participation in professional activities; effective use of technology in the instrumental program; and national, state, and professional standards. Clinical/Field experiences (all ages) required.

MUSC 378. Choral Methods and Materials (3)
This course acquaints students with effective ways to develop a successful choral program for any age group, based on a comprehensive choral music education model. Students are given a “womb to tomb” view of the singing voice, including physiological development, age appropriate vocal expectations, and establishing and maintaining vocal health. Topics include: philosophical basis for vocal music education; the child voice, the adolescent voice, and the adult voice; vocal tone; considerations for selecting repertoire including ensemble assessment, music evaluation, and multicultural music; rehearsal techniques, collaborative learning, and motivation; planning for the rehearsal; developing conducting technique; recruitment, auditioning, placement, score analysis and preparation; classroom management; managing a choral program; participation in professional activities; effective use of technology in a choral program; and national state, and professional standards. Clinical/Field experiences (all ages) required. Prereq: MUSC 276.

MUSC 381. Composition for Non-Majors I (2)
Techniques of motive development and composition in small forms. Prereq: Consent of department.

MUSC 382. Composition for Non-Majors II (2)
(See MUSC 381.)

MUSC 383. Audio Recording I (2)
A study of basic recording principles and systems and techniques of recording and editing. Prereq: Audio recording majors only.

MUSC 384. Audio Recording II (2)
Further study of basic recording principles and systems with an introduction to digital recording. Prereq: MUSC 383.

MUSC 385. Advanced Recording Techniques I (2)
A study of advanced microphone, recording, and monitoring systems and techniques with an emphasis on two track digital recordings of classical music and critical listening. Prereq: MUSC 384.

MUSC 386. Advanced Recording Techniques II (2)
Further study of advanced microphone, recording, and monitoring systems and techniques, with an emphasis on two track digital recordings of large ensemble classical music. Prereq: MUSC 385.

MUSC 387. Multitrack Recording Techniques I (2)
A study of multitrack recording and mixdown techniques. Prereq: MUSC 386. Audio recording majors only.
MUSC 388. Multitrack Recording Techniques II (2)
Further study of multitrack recording and mixdown techniques, with an emphasis on synchronization to video. Prereq: MUSC 387.

MUSC 390. Undergraduate Research Seminar (3)
Special projects appropriate to individual interests and needs.

MUSC 390E. Seminar in Music Theory (1)
Study of pedagogical, practical, and speculative aspects of music theory, with special projects. Limited to theory majors; others with consent of department.

MUSC 391. Recording Studio Maintenance I (1)
Study of techniques for optimizing professional recording equipment performance. Prereq: MUSC 384. Audio recording majors only.

MUSC 392. Recording Studio Maintenance II (1)

MUSC 393. Introduction to Early Music Performance Practice (3)
Summary and perspective of the problems and issues associated with the field of early music performance practices. Prereq: MUSC 321 and MUSC 322.

MUSC 394. Seminar in Early Music Performance Practice (3)
Seminar in a specific instrument and/or vocal area of performance practices, such as baroque vocal, instrumental, or keyboard practices. May be repeated because topics vary. Prereq: MUSC 393.

MUSC 396. Practice Teaching in Music (12)
Teaching music in both elementary and secondary schools, full time five days a week for 15 weeks. Closely supervised field experiences of all types with a wide variety of students. Emphasis on planning lessons and organizing materials, teaching methodologies, motivation, and student assessment. Topics addressed include communications and the arts, technology in learning, interdisciplinary learning, collaborative learning and teaching, creating a supportive learning environment, and professional development. Development of skills needed for self-assessment as well as student assessment. Clinical/Field experiences (all ages) required.

MUSC 399. Undergraduate Independent Studies (1-3)
Each student develops a topic of interest to be explored with a faculty member.

MUSC 399C. Acoustics of Music (1)
A seminar in the basic concepts of musical acoustics and research in this area. The students actively participate in experiments exploring various topics in musical acoustics.

Graduate Courses

MUSC 400A. Review of Musical Structure (3)
Instruction of fundamentals of form, counterpoint, and four-part harmony. Designed for graduate students; credit not applicable toward degree requirements.

MUSC 400B. Sight Singing and Ear Training Review (2)
Background in fundamentals of sight singing in four clefs; melodic and harmonic dictation including chromatic harmony and modulation. Designed for graduate students; credit not applicable toward degree requirements.

MUSC 408. Analysis of Musical Styles (3)
Analysis of selected musical compositions from various periods of the common practice era. Emphasis on traditional structures, stylistic features, and the relationship of analysis and performance.

MUSC 410. Pre-common Practice Theory and Analysis (3)
An exploration of treatises and analytical methods appropriate to music of the Medieval and Renaissance eras.

MUSC 417. Analytic Techniques I (3)
Exploration of several approaches to the examination of musical structures, emphasizing hierarchic functional analysis and the interaction of the elements. Focus on music in traditional forms.

MUSC 421. Methodologies of Music History (5)
Introduction to the scholarly study of music, including principles of music bibliography, techniques of library research, and evaluation of editions. Special emphasis given to the relationship between musical performance and research in the history and criticism of music. Attention will also be given to design of oral presentations and research papers on musical topics. Required of first-year students in the Master of Music degree program.

MUSC 423. Music History and Ideas (3)
Music aesthetics in relation to historical trends in cultural and intellectual thought.

MUSC 431. Medieval Music: Early Christian to 1425 (3)
The mass, liturgical drama, and early polyphony through the Ars Nova.

MUSC 432. Music of the Renaissance (3)
Vocal polyphonic music from the Burgundian school through the Elizabethan madrigal.

MUSC 433. Music of the Baroque (3)
Musical developments from Monteverdi to Bach and Handel.

MUSC 434. Viennese Classicism (3)
Development of the symphony, concerto, chamber music, and opera in the works of the Mannheim composers, Haydn, Mozart, and Beethoven.

MUSC 435. Nineteenth Century Music (3)
Romanticism and other 19th century trends in music up to impressionism.

MUSC 436. Twentieth Century Music (3)
Critical and analytical study of music since 1900. Examination and discussion of stylistic characteristics and aesthetic aims of contemporary composers.

MUSC 441. Philosophical Foundations of Music Education (3)
In this course, students explore major aesthetic philosophies that have influenced contemporary music education, and discuss current issues central to our field. Among topics include: basic views about art/music; creating art/music; meaning in art/music, experiencing art/music; music and aesthetic education; criticism in music; multicultural music; and critical theories and inquiry regarding music education. Students are asked to assess their own roles in music education, as well as their obligations and potential capacities for leadership in the profession. Students will work toward development of a personal professional philosophy of music education.

MUSC 442. Learning and Curriculum Development in Music (3)
Students explore (1) different theories regarding how people learn from birth through adulthood, including learning styles and special learners; (2) what is known regarding how children and adults acquire musical understanding/skill; (3) curriculum content, including the use of technology; (4) approaches to the organization of instructional content, including national and state standards; (5) development of music curricula. Students will work toward development of a curriculum in an area of their interest and expertise.

MUSC 443. Cognitive Psychology of Music (3)
Survey and critical review of research in the cognitive psychology of music as it relates to music education and music performance. Specific topics of study include physiology of the ear, auditory nerve, and brain; sound perception and cognition; foundations and measurement of music aptitude and achievement; the assessment of all types of music learning, and the validity and reliability of such measurement instruments; technology in research and teaching; cultural, ethnical, and socioeconomic differences among learners and their effects on music learning, teaching, and research; disabilities and giftedness and their effects on music learning, teaching, and research.

MUSC 444. Research and Measurement in Music Education (3)
Introduction to types and methodologies of research used in music education. Principles and procedures for developing and analyzing criterion measures used in research and the classroom. Development of research purposes, problems, literature reviews, designs, and procedure. Individual research projects are required. Topics include introduction to and uses of statistics; technology in research and teaching; cultural, ethnic, and socioeconomic differences among learners of all ages and their effects on music learning, teaching, and research; disabilities and giftedness and their effect on music learning, teaching, and research; measurement and assessment of all types of learning, and the validity and reliability of such measurement instruments.
MUSC 445. Research and Measurement in Music Education II (3)  
In-depth critical review of current research in music education. Examination of techniques for data analysis. Individual research projects are required, aimed toward the development of larger research efforts (especially thesis or dissertation). Topics include computer programs for statistical analysis; technology in research and teaching; cultural, ethnic, and socioeconomic differences among learners and their effects on music learning, teaching, and research; disabilities and giftedness and their effects on music learning, teaching, and research; measurement and assessment of all types of learning, and the validity and reliability of such measurement instruments.

MUSC 451. Recording Studio Internship (4)  
Principles of the teaching of theory at all levels, with examination and appraisal of teaching methods, textbooks, recent concepts, etc.

MUSC 461. Theory Pedagogy I (2)  
Principles of the teaching of theory at all levels, with examination and appraisal of teaching methods, textbooks, recent concepts, etc.

MUSC 462. Theory Pedagogy II (2)  
Principles of the teaching of theory at all levels, with examination and appraisal of teaching methods, textbooks, recent concepts, etc.

MUSC 463. Principles of String Playing and Teaching I (2)  
Principles of the teaching of theory at all levels, with examination and appraisal of teaching methods, textbooks, recent concepts, etc.

MUSC 464. Principles of String Playing and Teaching II (2)  
Principles of the teaching of theory at all levels, with examination and appraisal of teaching methods, textbooks, recent concepts, etc.

MUSC 471. Graduate Choral Conducting I (1)  
Study of the techniques of choral conducting and a general survey of choral literature.

MUSC 483. Electronic Sound Production I (2)  
A practical study of computer assisted electronic music composition covering traditional concepts of analog and digital synthesis, midi sequencing, sampling techniques, and video soundtrack production.

MUSC 484. Electronic Sound Production II (2)  
A practical study of computer assisted electronic music composition covering traditional concepts, analog and digital synthesis, midi sequencing, sampling techniques and video soundtrack production. Prereq: MUSC 483.

MUSC 490. Medieval/Renaissance Notation (3)  
Theory of chant, modal, mensural, and tablature notations. Practice in making literal transcriptions, editing, and preparing scores for performances.

MUSC 493. Introduction to Early Music Performance Practice (3)  
(See MUSC 393.)

MUSC 494. Seminar in Early Music Performance Practice (3)  
(See MUSC 394.)

MUSC 496. Practice Teaching in Music (12)  
Teaching music in both elementary and secondary schools, full time five days a week for 15 weeks. Closely supervised field experiences of all types with a wide variety of students. Emphasis on planning lessons and organizing materials, teaching methodologies, motivation, and student assessment. Topics addressed include communication and the arts, technology in learning, interdisciplinary learning, collaborative learning and teaching, creating a supportive learning environment, and professional development. Development of skills needed for self-assessment as well as student assessment. Clinical/Field experiences (all ages) required.

MUSC 499. Clinical/Field Experience (3)  
This provides clinical/field experiences with all ages of students in all teaching areas. Students from a variety of socioeconomic and cultural backgrounds are encountered. Instruction with special needs students, both disabled and gifted. Clinical/Field experiences (all ages) required.

MUSC 501. Special Reading (M.A. and M.M.) (1-18)  
(See MUSC 499.)

MUSC 529. Bibliography and Research Methods in Music (3)  
Seminar in research methods and techniques, stressing the analytic and functional approaches to bibliography.

MUSC 530. Practical Courses in Music (3)  
(See MUSC 493.)

MUSC 539. Doctor of Musical Arts Seminar (3)  
Prereq: MUSC 529.

MUSC 540A. Effective Teaching in General Music: Ideas that Work (2)  
Designed for elementary and middle school general music teachers, this hands-on course will focus on a variety of effective and practical teaching approaches for music teaching and learning, among them: enactive/iconic/symbolic approach to conceptual learning; active participation techniques; creating visuals for listening lesson; teaching musical concepts through children’s literature; using the generative approach learning rhythms and melodies; sound compositions, and song games. In addition, four areas of understanding that are critical to successfully teaching general music in school situations will be addressed: (1) importance of music for every child; (2) developmental characteristics of children that must be considered in designing learning experiences; (3) age-appropriate learning goals and objectives (including National Standards in Music) and how they may be assessed; and (4) sequencing of curriculum.

MUSC 590. Seminar in Music (3)  
Problems in musical criticism, aesthetics, and analysis, as well as historical style.

MUSC 591A. Music Education Seminar: Creativity (3)  
In this seminar, we will explore issues and theories involving creative thinking in general, and examine how creative thinking and musical experience interact. Topics include: definitions and theories of creativity; the creative process; the creative product; assessment; creativity in gifted education; teaching for creative growth; creative thinking and music composition (including improvisation), performance and listening; designing creative activities for the music classroom and rehearsal; available resources and professional organizations; and creativity as encouraged by state/national standards. Students will work toward development of a personal definition of creative thinking and how it can be applied to teaching in the music classroom.

MUSC 591C. Music Education Seminar: Conducting (3)  
In this course, students focus on advanced score study, preparation, and analysis. In depth conducting techniques on contemporary music and mixed meter compositions, along with the development of a comprehensive conducting bibliography are the major components in this seminar. Historical research, analytical evaluation, and the practical elements of the physical techniques required for one to conduct a chosen composition are all addressed for each composition study. Seminar discussions include aesthetic and philosophical ideologies, and the practical issues a conductor faces when put in control of the advanced ensemble.

MUSC 595A. Seminar in Music Theory: Analytical Projects (1-2)  
Individual projects in analysis for graduate students only.

MUSC 601. Special Readings (Ph.D./D.M.A.) (1-18)  
MUSC 651. Thesis: (M.A. and M.M.) (1-6)

MUSC 696. College Teaching Practicum (0)  
MUSC 701. Dissertation Ph.D. (1-18)

MUSC 702. Appointed Dissertation Fellow (9)

MUSC 751. Recital Document I-D.M.A. (1-3)

MUSC 752. Recital Document II - D.M.A. (1-3)

MUSC 753. Recital Document III-D.M.A. (1-6)

MUSC 782. Composition Document-D.M.A. (3)

Applied Music (APMU)  

Undergraduate Courses  

APMU 011. Recital Class (0)

APMU 101. Principal Performance Area I (1.5-3)  
Limited to music and music education majors.

APMU 102. Principal Performance Area II (1.5-3)  
Limited to music and music education majors.
APMU 111. Secondary Performance Area I (1.5-3)
Open to all university students.

APMU 112. Secondary Performance Area II (1.5-3)
Open to all university students.

APMU 120B. Music Methods: Voice (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 120D. Music Methods: Guitar (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 120G. Music Methods: Trumpet (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 120H. Music Methods: Violin (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 120J. Music Methods: String (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 120K. Music Methods: Brass (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 120L. Music Methods: Clarinet (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 120M. Music Methods: Woodwind (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 120N. Music Methods: Percussion (1)
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Prereq: Music education majors. Non-music majors accepted with consent of department.

APMU 201. Principal Performance Area III (1.5-3)
Limited to music and music education majors.

APMU 202. Principal Performance Area IV (1.5-3)
Limited to music and music education majors.

APMU 211. Secondary Performance Area III (1.5-3)
Open to all university students.

APMU 212. Secondary Performance Area IV (1.5-3)
Open to all university students.

APMU 241. Piano Pedagogy I (1)

APMU 242. Piano Pedagogy II (1)

APMU 301. Principal Performance Area V (1.5-3)
Limited to music and music education majors.

APMU 302. Principal Performance Area VI (1.5-3)
Limited to music and music education majors.

APMU 311. Secondary Performance Area V (1.5-3)
Open to all university students.

APMU 312. Secondary Performance Area VI (1.5-3)
Open to all university students.

APMU 326. Introduction to the Harpsichord (2)
Introduction to the harpsichord technique and the interpretation of 17th- and 18th-Century Baroque keyboard music. Study of national styles, ornamentation, articulation, tempi, dynamics, fingerings, and registration. Focus is on short representative works of Byrd, Couperin, Rameau, Duphly, Bach, Scarlatti, and Soler, as well as other works chosen by participating students. Limited to six students. Prereq: Open to CIM and Case Western Reserve music majors with keyboard background; consent of department; not open to harpsichord majors.

APMU 327. Accompanying at the Harpsichord (2)
A practical introduction to accompanying a variety of Baroque vocal and instrumental works in a stylistically appropriate manner. Particular emphasis on the Bach sonatas for flute, violin, and viola da gamba. Students who are accompanying in recitals are encouraged to perform in class and receive coaching. Limited to six students. Prereq: APMU 326 and consent of department.

APMU 333F. Guitar Seminar (1)

APMU 333G. Organ Practicum (1)

APMU 341. Piano Pedagogy III (1)
Organizing piano literature into levels of difficulty; appropriate use of published materials; in-depth study of psychological/developmental differences in the various age groups; problems pertaining to the adult pupil and the pupil who has had inadequate previous training; teaching of secondary piano at the collegiate level. The class meets one hour weekly. Class members observe instruction within the CIM Conservatory and Preparatory Departments.

APMU 342. Piano Pedagogy IV (1)
(See APMU 341.)

APMU 366. Wind Ensemble (0-1)

APMU 368A. String/Piano Chamber Music (1)

APMU 368B. Intensive Quartet Seminar (2)

APMU 369A. Miscellaneous Ensembles (0-2)

APMU 369B. Contemporary Music Ensemble (1-2)

APMU 380A. Renaissance Instrumental and Vocal Ensemble (0-1)

APMU 380B. Early Music Singers (0-1)

APMU 380C. Other Early Music Ensembles (0-1)

APMU 380D. Baroque Orchestra (0-1)

APMU 381A. CIM Symphony Orchestra (0-1)

APMU 382A. University Circle Chorale (0-1)

APMU 382B. University Circle Chamber Choir (0-1)

APMU 382C. Cleveland Orchestra Chorus (0-1)

APMU 382D. University Singers (0-1)

APMU 383A. Jazz Ensemble I (0-1)

APMU 383B. Jazz Ensemble II (0-1)

APMU 383C. Symphonic Winds (0-1)

APMU 383D. Spartan Marching Band (0-1)

APMU 383F. Handbell Choir (0)

APMU 385. University Circle Chamber Orchestra (0-1)

APMU 386. Keyboard Repertory Seminar (0-1)
Intensive study of the repertory for keyboard instruments, including solo literature, chamber music, and other collaborative genres. Master class format with regular performances by enrolled students. Enrollment limited to Case Western Reserve keyboard majors.

Graduate Courses

APMU 401. Principal Performance Area VII (1.5-3)
Limited to music and music education majors.

APMU 402. Principal Performance Area VIII (1.5-3)
Limited to music and music education majors.

APMU 411. Secondary Performance Area VII (1.5-3)
Open to all university students.

APMU 412. Secondary Performance Area VIII (1.5-3)
Open to all university students.

APMU 445. Suzuki Pedagogy I (2)

APMU 446. Suzuki Pedagogy II (2)

APMU 447. Suzuki Pedagogy III (3)

APMU 448. Suzuki Pedagogy IV (3)
APMU 501. Principal Performance Area IX (1.5-3)
Limited to music and music education majors.

APMU 502. Principal Performance Area X (1.5-3)
Limited to music and music education majors.

APMU 511. Secondary Performance Area IX (1.5-3)
Open to all university students.

APMU 512. Secondary Performance Area X (1.5-3)
Open to all university students.

APMU 602. Principal Performance Area XI (1.5-3)
Limited to D.M.A. Students.

Natural Sciences

102 Baker Building
Phone 216-368-2928; Fax 216-368-4718
Joanne Westin, Director

Undergraduate Programs

Major
The natural sciences major is an interdepartmental science program that leads to the Bachelor of Arts degree. It is intended to serve students whose interests and objectives call for a major in the humanities or social sciences that is accompanied by broad background in the natural sciences; e.g. history and philosophy of science and technology. Natural sciences may be taken only as a second major. The student also must declare and complete a major in one of the humanities or social sciences, except for the program in gerontological studies.

The program requires a minimum of 50 semester hours of work in natural sciences and mathematics. The departments included in the major are astronomy, biology, chemistry, geological sciences, and physics. The student must complete a minimum of 20 hours in one of the departments, a minimum of 8 hours each in two other of these departments, and 3 hours each in the remaining two departments. In addition, all natural sciences majors must complete MATH 125 and 126 or higher-level courses in mathematics. The courses selected in each of these departments must generally be courses that also satisfy major or related course requirements of an existing science major (though ASTR 201-202 is acceptable).

Minor
A minor is achieved through completion of the requirements specified below for any four of the five departments listed.

Biology
Any two of BIOL 214, 215, 216

Chemistry
Completion of one of the following sequences:
CHEM 105, 106, 113
or
CHEM 111, 113, ENGR 145

Geological Sciences
Any one of GEOG 101, 110, 115 or 117; and GEOG 119; and one other GEOG course.

Mathematics
Completion of one of the following sequences:
MATH 125, 126
or
MATH 121, 122

Physics
Completion of one of the following sequences:
PHYS 115, 116
or
PHYS 121, 122, 221

Department of Nutrition

2123 Abington Road, Room 201
Phone 368-2440; Fax 368-6644
Website: http://www.cwru.edu/med/nutrition/home/html
Henri Brunengraber, Chair

The department’s focus is on human nutrition and the application of the science of nutrition to the maintenance and improvement of health. Undergraduate programs are designed for students interested in nutritional biochemistry and metabolism, molecular nutrition, professional study in dietetics, public health nutrition, medicine, dentistry or nursing. Graduate programs emphasize dietetics, public health nutrition, nutritional biochemistry and molecular nutrition.

The Department of Nutrition offers programs leading to the following: Bachelor of Science degree in Nutrition, Bachelor of Arts degree in Nutrition, Bachelor of Arts degree in Nutritional Biochemistry and Metabolism, Bachelor of Science degree in Nutritional Biochemistry and Metabolism, Master of Science degree in Nutrition, Master of Science degree in Public Health Nutrition, and Doctor of Philosophy degree. A nutrition minor is available. Specialty programs are available in areas such as maternal and child nutrition or gerontology. The specialty is in addition to the basic graduate degree.

Special announcements describing the various programs and providing additional information are available from the department.

Faculty
Henri Brunengraber, M.D., Ph.D. (Universite de Liege)
Professor and Chair of Department
Edith Lerner, Ph.D. (University of Wisconsin – Madison)
Associate Professor and Vice Chair of Department
Hope Barkoukis, Ph.D. (Case Western Reserve University)
Assistant Professor
Margaret M. Cicirella, M.A., M.S. (Case Western Reserve University)
Instructor
Paul Ernsberger, Ph.D. (Northwestern University)
Associate Professor
Karen M. Fiedler, Ph.D. (University of Tennessee)
Associate Professor
Maria Hatzoglou, Ph.D. (University of Athens)
Associate Professor
Takhir Kasumov, Ph.D. (Moscow State)
Instructor
Mary Beth Kavanagh, M.S, (Case Western Reserve University)
Instructor
Janos Kerner, Ph.D. (Hungarian Academy of Sciences)
Assistant Professor
Jane Korsberg, M.S. (Case Western Reserve University)
Instructor
Laura Nagy, Ph.D. (University of California-Berkeley)
Associate Professor
Patricia Papsidero, M.S. (Case Western Reserve University)
Instructor
Isabel M. Parraga, Ph.D. (Case Western Reserve University)
Associate Professor
Undergraduate Programs

Major Programs

The undergraduate degree in nutrition is appropriate for students who wish to: (1) pursue graduate programs in nutritional biochemistry, molecular nutrition, dietetics, public health nutrition or other biomedical sciences, (2) enter professional schools of dentistry, medicine, or nursing; (3) apply to dietetic internships or approved experience programs in order to prepare for the professional practice of dietetics; (4) pursue technical careers in the food or pharmaceutical industry. This major offers flexibility in course selection within a framework of general program requirements. The selection of courses depends on the student’s choice of emphasis. Students wishing to qualify for admission to professional or graduate programs need to include specific courses considered prerequisites for admission. Students interested in applying to dietetic internships must meet specific course requirements (Didactic Program in Dietetics) as required by the Commission on Accreditation for Dietetics Education of the American Dietetic Association. These requirements are met in the courses that comprise the Didactic Program in Dietetics (DPD).
Bachelor of Science degree requires the completion of the Arts and Sciences General Education Requirements (GER), PHED 101, 102, and the following courses:

- NTRN 201, 342, 343, 363, 364 and three NTRN electives
- BIO 141; BIOL 348 or PHOL 480
- BIO 307 or DEND 307
- STAT 201 or 243 or 312 or 313

Bachelor of Arts degree requires the completion of the Arts and Sciences GER, PHED 101, 102, and the following courses:

- NTRN 201, 342, 343, 363, 364, 399 and two NTRN electives
- CHEM 105, 106, 223
- BIO 214; BIOL 348 or PHOL 480
- BIO 307 or DEND 307

**Nutritional Biochemistry and Metabolism**

Bachelor of Arts degree requires the completion of the Arts and Sciences GER, PHED 101, 102, and the following courses:

- NTRN 201, 342, 343, 363, 364, 452 and two NTRN electives
- MATH 125, 126
- CHEM 105, 106, 113, 223, 224, 233, 234
- BIO 214, 215
- BIOL 348 or PHOL 480
- PHYS 115, 116
- BIO 307, 334

**Minor Programs**

The basic sequence for a minor program consists of NTRN 201, Nutrition (3); NTRN 343, Dietary Patterns (3); and an additional 9 hours of nutrition courses, selected from: NTRN 328, 342, 351, 363, 364, 388.

**Nutrition (NTRN)**

**Undergraduate Courses**

NTRN 201. Nutrition (3)

The nutrients, their functions, food sources, and factors affecting human needs throughout life.

NTRN 328. Child Development and Health (3)

Growth and development of the child from prenatal through adolescence, including individuality, maturation, and biological needs.

NTRN 342. Food Science (5)

Chemical, physical and biological properties of food constituents and their interactions in food preparation and processing and practical application of processing methods and their effect on nutritional quality and acceptability. Laboratory and lecture. Prereq: CHEM 106.

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**Bachelor of Science Degree in Nutrition: Human Nutrition Major**

**Fall Semester**

**Freshman**

- CHEM 105 Principles of Chemistry I ........................................... (3)
- ENGL 150 Expository Writing ................................................... (3)
- MATH ................................................................. (3-4)
- GER: Social Sciences ......................................................... (3)
- GER: Arts/Humanities ......................................................... (3)
- PHED 101 Physical Education ................................................ (0)

**Sophomore**

- NTRN 342 Food Science ...................................................... (5)
- STAT 201 Basic Statistics for the Social and Life Sciences I .... (3)
- CHEM 223 Introductory Organic Chemistry I ....................... (3)
- CHEM 233 Introductory Organic Chemistry Laboratory * .... (2)
- GER: Social Sciences ......................................................... (3)

**Junior**

- BIO 348 Human Anatomy and Physiology ......................... (4)
- DEND 307 Biochemistry .................................................... (4)
- GER: Arts/Humanities ......................................................... (3)
- GER: Global Diversity ....................................................... (3)

**Senior**

- NTRN 363 Energy, Protein, and Minerals .......................... (3)
- NTRN Elective .................................................................. (3)
- Electives ................................................................. (12)

* Strongly recommended but not required.

**Spring Semester**

**Freshman**

- CHEM 106 Principles of Chemistry II ............................... (3)
- CHEM 113 Principles of Chemistry Laboratory .................... (2)
- NTRN 201 Nutrition ......................................................... (3)
- MATH ................................................................. (3-4)
- BIOL 214 Genes and Evolution .......................................... (4)
- PHED 102 Physical Education ........................................... (0)

**Sophomore**

- NTRN 343 Dietary Patterns ................................................. (3)
- CHEM 224 Introductory Organic Chemistry II* ................... (3)
- CHEM 234 Introductory Organic Chemistry Laboratory II* .... (2)
- GER: Social Sciences ......................................................... (3)
- GER: Arts/Humanities ......................................................... (3)

**Junior**

- BIO 343 Microbiology* ...................................................(3)
- BIO 344 Laboratory for Microbiology* ............................... (2)
- NTRN elective ................................................................ (3)
- GER: Arts/Humanities ......................................................... (3)
- Elective ................................................................. (6)

**Senior**

- NTRN 364 Vitamins .......................................................... (3)
- NTRN elective ................................................................ (3)
- Elective ................................................................. (9)
Bachelor of Arts Degree in Nutrition: Nutritional Biochemistry and Metabolism Major

Freshman Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MATH 125 Mathematics I</td>
<td>(4)</td>
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<tr>
<td>CHEM 105 Principles of Chemistry I</td>
<td>(3)</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3)</td>
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<tr>
<td>GER: Arts/Humanities</td>
<td>(3)</td>
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<tr>
<td>GER: Social Sciences</td>
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<tr>
<td>PHED 101 Physical Education</td>
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<tr>
<td>Spring</td>
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<tr>
<td>MATH 126 Mathematics II</td>
<td>(4)</td>
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<tr>
<td>CHEM 106 Principles of Chemistry II</td>
<td>(3)</td>
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<tr>
<td>CHEM 113 Principles of Chemistry Laboratory</td>
<td>(2)</td>
</tr>
<tr>
<td>NTRN 201 Nutrition</td>
<td>(3)</td>
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<tr>
<td>BIOL 214 Genes and Evolution</td>
<td>(4)</td>
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<tr>
<td>PHED 102 Physical Education</td>
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<td>Sophomore Year</td>
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<td>Fall</td>
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<tr>
<td>CHEM 223 Introductory Organic Chemistry I</td>
<td>(3)</td>
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<tr>
<td>CHEM 234 Introductory Organic Chemistry Laboratory</td>
<td>(2)</td>
</tr>
<tr>
<td>NTRN 342 Food Science</td>
<td>(2)</td>
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<tr>
<td>BIOL 215: Cells and Proteins</td>
<td>(5)</td>
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<tr>
<td>GER: Social Sciences</td>
<td>(3)</td>
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<td>Spring</td>
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<tr>
<td>CHEM 224 Introductory Organic Chemistry II</td>
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<tr>
<td>CHEM 234 Introductory Organic Chemistry Laboratory II</td>
<td>(2)</td>
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<tr>
<td>GER: Arts/Humanities</td>
<td>(3)</td>
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<tr>
<td>GER: Social Sciences</td>
<td>(3)</td>
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<td>Elective</td>
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Junior Year

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<tr>
<th>Fall</th>
<th>Credit Hours</th>
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<tr>
<td>BIOL 348 Human Anatomy and Physiology</td>
<td>(4)</td>
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<tr>
<td>PHYS 115 Introductory Physics I</td>
<td>(4)</td>
</tr>
<tr>
<td>BIOL 307 General Biochemistry</td>
<td>(4)</td>
</tr>
<tr>
<td>GER: Arts/Humanities</td>
<td>(3)</td>
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<tr>
<td>Spring</td>
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<tr>
<td>PHYS 116 Introductory Physics II</td>
<td>(4)</td>
</tr>
<tr>
<td>GER: Global Diversity</td>
<td>(3)</td>
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<tr>
<td>GER: Arts/Humanities</td>
<td>(3)</td>
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<td>Elective</td>
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Senior Year

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<tr>
<th>Fall</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>NTRN 363 Energy, Protein, Minerals</td>
<td>(3)</td>
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<tr>
<td>NTRN 452 Nutritional Biochemistry</td>
<td>(3)</td>
</tr>
<tr>
<td>BIOC 334 Protein and Enzymes</td>
<td>(3)</td>
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<tr>
<td>Electives</td>
<td>(3)</td>
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<tr>
<td>Spring</td>
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<tr>
<td>NTRN 364 Human Nutrition II: Vitamins</td>
<td>(3)</td>
</tr>
<tr>
<td>Nutrition electives</td>
<td>(6)</td>
</tr>
<tr>
<td>Elective</td>
<td>(3)</td>
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NTRN 434. Advanced Human Nutrition II (3)
Emphasis on reading original research literature on vitamins with development of critical evaluation and thinking skills. Prereq: NTRN 433 or consent.

NTRN 435. Maternal and Child Nutrition (3)
Study of current research literature on nutrition for pregnancy, lactation, infancy and childhood, including assessment and requirements. Prereq: Nutrition major or consent of instructor.

NTRN 437. Evaluation of Nutrition Information for Consumers (3)
Reading and appraisal of food and nutrition literature written for the general public, including books, periodicals, and audio and visual sources. Prereq: Nutrition major or consent of instructor.

NTRN 438. Trends in Diet Therapy (3)
Evaluation and interpretation of modern concepts of nutrition related to abnormalities requiring dietary modifications. Prereq: NTRN 365 or equivalent.

NTRN 440. Nutrition for the Aging and Aged (3)
Consideration of the processes of aging and needs which continue throughout life. The influences of food availability, intake, economics, culture, physical and social conditions and chronic disease as they affect the ability of the aged to cope with living situations. Prereq: Nutrition major or consent of instructor.

NTRN 446. Advanced Maternal Nutrition: Special Topics (3)
Analysis of the problems commonly associated with high-risk pregnancies and fetal outcome. Discussion of causes, mechanisms, management and current research. Prereq: NTRN 435 or consent.

NTRN 451. Food Service Systems Management (3)
Application of organizational theory and skills in the preparation and service of quantity food. Laboratory experiences in professional food services are included. Students will analyze one aspect of food service management in depth. Prereq: Nutrition Major or consent.

NTRN 452. Nutritional Biochemistry and Metabolism (3)
Mechanisms of regulation of pathways of intermediary metabolism; amplification of biochemical signals; substrate cycling and use of radioactive and stable isotopes to measure metabolic rates. Prereq: BIOC 307 or equivalent. Cross-listed as BIOC 452.

NTRN 454. Isotope Tracer Methodology (3)
Stable and radioactive isotopes in metabolic research concentrating on the design of in-vitro and in-vivo investigative protocols using mostly stable isotopes and mass spectrometric analysis; critical interpretation of data from the recent literature; and pathway identification and kinetics. Prereq: BIOC 407.

NTRN 455. Molecular Nutrition (3)
Nutrient control of gene expression in mammalian cells with deregulation of expression of these genes. The molecular basis of nutrition-related diseases, such as diabetes mellitus, PKU, and LDL-receptor deficiency, will be discussed. The application of genetic manipulation to metabolism and nutrition will be evaluated. Prereq: BIOC 407.

NTRN 460. Sports Nutrition (3)
Study of the relationships of nutrition and food intake to body composition and human performance. Laboratory sessions include demonstrations of body composition and fitness measurements and participation in a research project. Prereq: NTRN 363 or NTRN 433 or consent.

NTRN 516. Seminar in Dietetics I (4)
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Prereq: Dietetic internship.

NTRN 517. Seminar in Dietetics II (4)
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Prereq: Dietetic internship.

NTRN 528. Introduction to Public Health Nutrition (3)
Philosophy, objectives, organization, and focus of government and voluntary agencies with emphasis on nutrition components. Prereq: Public health nutrition majors only.

NTRN 530. Public Health Nutrition (3)
Analysis of public health programs in government and voluntary health agencies and the effect of legislation. Emphasis on integration with other disciplines working in public health settings and the role of a public health nutritionist. Prereq: Consent of instructor.

NTRN 531. Public Health Nutrition Field Experience (1-6)
Individually planned public health experience. May be concurrent with course work in local agencies or in blocks of full-time work with a city, county, or state health agency. Prereq: Open to public health nutrition students only.

NTRN 532A. General Nutrition Care (1-3)
Individually arranged clinical experience.

NTRN 532C. Specialized Public Health Nutrition Field Experience (1-3)
Individually arranged clinical experience. Prereq: Public Health Nutrition students only.

NTRN 532D. Hospital Dietetics (1-3)
Individually arranged clinical experience.

NTRN 532E. Clinical Research: Methods in Nutrition and Metabolism (3)
Individually arranged.

NTRN 533. Nutritional Care of Neonate (3)
Nutritional assessment and management of high-risk newborns with emphasis on prematurity and low birth weight. Review of current literature coordinated with clinical experience in the neonatal intensive care unit. Issues on follow-up included. Prereq: NTRN 435 or consent.

NTRN 550A. Advanced Community Nutrition (3)
Development of skills needed by the community dietician. Emphasis on effective tools for service development and delivery. Recommended courses of action for the professional.

NTRN 550B. Seminar: Dietetics (1)
NTRN 551. Seminar in Advanced Nutrition (2-3)

NTRN 561. Investigative Methods in Nutrition (1-4)
Research methods appropriate for nutrition. Methods for conducting research in nutrition and food sciences, food service management and dietetics. Designing research proposals. Prereq: Nutrition major or consent of instructor.

NTRN 601. Special Problems (1-18)
NTRN 651. Thesis M.S. (1-18)
NTRN 701. Dissertation Ph.D. (1-18)
NTRN 702. Appointed Dissertation Fellow (9)

Department of Philosophy

203 Clark Hall
Phone 216-368-2810; Fax 216-368-0814
Colin McLarty, Chair

The Department of Philosophy offers an undergraduate major leading to the Bachelor of Arts degree. A student majoring in philosophy must satisfy the requirements of the Arts and Sciences General Education Requirements. It offers minor programs and sequences for the undergraduate along with graduate-level courses for candidates for the Master of Arts degree in other fields such as biomedical, ethics, history, English, math and science. The department’s course offerings are designed not only to provide knowledge and skills required for students whose main interest is in philosophy but also to educate students in general about the intellectual issues that a reflective person is likely to encounter in various contexts of civilized life. The department emphasizes the relevance of philosophy to mathematics, computer science, and disciplines in the natural sciences, the social sciences, the humanities and arts, and law.

The major program in philosophy, besides offering a solid foundation for advanced study in philosophy and enriching
programs in other disciplines, develops the skills for analytical and critical thinking, effective communication and rational decision needed in a wide range of endeavors. The program thus provides majors with unusual flexibility in the choice of subsequent careers, including law, medicine, and management while complementing the pursuit of career objectives with a greater perspective and a richer quality of intellectual life.

The department participates in an interdisciplinary major program in the history and philosophy of science and technology leading to the Bachelor of Arts degree in collaboration with the Department of History. The department also participates in, and contributes courses to, the interdisciplinary minor in artificial intelligence.

**Faculty**

Colin McLarty, Ph.D. (Case Western Reserve University)

Associate Professor and Chair

- Logic: philosophy of logic; philosophy of mathematics; philosophy of science; contemporary French philosophy
- Philosophy: political and social philosophy; philosophy of law; philosophy of feminism; Hegel; contemporary continental philosophy

Laura E. Hengehold Ph.D. (Loyola University)

Assistant Professor

- Political and social philosophy: philosophy of law; philosophy of law; philosophy of feminism; Hegel; contemporary continental philosophy

Chin-Tai Kim, Ph.D. (Harvard University)

Professor

- History of philosophy (17th-, 18th-, and 19th-century philosophy); theory of knowledge, metaphysics; ethics; phenomenology
- Lecturer in History and Philosophy

Caroline A. Whitbeck, Ph.D. (Massachusetts Institute of Technology)

The Elmer G. Beamer-Hubert H. Schneider Professor of Ethics

- Ethics; practical ethics; professional ethics

Laura E. Hengehold Ph.D. (Loyola University)

Assistant Professor

- Political and social philosophy: philosophy of law; philosophy of feminism; Hegel; contemporary continental philosophy

**Associate Faculty**

Patricia Princehouse (Harvard University)

Lecturer in History and Philosophy

- History and philosophy of science (19th and 20th centuries), biology, geology, race, gender and cultural history.

**Adjunct Faculty**

Joel Levin, Ph.D (University of Oxford)

Adjunct Associate Professor of Philosophy

Adjunct Professor of Law

Stephen Post, Ph.D. (University of Chicago)

Associate Professor of Biomedical Ethics

Biomedical ethics; applied ethics

**Undergraduate Programs**

**Major**

The major consists of 30 hours (ten 3-credit courses) in philosophy, including PHIL 101, 201, 301, 302, and six other courses to be determined in consultation with the department’s undergraduate advisor. However, a student may request of the advisor that up to 6 hours (two 3-credit courses) of the required 18 hours in six 3-credit philosophy electives be taken in another field or other fields. Such a request should be supported by considerations showing how the substitution(s) would strengthen the student’s major in philosophy. The advisor must approve the substitution(s) in advance.

**Minor**

The department offers a range of possible minor programs, each of which must include PHIL 101 and four other courses in philosophy at the 200- or 300-level (excluding PHIL 390 and 399) chosen to meet the specific needs of students majoring in other fields. The undergraduate advisor will assist students in devising minor programs.

**Sequences for Students in the Engineering Core**

All sequences must include PHIL 101 and two other philosophy courses at the 200- or 300-levels (excluding PHIL 390 and 399) as approved by the undergraduate advisor. A typical sequence, for example, will consist of PHIL 101 and two courses from one of the following groups:

**Logic and Scientific Methodology**

- PHIL 201, Introduction to Logic (3)
- PHIL 303, Natural Philosophy I (3)
- PHIL 304, Natural Philosophy II (3)
- PHIL 303, Evolution, Creation and Science (3)
- PHIL 309, Philosophical Issues in Genetics (3)

**Logic, Formal Systems, and Philosophy of Mathematics**

- PHIL 201, Introduction to Logic (3)
- PHIL 306, Mathematical Logic (3)
- PHIL 313, Philosophy of Mathematics (3)

**Value Theory**

- PHIL 102 Ethics—An Interdisciplinary Introduction (3)
- PHIL 305, Ethics (3)
- PHIL 205, Contemporary Moral Problems (3)
- PHIL 304, Science and Engineering Ethics (3)
- PHIL 325, Philosophy of Feminism (3)
- PHIL 334, Political and Social Philosophy (3)
- PHIL 335, Philosophy of Law (3)

**Language, Mind and Cognition**

- PHIL 201, Introduction to Logic (3)
- PHIL 345, Epistemology and Metaphysics (3)
- PHIL 365, Philosophy of Mind (3)
- PHIL 385, Philosophy of Language (3)

**Philosophy and Culture**

- PHIL 225, Evolution
- PHIL 301, Ancient Philosophy (3)
- PHIL 320, Phenomenology, Existentialism, and Hermeneutics (3)
- PHIL 333 Philosophy of Religion
- PHIL 345, Epistemology and Metaphysics (3)
- PHIL 355, Nineteenth and Twentieth-Century Philosophy (3)
- PHIL 356, Comparative Philosophy (3)
- PHIL 370, Philosophy and Literature (3)

There are other possible sequences.

**Philosophy Courses for the General Education Requirement:**

PHIL 201 may be used to satisfy the Mathematical Reasoning and Analysis requirement. PHIL 101, with any one of the following courses, 204, 205, 302, 305, 334, 345, and 370, may be used to satisfy the sequence requirement in History, Philosophy and Religion. PHIL 356, Comparative Philosophy may be used to satisfy the Global and Cultural Diversity requirement.

**Departmental Honors**

The department offers an Honors Program for students enrolled in its major program which involves completing a substantial thesis, passing an oral examination on the thesis, and maintaining a B average in philosophy courses taken while in the program. To be eligible for admission, a student should have an overall grade point average of B or better, and a grade of B or better in each
philosophy course already taken. A student normally should have taken at least four, and at most seven, philosophy courses at the time of application for admission. An honors student should register for PHIL 399, Directed Study (3), to do honors work. An interested student should apply for admission to the program during the first semester of junior year.

Philosophy (PHIL)
Undergraduate Courses

PHIL 101. Introduction to Philosophy (3)
Basic problems of philosophy and methods of philosophical thinking. Problems raised by science, morality, religion, politics, and art. Readings from classical and contemporary philosophers. Normally given in multiple sections with different instructors and possibly with different texts. All sections share core materials in theory of knowledge, metaphysics, and ethics despite differences that may exist in emphasis.

PHIL 102. Ethics, An Interdisciplinary Introduction (3)
This course will introduce methods and literature of several disciplines, including philosophy, that bear on contemporary ethical issues. The goal is to prepare students for a lifetime of ethical reflection, discussion, and problem-solving, as well as more advanced study in the disciplines introduced by enhancing their understanding of ethical concepts and moral reasoning. Topics include lying, moral responsibility, and power, specifically rights and responsibilities of citizens, students, teachers, engineers, health care providers, and accountants.

PHIL 201. Introduction to Logic (3)
Presentation, application, and evaluation of formal methods for determining the validity of arguments. Discussion of the relationship between logic and other disciplines.

PHIL 203. Natural Philosophy I (3)
Historical and philosophical interpretation of some epochal events in development of science. Copernican revolution, Newtonian mechanics, Einstein’s relativity physics, quantum mechanics, and evolutionary theory; patterns of scientific growth; structure of scientific “revolutions;” science and “pseudo-science.” First half of a year-long sequence. Cross-listed as HSTY 203.

PHIL 204. Natural Philosophy II (3)
Conceptual, methodological, and epistemological issues about science: concept formation, explanation, prediction, confirmation, theory construction and status of unobservables; metaphysical presuppositions and implications of science; semantics of scientific language; illustrations from special sciences. Second half of a year-long sequence. Cross-listed as HSTY 207.

PHIL 205. Contemporary Moral Problems (3)
Examination of selected contemporary moral problems and contemporary faces of perennial moral problems such as: when, if ever, lying is justified; the value of honesty and of confidentiality; under what circumstances, if any, various types of killing (suicide, execution, in war, euthanasia, killing of lower animals or ecosystems) are justified. Additional moral problems raised by new knowledge (such as genetic information) or new technology (such as rights to digital information, or the ability to), and responsible uses of these and other sources of power. Clarification of the concepts of value; ethical evaluation and justification; ethical argument, moral relevance, and the notion of a moral problem itself. Readings will draw on classical and contemporary sources in philosophy.

PHIL 225. Evolution (3)
Multidisciplinary study of the course and processes of organic evolution provides a broad understanding of the evolution of structural and functional diversity, the relationships among organisms and their environments, and the phylogenetic relationships among major groups of organisms. Topics include the genetic basis of micro- and macro-evolutionary change, the concept of adaptation, natural selection, population dynamics, theories of species formation, principles of phylogenetic inference, biogeography, evolutionary rates, evolutionary convergence, homology, Darwinian medicine, and conceptual and philosophic issues in evolutionary theory. Cross-listed as ANTH 225; BIOL 225; GEOL 225; and HSTY 225.

PHIL 270. Introduction to Gender Studies (3)
This course introduces women and men students to the methods and concepts of gender studies, women’s studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, and art history. It is the required introductory course for students taking the women’s studies major. Cross-listed as WMST 201.

PHIL 271. Bioethics: Dilemmas in Research and Clinical Practice (3)
(See BETH 271.) Cross-listed as BETH 271.

PHIL 301. Ancient Philosophy (3)

PHIL 302. Modern Philosophy (3)

PHIL 303. Topics in Philosophy of Science (3)
In-depth study of selected topics in general philosophy of science or philosophy of physical, biological, or social science. Topics may include: theories of explanation, prediction, and confirmation; semantics of scientific language; reductionism; space, time and relativity; philosophical issues about quantum mechanics; philosophical issues about life sciences (e.g., evolution, teleology, and functional explanation); explanation and understanding in social sciences; value in social science. Prereq: PHIL 101 or PHIL 201 or PHIL 203.

PHIL 304. Science and Engineering Ethics (3)
This course prepares students to recognize ethical problems that commonly arise in the scientific and engineering workplace, to understand ethical concepts, to evaluate ethical arguments, and to critically examine responses to problems and their ethical ramifications. It addresses questions such as: What are the criteria of fairness in crediting contributions to research? How safe is safe enough? What are professional responsibilities, and how do they change over time? What is research misconduct? When is ignorance culpable? What is intellectual property and what protections does it deserve? When is biological testing of workers justified? What are responsible ways of raising concerns, and what supports do good organizations give for raising them? What treatment counts as harassment or as an expression of prejudice? What are good means for controlling it? What are scientists’ and engineers’ responsibilities for environmental protection? What is a “conflict of interest” and how is it controlled? What protections for human research subjects are warranted? What, if any, use of animals in research is justified? Prereq: PHIL 101 or PHIL 205.

PHIL 305. Ethics (3)

PHIL 306. Mathematical Logic and Model Theory (3)
Propositional calculus and quantification theory; consistency and completeness theorems; goedal incompleteness results and their philosophical significance; introduction to basic concepts of model theory; problems of formulation of arguments in philosophy and the sciences.

PHIL 309. Philosophical Issues in Genetics (3)
A philosophical examination of the history and cultural connections of the science of genetics and its precursors. Genetics is a phenomenon of the twentieth century. Thus, it is new. Yet, its implications and dilemmas are enmeshed in old traditions and stereotypes, and the dynamics of cultural change. To explore the breadth of philosophical repercussions of genetics, this course will draw on science, technology, medicine, and their histories, but will also range wider to include aspects of the social history of racism and class relations, changing attitudes toward sexuality, the intricacies of big business and international cooperation, and other such diverse areas. Prereq: PHIL 101 or PHIL 203 or PHIL 204.
PHIL 313. Philosophy of Mathematics (3)
Logical paradoxes and their effects on foundations of mathematics. Status of mathematical entities and nature of mathematical truths. Formalist, logicist, and intuitionist positions. Prereq: PHIL 101 or PHIL 201.

PHIL 315. Selected Topics in Philosophy (3)
Examination of views of a major philosopher or philosophical school, a significant philosophical topic, or a topic that relates to philosophy and other discipline. Prereq: PHIL 101.

PHIL 320. The Phenomenological Tradition (3)
The background of phenomenology: Descartes, Kant, and Brentano. The epistemological rationale of Husserl’s phenomenology and its ontological implications; the powers and limits of the phenomenological method. Heidegger’s transformation of phenomenology to interpretive ontology of human existence. The development of interpretation theory as the foundation of all human existence. The development of interpretation theory as the foundation of all human sciences in Gadamer and Ricoeur. Prereq: PHIL 101 or consent.

PHIL 325. Philosophy of Feminism (3)
Dimensions of gender difference. Definition of feminism. Critical examination of feminist critiques of culture, including especially politics, ideology, epistemology, ethics, and psychology. Readings from traditional and contemporary sources. Prereq: PHIL 101.

PHIL 330. Topics in Ethics (3)
Examination of views of ethics of a major philosopher or philosophical school, a significant philosophical topic in ethics, or a topic that relates ethics to philosophy and another discipline. Prereq: PHIL 205 or PHIL 101.

PHIL 333. Philosophy of Religion (3)
Topics include: classical and contemporary arguments for God’s existence; divine foreknowledge and human freedom; the problem of evil and theodicy; nature and significance of religious experience; mysticism; varieties of religious metaphysics; knowledge, belief and faith; nature of religious discourse. Readings from traditional and contemporary sources. Prereq: PHIL 101. Cross-listed as RLGN 333.

PHIL 334. Political and Social Philosophy (3)
Justification of social institutions, primarily political ones. Such distinctions as that between de facto and legitimate authority; analysis of criteria for evaluation, such as social justice and equality; inquiry into theories of justification of the state; theory of democratic government and its alternatives. Readings from classical and contemporary sources. Prereq: PHIL 101. Cross-listed as POSC 354.

PHIL 335. Philosophy of Law (3)
Nature of law and legal systems; bearing of moral justice on legal validity; nature and justification of criminal law and punishment; nature of legal rules and of obligations to law in legal systems; logic of legal reasoning; distinctions of concepts such as legal responsibility and causation. Reading from classical and contemporary sources. Prereq: PHIL 101. Cross-listed as LAWS 353.

PHIL 345. Epistemology and Metaphysics (3)
Traditional problems of epistemology, such as definition of knowledge, justification of belief, nature of evidence and foundationalism, skepticism, the a priori, and the role of sense perception in knowledge. Metaphysical presuppositions and implications of epistemological views. Forms of realism and anti-realism. Prereq: PHIL 101.

PHIL 355. 19th and Early 20th Century Philosophy (3)
History of philosophy after Kant up to and including logical empiricism. Interpretation and comparison of important philosophers and philosophical schools of the period in terms of common methods, problems, themes, doctrines, and ideologies. Emphasis on Schopenhauer, Hegel, Kierkegaard, Marx, and Nietzsche. Prereq: PHIL 101.

PHIL 356. Comparative Philosophy (3)
Comparison of significant philosophers or philosophical schools of non-Western traditions with Western counterparts on metaphysical, epistemological, ethical, aesthetic, and sociopolitical theoretic issues. The non-Western traditions to be considered include the Indian and the Far Eastern, but not exclusively. Discussion, in context, of the problems of comparative hermeneutics. Readings will include original sources in English translation. Prereq: PHIL 101.

PHIL 365. Philosophy of Mind (3)
Traditional problems such as the relation of mind and body, knowledge of other minds, free will and determination, and nature of psychological explanation. Analysis of chief theories of mind. Analysis of mental concepts such as intention, action, decision, emotion, and will. Prereq: PHIL 101.

PHIL 370. Philosophy and Literature (3)
Affinities and tensions between philosophy and literature and issues that arise in their interface. Topics include: philosophical use of literary devices; literary use of philosophical ideas; literary philosophy and philosophical literature; and hermeneutics of literature and philosophy. Readings in philosophy and literature from both traditional and contemporary sources. Team-taught by faculty of the philosophy and literature departments. Prereq: PHIL 101. Cross-listed as CMPL 371.

PHIL 394. Seminar in Evolutionary Biology (3)
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners’ conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable hypotheses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Cross-listed as ANTH 394, BIOL 394, GEOL 394, and HSTY 394.

PHIL 399. Directed Study (3)
Open to students in either of the major programs and to minors.

Graduate Courses

PHIL 403. Topics in Philosophy of Science (3)
(See PHIL 303.)

PHIL 404. Science and Engineering Ethics (3)
(See PHIL 304.)

PHIL 405. Ethics (3)
(See PHIL 305.)

PHIL 406. Mathematical Logic and Model Theory (3)

PHIL 409. Philosophical Issues in Genetics (3)
(See PHIL 309.)

PHIL 413. Philosophy of Mathematics (3)
(See PHIL 313.)

PHIL 415. Selected Topics In Philosophy (3)
(See PHIL 315.)

PHIL 420. The Phenomenological Tradition (3)
(See PHIL 320.) Prereq: Graduate standing or consent.

PHIL 425. Philosophy of Feminism (3)
(See PHIL 325.) Prereq: PHIL 101.

PHIL 430. Topics in Ethics (3)
(See PHIL 330.)

PHIL 433. Philosophy of Religion (3)
(See PHIL 333.) Prereq: PHIL 101. Cross-listed as RLGN 433.

PHIL 434. Political and Social Philosophy (3)
(See PHIL 334.) Cross-listed as POSC 454.

PHIL 435. Philosophy of Law (3)
(See PHIL 335.) Prereq: PHIL 101.

PHIL 445. Epistemology and Metaphysics (3)
(See PHIL 345.)

PHIL 455. 19th and Early 20th Century Philosophy (3)
(See PHIL 355.)

PHIL 456. Comparative Philosophy (3)
(See PHIL 356.) Prereq: PHIL 101.

PHIL 465. Philosophy of Mind (3)
(See PHIL 365.)
PHIL 470. Philosophy and Literature (3)
(See PHIL 370.)

PHIL 494. Seminar in Evolutionary Biology (3)
(See PHIL 394.) Cross-listed as ANTH 494, BIOL 494, GEOL 494, and HSTY 494.

PHIL 600. Tutorial (1-18)

PHIL 651. Thesis M.A. (1-6)
For Ph.D. candidates in fields related to philosophy.

PHIL 700. Advanced Tutorial and Dissertation (1-18)

Department of Physical Education and Athletics

Veale Center
Phone 216-368-2867; Fax 216-368-5475
David M. Hutter, Chair

The Department of Physical Education offers the student a variety of opportunities from challenging academic classes to vigorous recreational activities.

Faculty

David M. Hutter, Ph.D. (The Ohio State University)
Professor and Chair
Athletic Director

Jennie Amodio, B.A. (Ohio University)
Instructor
Softball Coach

Todd Clark, B.A. (Kenyon College)
Instructor
Men and women’s swim coach

Robert Del Rosa, M.A. (Western Reserve College)
Associate Professor
Wrestling coach; assistant director of athletics

Emily Donovan, B.A. (Kenyon College)
Instructor
Women’s Soccer Coach

Gerald Harbak, M.S. (Western Reserve University)
Assistant Professor
Soccer coach; golf coach

Dennis Harris, B.S. (The Ohio State University)
Instructor
Men’s track and field coach; assistant football coach

Kristin Hughes, M.S. (Smith College)
Instructor
Women’s basketball coach, Assistant Athletic Director

Adam Hutchinson, M.S. (University of Massachusetts at Amherst)
Instructor
Men’s Basketball Coach

Patrick Kennedy, M.S. (University of Maryland)
Assistant Professor
Associate Athletic Director
Director of intramurals, coordinator of club sports and coordinator of facilities

Kathy Lanese, B.S. (Ohio University)
Instructor
Women’s Track and Field Coach

Barb Moore, M.S. (West Virginia University)
Instructor
Head Athlete Trainer

Mina Moore, B.S. (Wayne State University)
Instructor
Associate director, Intramurals

Joe Perella, B.S. (John Carroll University)
Instructor
Head Football Coach

Nancy Rahn, M.S. (West Chester University)
Instructor
Tennis coach, Coordinator of Physical Education

Jerry Seimon, B.S. (Kent State University)
Instructor
Baseball; assistant football coach

Jeff Tomaszewski, B.A. (Case Western Reserve University)
Instructor
Assistant Athletic Trainer

Undergraduate Programs

Sports Medicine

The purpose of the sports medicine minor is to expose students to the theory and practical aspects of prevention, recognition, and treatment of athletic injuries.

Required: PHED 332, 334, 339, 340, 341, 342

Lifetime Sports Program

The department has designed an instructional program of modern activities and lifetime sports. Each semester 15 to 25 coeducational lifetime sports classes are offered. Freshmen, who have a one-year physical education requirement, have first priority in electing PHED 010 to 199. Others who have completed the requirement may audit classes.

A number of popular advanced lifetime sports activities are also offered for one hour of academic credit. Advanced skills, strategy, and coaching are taught (PHED 200 to 299).

Recreational Activities and Intercollegiate Athletics

The intramural program provides a continuous schedule of activities throughout the year. Individual and team sports are available to students in several divisions: residence hall, fraternity, women, coed, graduate, and open. Intercollegiate varsity athletic competition is available in 12 sports for men and 10 sports for women.

Physical Education (PHED)

Undergraduate Courses

PHED 012. Badminton (0)
PHED 016. Cross Country Skiing (0)
PHED 017. Dance Aerobics (0)
PHED 019. Golf (0)
PHED 024. Jogging (0)
PHED 025. Power Volleyball (0)
PHED 026. Racquetball (0)
PHED 028. Squash (0)
PHED 029. Swimming: Beginners/Intermediate (0)
PHED 030. Swimming: Endurance (0)
PHED 031. Tennis (0)
PHED 034. Weight Training (0)
PHED 039. Bowling (0)
PHED 040. Basketball (0)
PHED 041. Softball (0)
PHED 050. Personal Safety Awareness (0)
PHED 055. Cardio-Fitness (0)
PHED 218. Wellness (1)
Prereq: Advanced swimming skills.
PHED 219. Weight Training III (1)
Prereq: PHED 216.
PHED 302. Psychology of Sport (2)
The major psychological dimension underlying an individual's participation in sport. Selected areas that influence the acquisition of physical skill and performance in sports.
PHED 325. Officiating Basketball (2)
Administrative procedures, promotion, managerial relationships, scheduling, tournaments, budgeting, scoring systems, and officiating.
PHED 332. Care and Prevention of Athletic Injuries (3)
Designed as introduction to field of athletic training. Students become acquainted with various responsibilities of athletic trainers. Helps students better understand injury prevention and basis foundations of sport trauma. Study includes injury evaluation and treatment of the foot, ankle, knee, and lower leg.
PHED 334. Advanced Athletic Training I (3)
Introduces students to sports medicine management, including emergency procedures and general assessment skills. Principles underlying therapeutic modalities and exercise rehabilitation are discussed. Injury evaluation and treatment for the abdomen, shoulder, forearm, wrist, and hand are included. Prereq: PHED 352 and PHED 340.
PHED 337. Perspectives in Sex (3)
The many facts of human sexuality; incorporating this information into an effective healthy program of living.
PHED 339. Advanced Athletic Training II (3)
Concentrates on rehabilitation and modality application. Special topics such as drugs, nutrition, health conditions related to sports and gender issues are covered. Care and management of head, spinal, thoracic, and hip injuries included. Students participate in physical therapy clinic. Prereq: PHED 352 and PHED 340 and PHED 334.
PHED 340. Human Anatomy (3)
The purpose of this course is to instruct the student in basic anatomy. Joint and muscle action as it relates to performance is covered.
PHED 341. Physiology of Exercise (3)
Exercise physiology is an aspect of sports medicine that involves the study of how the body, from a functional standpoint, responds and adjusts to exercise. The study of exercise physiology is based on factual information derived primarily from experimental research. Laboratory work is an integral part of this course. Prereq: PHED 340.
PHED 342. Biomechanics (3)
The purpose of this course is to give the students an understanding of biomechanics. This course will help students better understand why specific mechanisms result in specific injuries. Topics include strength vs. power, dynamics, closed kinetic chain, open kinetic chain, and biomechanical analysis of specific joints. Prereq: PHED 340.
PHED 357. Principles of Coaching (2)
Designed to provide methods and techniques for coaching sport. Topics include teaching skill, motivating participants, training, conditioning, practice organization, budget, equipment, and facility management, and psychological, sociological and philosophical implications.

Department of Physics

Rockefeller Building
Phone 216-368-4000; 800-368-PHYS (7497)
Fax 216-368-4671
Lawrence M. Krauss, Chair

The Department of Physics offers programs leading to the following undergraduate degrees: Bachelor of Arts, Bachelor of Science in Physics, Bachelor of Science in Mathematics and Physics, and Bachelor of Science in Engineering with an Engineering Physics major. It also offers the graduate degrees, Master of Science and Doctor of Philosophy. All of these programs involve the study of the basic laws of nature and the properties of energy and matter in their various forms. The curriculum reflects the
varied interests of the faculty and can thus prepare students for a wide range of future activities. At the undergraduate level, open electives and engineering physics concentration area courses tailor the programs to the individual student’s interests and career plans. Individualized programs are developed with the aid of an advisor. A similar flexibility exists in the first few years of graduate study. The research leading to the Ph.D. degree normally centers on a specific area of physics. However, even at this stage, the broad background and training characteristic of a physics degree are emphasized.

Faculty

Lawrence M. Krauss, Ph.D. (Massachusetts Institute of Technology)
Ambrrose Swasey Professor of Physics and Chair of the Department, Professor of Astronomy (lmk9@po.cwru.edu)

Theoretical physics, particle physics, astrophysics, cosmology

Daniel Akerib, Ph.D. (Princeton University)
Associate Professor (das5@po.cwru.edu)

Experimental astrophysics

Robert W. Brown, Ph.D. (Massachusetts Institute of Technology)
Institute Professor (rwb@po.cwru.edu)

Particle physics theory, cosmology, medical imaging, industrial physics

Gary Chottiner, Ph.D. (University of Maryland)
Director of Undergraduate Studies, Professor (gsc2@po.cwru.edu)

Experimental physics of surfaces and thin films

Corbin E. Covault, Ph.D. (Harvard University)
Associate Professor

Experimental high energy astrophysics

David E. Farrell, Ph.D. (University of London)
Professor (def@po.cwru.edu)

Experimental condensed matter physics, superconductors, medical physics

Kathleen Kash, Ph.D. (Massachusetts Institute of Technology)
Professor (kxk43@po.cwru.edu)

Experimental condensed matter and mesoscopic physics, quantum semiconducting structures

Kenneth L. Kowalski, Ph.D. (Brown University)
Professor (kkk3@po.cwru.edu)

Theoretical and experimental particle physics

Walter Lambrecht, Ph.D. (University of Ghent)
Professor (wxl2@po.cwru.edu)

Theoretical condensed matter physics; electronic structure based physics of materials

Harsh Mathur, Ph.D. (Yale University)
Associate Professor, (bxm7@po.cwru.edu)

Condensed matter theory

Rolf G. Petschek, Ph.D. (Harvard University)
Professor (rgp@po.cwru.edu)

Theoretical condensed matter, optical materials

Charles Rosenblatt, Ph.D. (Harvard University)
Director of Graduate Studies, Professor (crv@po.cwru.edu)

Experimental condensed matter physics, liquid crystals and complex fluids

John Ruhl, Ph.D. (Princeton University)
Professor (rubf@erebus.phys.cwru.edu)

Experimental Astrophysics and Cosmology

Donald E. Schuele, Ph.D. (Case Institute of Technology)

Experimental condensed matter physics, properties of materials

Jic Shen, Ph.D. (Columbia University)

Experimental condensed matter physics, ultrafast optics, terahertz spectroscopy

Kenneth D. Singer, Ph.D. (University of Pennsylvania)
Associate Chair, Professor (kds4@po.cwru.edu)

Experimental condensed matter physics, nonlinear optics

Glenn D. Starkman, Ph.D. (Stanford University)
Associate Professor (gds6@po.cwru.edu)

Theoretical cosmology, particle physics, astrophysics

Cyrus Taylor, Ph.D. (Massachusetts Institute of Technology)
Armington Professor (ctt@po.cwru.edu)

Experimental condensed matter physics, properties of materials

Philip L. Taylor, Ph.D. (University of Cambridge)
Perkins Professor of Physics (plt@po.cwru.edu)

Theoretical Astrophysics and Cosmology

Glenn D. Starkman, Ph.D. (Stanford University)

Experimental condensed matter physics, particle physics

The Bachelor of Science in Physics

The Bachelor of Science in Physics requires completion of the Arts and Sciences General Education Requirements (GER), the courses listed in the following table and 127 total credits. Courses required for the B.S. in Physics satisfy the 12 credit GER for Natural and Mathematical Sciences.

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
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</thead>
<tbody>
<tr>
<td>PHYS 121 or 123. Physics I, Mechanics</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122 or 124. Physics II, Electric. &amp; Magnetism</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221. Introduction to Modern Physics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 203. Analog and Digital Electronics</td>
<td>2F</td>
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</tr>
<tr>
<td>PHYS 204. Advanced Instrumentation Laboratory</td>
<td>2S</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 250. Mathematics, Physics, and Computing</td>
<td>2S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 310. Classical Mechanics</td>
<td>2S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 301. Advanced Laboratory Physics I</td>
<td>3F</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 351. Introduction to Quantum Mechanics I</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 302. Advanced Laboratory Physics II</td>
<td>3S</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 324. Electricity and Magnetism I</td>
<td>3S</td>
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<tr>
<td>PHYS 332. Introduction to Quantum Mechanics II</td>
<td>3S</td>
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<tr>
<td>PHYS 315. Introduction to solid State Physics</td>
<td>4F</td>
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<td>PHYS 325. Electricity and Magnetism II</td>
<td>4F</td>
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<tr>
<td>PHYS 351. Physics Senior Project</td>
<td>4</td>
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<tr>
<td>PHYS 316. Intro. to Nuclear and Particle Physics</td>
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<td>CHEM 113. Principles of Chemistry Laboratory</td>
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<tr>
<td>ENGR 131. Elementary Computer Programming</td>
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<td>MATH 223 or 227. Calculus 3</td>
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<td>MATH 224. Elementary Differential Equations</td>
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<td>PHED two semesters</td>
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<td><strong>Subtotal</strong></td>
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<td>25(27)</td>
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<tr>
<td>Open electives**</td>
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<tr>
<td>A&amp;S GER</td>
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<tr>
<td>Major/GER overlap</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td>127</td>
</tr>
</tbody>
</table>

* course usually taken in this year, offered only in F = fall, S = spring
** or other approved computational course
*** The number of open electives may vary as determined by the degree requirement that the total number of credits add to 127 or more.
### The Mathematical Physics Concentration in the Bachelor of Science in Physics Degree Program

Students who are interested in theoretical physics and who have a strong background in mathematics may consider applying for admission to the variation on the B.S. in Physics. This program is based on the B.S. in Physics, but with certain substitutions in the course requirements. Several of the laboratory courses are replaced by advanced mathematics courses and some of the undergraduate physics courses are replaced by graduate courses.

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 121 or 123. Physics I, Mechanics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 122 or 124. Physics II, Electricity &amp; Magnetism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 221. Introduction to Modern Physics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[PHYS 203. Analog and Digital Electronics]</td>
<td>[2F]</td>
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<tr>
<td>M-group I** Adv. Math</td>
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<td></td>
</tr>
<tr>
<td>PHYS 204. Advanced Instrumentation Laboratory</td>
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</tr>
<tr>
<td>PHYS 250. Mathematics, Physics, and Computing</td>
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<tr>
<td>PHYS 310. Classical Mechanics</td>
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<tr>
<td>[PHYS 301. Advanced Laboratory Physics I]</td>
<td>[3F]</td>
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<tr>
<td>PHYS 349. Methods of Mathematical Physics I</td>
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<tr>
<td>PHYS 313. Thermodynamics &amp; Statistical Mechanics</td>
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<td>3F</td>
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<tr>
<td>[PHYS 331. Introduction to Quantum Mechanics I]</td>
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<tr>
<td>[PHYS 324. Electricity and Magnetism I]</td>
<td>[3S]</td>
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<tr>
<td>PHYS 425. Classical Electromagnetism (grad)</td>
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<td>4F</td>
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<tr>
<td>[PHYS 332. Introduction to Quantum Mechanics II]</td>
<td>[3S]</td>
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</tr>
<tr>
<td>PHYS 482. Quantum Mechanics II (grad)</td>
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<td>PHYS 315. Introduction to Solid State Physics</td>
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<td>4F</td>
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<td>[PHYS 325. Electricity and Magnetism II]</td>
<td>[4F]</td>
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<td>PHYS 350. Methods of Mathematical Physics II</td>
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<td>M-group 3*** Adv. Math</td>
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<td>PHYS 310. Intro. to Nuclear and Particle Physics</td>
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<td><strong>Subtotal</strong></td>
<td><strong>64</strong></td>
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### Course Requirements

<table>
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<tr>
<th>Course</th>
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<th>Cr.</th>
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</thead>
<tbody>
<tr>
<td>CHEM 105 or 111. Principles of Chemistry I</td>
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<td>3 (4)</td>
</tr>
<tr>
<td>CHEM 106 or ENGR 145. Principles of Chemistry II</td>
<td></td>
<td>3 (4)</td>
</tr>
<tr>
<td>CHEM 113. Principles of Chemistry Laboratory</td>
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</tr>
<tr>
<td>ENGR 131. Elementary Computer Programming***</td>
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<tr>
<td>MATH 121 or 123. Calculus I</td>
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<tr>
<td>MATH 122 or 124. Calculus 2</td>
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<tr>
<td>MATH 223 or 227. Calculus 3</td>
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<td>3</td>
</tr>
<tr>
<td>MATH 224. Elementary Differential Equations</td>
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<td>3</td>
</tr>
<tr>
<td><strong>PHED two semesters</strong></td>
<td><strong>0</strong></td>
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</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>25(27)</strong></td>
<td></td>
</tr>
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</table>

Open Electives **15**

A&S GER **39**

Major/GER overlap **12**

**Total** **127**

* course usually taken in this year, offered only in F = fall, S = spring

** M-group 1, 2 and 5 are to be chosen from among approved advanced mathematics or statistics courses.

*** or other approved computational course

**** The number of open electives may vary as determined by the degree requirement that the total number of credits add to 127 or more.
The Biophysics Concentration in the Bachelor of Science in Physics Degree Program

This new concentration is addressed to those students interested in a combined study in biology and physics. The degree is a track within the standard B.S. in Physics. Four physics courses and certain open-elective credits are replaced by a “biogroup” of five courses, and a technical elective described below. The first of the two junior-level standard laboratory courses is replaced by one with a biology focus. All substitutions must be approved by a physics faculty committee.

The following table illustrates the requirements for the Bachelor of Science in Physics with Biophysics Concentration. Those courses in the standard B.S. program that are to be replaced are shown in brackets; their replacements are either found in the same entry or in the biogroup category.

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 121 or 123. Physics I, Mechanics</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122 or 124. Physics II, Electricity &amp; Magnetism</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221. Introduction to Modern Physics</td>
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<td>3</td>
</tr>
<tr>
<td>PHYS 203. Analog and Digital Electronics</td>
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<tr>
<td>PHYS 204. Advanced Instrumentation Laboratory</td>
<td>2F</td>
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<tr>
<td>PHYS 250. Mathematics, Physics, and Computing</td>
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<tr>
<td>PHYS 310. Classical Mechanics</td>
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<tr>
<td>[PHYS 301]. [Advanced Laboratory Physics I]</td>
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<tr>
<td>PHYS 303. Advanced Lab.: Biophysics Concentration</td>
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<tr>
<td>PHYS 313. Thermodynamics &amp; Statistical Mechanics</td>
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<tr>
<td>PHYS 331. Introduction to Quantum Mechanics I</td>
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<tr>
<td>[PHYS 302]. [Advanced Laboratory Physics II]</td>
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<tr>
<td>PHYS 324. Electricity and Magnetism I</td>
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<tr>
<td>[PHYS 332] [Introduction to Quantum Mechanics II].</td>
<td>[3S]</td>
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<tr>
<td>[PHYS 315] [Introduction to Solid State Physics]</td>
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<tr>
<td>Tech elective**</td>
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<tr>
<td>PHYS 325. Electricity and Magnetism II</td>
<td>4F</td>
<td>3</td>
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<tr>
<td>PHYS 351. Physics Senior Project (biophysics topics)</td>
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<tr>
<td>[PHYS 316] [Intro. to Nuclear and Particle Physics]</td>
<td>[4S]</td>
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</table>
| ** Course usually taken in this year, offered only in F = fall, S = spring
| *** PHYS 315 or PHYS 316 are suggested technical electives
| **** or other approved computational course

Subtotal ........................................................................ 50

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
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<tbody>
<tr>
<td>CHEM 105 or 111. Principles of Chemistry I</td>
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<td>CHEM 106 or ENGR 145. Principles of Chemistry II</td>
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<td>CHEM 113. Principles of Chemistry Laboratory</td>
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<tr>
<td>ENGR 131*** Elementary Computer Programming</td>
<td>1</td>
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<td>MATH 121 or 123. Calculus 1</td>
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<td>MATH 224. Elementary Differential Equations</td>
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<tr>
<td>B-group 1**** “biogroup”</td>
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<tr>
<td>B-group 2**** “biogroup”</td>
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<td>B-group 3**** “biogroup”</td>
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<td>B-group 4**** “biogroup”</td>
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<tr>
<td>B-group 5**** “biogroup”</td>
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<td>Subtotal .................................................... 42(44)</td>
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</table>

* The number of open electives vary in order to arrive at the total number of 128 credits.
Employment opportunities at the bachelor’s level include research, development and technical assistance (engineering, computer programming and management) in industrial, government and university settings.

A program in teacher certification (grades 7 through 12), based on the BA degree, is available for students interested in a career in teaching physics at the secondary level.

**Teacher Licensure**

Two options are available within the B.A. physics major for students to become eligible for licensure as teachers in secondary schools (Adolescents to Young Adults) qualified to teach physics or to teach physical sciences (both physics and chemistry.) Students interested in either option should contact Professor Gary Chottiner. In addition to content (subject area) requirements, a 35 semester hour sequence in professional education is required comprising courses taken at Case Western Reserve and at John Carroll University, culminating in student teaching. (See EDUCATION [EDUC & EDJC]).

### The Bachelor of Science Degree in Mathematics and Physics

In contrast to an applied mathematics degree or the B.S. in Physics with a Mathematical Physics Concentration, this is a synergistic, coherent, and parallel education in mathematics and physics. To a close approximation, the challenging course work corresponds to combining the mathematics and physics cores, with the physics laboratory cluster replaced by a single senior-year laboratory semester. A student in this new program may use either of two official advisors, one available from each department, who would also constitute a committee for the administration of the degree and the approval of curriculum petitions.

The total number of required credits is 126 (35 MATH, 38 PHYS, 6 senior project, 11-13 ENGR and CHEM, 27 A&S GER with 12 of the normal 39 GER credits satisfied by MATH and PHYS courses). There are 7-9 credits of open electives.

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
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<tbody>
<tr>
<td>PHYS 121 or 123 Physics I, Mechanics</td>
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<tr>
<td>PHYS 122 or 124 Physics II, Electricity &amp; Magnetism</td>
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<td>4</td>
</tr>
<tr>
<td>PHYS 221 Introduction to Modern Physics</td>
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<tr>
<td>PHYS 310 Classical Mechanics</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHYS 313 Thermodynamics &amp; Stat. Mech.</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 331 or 481 Quantum I</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 332 or 482 Quantum II</td>
<td>3S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 315 or 316 Cond. Matter or Nuclear/Particle</td>
<td>4F/4S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 425 Adv Elec &amp; Mag</td>
<td>4F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 472 Grad Lab</td>
<td>4S</td>
<td>3</td>
</tr>
<tr>
<td>MATH 121 or 123 Calculus I</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>MATH 122 or 124 Calculus II</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>MATH 223 or 227 Calculus III</td>
<td>2</td>
<td>3</td>
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<tr>
<td>MATH 224 Diff. Eqs.</td>
<td>2</td>
<td>3</td>
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<tr>
<td>MATH 307 Algebra I</td>
<td>2F</td>
<td>3</td>
</tr>
<tr>
<td>MATH 308 Algebra II</td>
<td>2S</td>
<td>3</td>
</tr>
<tr>
<td>MATH 321 Analysis I</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>MATH 322 Analysis II</td>
<td>3S</td>
<td>3</td>
</tr>
<tr>
<td>MATH 324 Complex Var</td>
<td>3S</td>
<td>3</td>
</tr>
<tr>
<td>MP group I</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>MP group II</td>
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<tr>
<td>MP group III</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>MP group IV</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHYS 351 or MATH 351 Sr Proj</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>ENGR 131 CompProg</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CHEM 105 or 111 **Intro Chem I</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 106 or ENGR 145** Intro Chem II</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 113 Chem Lab</td>
<td></td>
<td>2</td>
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<tr>
<td>PHED</td>
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<td>2</td>
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<tr>
<td>Open Electives</td>
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<td>7-9</td>
</tr>
<tr>
<td>A&amp;S GER</td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>Major/GER overlap</td>
<td></td>
<td>-12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>127</td>
</tr>
</tbody>
</table>

* Course usually taken in this year, offered only in F = fall, S = spring
** If approved by the M&P committee, other science sequence courses may be substituted.
*** The ‘MP group’ of four courses corresponds to two physics courses and two mathematics courses. The physics courses would be chosen from P250, P349, and P350. The mathematics courses are subject to approval by the advisory committee and are thereby referred to as ‘approved electives.’ They may be chosen from the general list of mathematics courses at the 300 level or higher. Also subject to approval, it may be possible to choose a course from outside of the mathematics and physics departments as a substitute in the MP group.
**** The number of open electives will vary depending on whether students choose 3 credit or 4 credit courses to fulfill the chemistry/science requirement.
The Bachelor of Arts degree with Physics Major

The Bachelor of Arts degree with a Physics Major requires completion of the Arts and Sciences General Education Requirements (GER) and 120 total credits, of which 56 are specified by the Physics Department as shown below. Courses specified for this major satisfy the 12-credit Arts and Sciences GER for Natural and Mathematical Sciences.

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 115, 121 or 123. Intro. Mechanics</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 116, 122 or 124. Intro Electricity &amp; Magnetism</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221. Introduction to Modern Physics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 250. Mathematics, Physics, and Computing</td>
<td>2S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 309. Selected Physics Experiments</td>
<td>2F</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 313. Thermodynamics &amp; Statistical Mechanics</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 331. Introduction to Quantum Mechanics</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 351. Physics Senior Project</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>2 of the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 310. Classical Mechanics</td>
<td>2S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 324. Electricity and Magnetism</td>
<td>3S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 315. Introduction to Solid State Physics</td>
<td>4F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 316. Intro. to Nuclear &amp; Particle Physics</td>
<td>4S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 326. Physical Optics</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 328. Cosmology &amp; Structure of the Universe</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td>36</td>
</tr>
</tbody>
</table>

* course usually taken in this year, offered only in F = fall, S = spring
** A two course science sequence chosen from: CHEM 105 and 106; CHEM 111 and ENGR 145; BIOL 110 and either BIOL 210 or BIOL 220; or another two course sequence totaling 6 or more credits in a quantitative science (other than physics), with written approval of the Physics Undergraduate Curriculum Committee.
*** or other approved computational course
**** The BA degree requires a minimum of 30 semester hours at the 300-400 level, of which only 22 are specified as PHYS courses.
entrepreneurs. It enables students and graduates to build on their physics skills to start new high-tech businesses or to launch new product lines in existing companies. The program provides top-level academic instruction and real-world entrepreneurial experience while connecting students with the business executives and leaders, experts, and venture capitalists who are crucial to success in start-up and growing ventures.

**Facilities**

The Department of Physics maintains research laboratories in experimental and theoretical astrophysics and cosmology, elementary particle physics, low temperature physics, optics, condensed matter physics, surface physics, medical physics, and industrial physics.

In collaboration with the Center for Particle Astrophysics at Berkeley, the experimental particle-astro-physics group is leading a search to discover the identity of possible weakly interacting massive elementary particles that may make up the bulk of the matter in the universe. In collaboration with the NASA-Caltech Jet Propulsion Laboratory in Pasadena, the particle-astro-physics group is developing plans to launch a satellite to do ultra-high resolution and high contrast astronomical observations. In collaboration with researchers at the University of Chicago and McGill University, the particle-astro-physics group is also operating a new experiment for gamma-ray astronomy in the energy range from 20 to 500 GeV, called STACEE (Solar Tower Solar Cherenkov Effect Experiment) located at the National Solar Thermal Test Facility (NSTTF) at Sandia National Laboratories in Albuquerque, New Mexico. STACEE has been in preparation since 1998, and makes use of a large field of heliostat mirrors to detect gamma-rays from energetic astrophysical sources including pulsars, supernova remnants, and active galactic nuclei. Detector design and data analysis software and computing facilities are located in the department.

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**The Bachelor of Science in Engineering Degree with Engineering Physics Major**

The B.S.E., major in engineering physics, requires completion of the Case School of Engineering’s Engineering Core Curriculum and completion of at least 12 hours of course work in an engineering concentration area. Required courses are listed in the following table:

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 121 or 123. Physics I, Mechanics</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122 or 124. Physics II, Electricity &amp; Magnetism</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221. Introduction to Modern Physics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 208. Instrumentation &amp; Signal Analysis Laboratory</td>
<td>2S</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 250. Mathematics, Physics, and Computing</td>
<td>2S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 310. Classical Mechanics</td>
<td>2S</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 317. Engineering Physics Laboratory I</td>
<td>3F</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 313. Thermodynamics &amp; Statistical Mechanics</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 331. Introduction to Quantum Mechanics I</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 318. Engineering Physics Laboratory II</td>
<td>3S</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 324. Electricity and Magnetism I</td>
<td>3S</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 315. Introduction to Solid State Physics</td>
<td>4F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 325. Electricity and Magnetism II</td>
<td>4F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 353. Senior Project</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>50</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>127</strong></td>
<td></td>
</tr>
</tbody>
</table>

* course usually taken in this year, offered only in F = fall, S = spring

** PHYS 332, EEAP 321, EEAP 420, EMSE 314, or EMSE 405

*** Engineering Physics Concentration courses are flexible, but must be in a specific engineering discipline or study area and be approved by an advisor. Possible concentration areas include:

- Aerospace engineering
- Biomedical engineering “hardware”
- Biomedical engineering “software”
- Chemical engineering
- Civil engineering (solid mechanics, structural and geotechnical, environmental)
- Computer science
- Computer systems hardware
- Computer systems software
- Control systems and automation
- Electrical engineering
- Macromolecular science
- Materials science and engineering
- Mechanical engineering
- Signal processing
- Systems analysis and decision making
The optics and optical materials group uses optical techniques to examine both the fundamental properties and potential technological applications of semiconductors, metals and insulators, polymers and liquid crystals, and fluids. Extensive facilities for linear, nonlinear, and light scattering studies are available, including gas ion, titanium sapphire, and ring dye lasers for continuous wave studies, a tunable picosecond and femtosecond pulsed laser system, and a tunable nanosecond laser system for nonlinear optical studies. Facilities also include video image acquisition and analysis, microscopy, holography, refractometry, ultrafast spectroscopy, and absorption and reflection spectroscopy. The optical materials centers house a full array of equipment, including photolithography for sample preparation.

The condensed matter experimentalists make use of a wide range of techniques and associated instrumentation to study properties of materials in bulk and in thin films and surfaces. Among these techniques are electron-positron annihilation, optical harmonic generation, terahertz spectroscopy, photoconductivity, magnetic susceptibility, precision dielectric constants, photoluminescence spectroscopy, and electron energy loss spectroscopy. Among the special facilities available within the department for condensed matter research are a 15-inch Varian electromagnet; helium 3He-4He dilution refrigerators (15 mK and 5 mK); several superconducting magnets, including 6T, 9T, and 14T magnets and an 8.2 T warm-bore superconducting magnet with optical access along all three Cartesian axes. Low-temperature facilities are available for research on two-dimensional arrays on liquid helium and superconductors. Other equipment includes dynamic light scattering and high resolution birefringence apparatus; high resolution differential scanning calorimeter; instrumentation for experiments up to pressures of 225,000 psi at room temperature and to pressures of 30,000 psi with the temperature variable from 4.2K to 400K; ultrahigh vacuum equipment; and a complete array of surface analysis equipment including low-energy and reflection high-energy electron diffraction, X-ray and ultraviolet photoemission spectrometers, Auger electron spectrometers, and atomic force, scanning tunneling, and near field scanning optical microscopes usable in both “read” and “write” modes for nanolithography.

Theoretical physics research utilizes a wide variety of computer, both on and off campus. The particle-astrophysics theory group maintains a UNIX cluster of RISC machines as well as clustered PCs with which it performs intensive numerical calculations in such areas as Big Bang nucleosynthesis, neutrino astrophysics, dark matter studies, stellar evolution, physics of the very early universe, and large-scale structure in the Universe. Molecular modeling and other simulations are performed on ultrafast workstations. The electronic structure group uses a cluster of high-speed UNIX workstations and links to the Ohio Supercomputer Center to perform computational physics of materials.

Well-equipped undergraduate and graduate laboratory facilities are provided. Experiments in the junior and senior years are selected from a large number of possibilities, with the general level of sophistication increasing as the student advances. All students participate in research as described above through the senior project.

The new Physics Entrepreneurship Master’s degree program will enable the students and graduates of the program to build on their physics skills to start new high-tech businesses or launch new product lines in existing companies, and then successfully grow these ventures. The purpose of this new degree track is to provide students having a background in physics and an interest in technological innovation with the training and experience needed to efficiently play leading roles in new high-tech ventures. While many physicists have traditionally pursued such career paths, this is the first physics program designed to prepare them for such a role.

**Physics (PHYS)**

**Undergraduate Courses**

**PHYS 100. Space, Time, and Motion (3)**
An introductory course in physics for students of the liberal arts. Discussion of how physics is performed, what important discoveries about natural phenomena have been made by physicists, and what are the most exciting questions being tackled by physicists today. Connections to current work appearing in various popular media will be made. In particular, emphasis is made on the connections between the fundamental discoveries that led to our understanding of motion and the light, and much of the ongoing research at the forefront of modern physics.

**PHYS 101. Distinguishing Science from Pseudo-Science (3)**
There are many current issues arising in popular discourse, ranging from the believability of ESP to reincarnation, to “free energy” machines, which can benefit from simple physical analyses. This course will provide an introduction to the use of basic principles of physics to explore the viability of these ideas. A seminar format will be utilized with specific topics presented by students and by the instructor. Prereq: PHYS 100, PHYS 115, PHYS 121, or PHYS 123.

**PHYS 113. Principles of Physics Laboratory (2)**
The laboratory portion of the first two semesters of introductory physics. (A two-semester course.) Prereq: Departmental permission.

**PHYS 113A. Principles of Physics Laboratory - Mechanics (1)**
The laboratory portion of first semester introductory physics. Prereq: Departmental permission.

**PHYS 113B. Principles of Physics Laboratory - Electricity and Magnetism (1)**
The laboratory portion of the second semester of physics. Prereq: Departmental permission.

**PHYS 115. Introductory Physics I (4)**
First part of a two-semester calculus-based sequence directed primarily towards students working towards a B.A. in science, with an emphasis on the life sciences. Kinematics; Newton’s laws; gravitation, simple harmonic motion; mechanical waves; fluids; ideal gas law; heat and the first and second laws of thermodynamics. This course has a laboratory component. Prereq: MATH 121, MATH 123, or MATH 125.

**PHYS 116. Introductory Physics II (4)**
Electrostatics, Coulomb’s law, Gauss’s law; capacitance and resistance; DC circuits; magnetic fields; electromagnetic induction; RC and RL circuits; light; geometrical optics; interference and diffraction; special relativity; introduction to quantum mechanics; elements of atomic, nuclear and particle physics. This course has a laboratory component. Prereq: PHYS 115.

**PHYS 121. General Physics I. Mechanics (4)**
Particle dynamics, Newton’s laws of motion, energy and momentum conservation, rotational motion, and angular momentum conservation. This course has a laboratory component. Prereq: MATH 121 or MATH 123 or MATH 125 or one year of high school calculus.

**PHYS 122. General Physics II. Electricity and Magnetism (4)**
Electricity and magnetism, emphasizing the basic electromagnetic laws of Gauss, Ampere, and Faraday. Maxwell’s equations and electromagnetic waves, interference, and diffraction. This course has a laboratory component. Prereq: PHYS 121 or PHYS 123. Coreq: MATH 122, MATH 124, or MATH 126.

**PHYS 123. Physics and Frontiers I - Mechanics (4)**
The Newtonian dynamics of a particle and of rigid bodies. Energy, momentum, and angular momentum conservation with applications. A selection of special frontier topics as time permits, including fractals and chaos, special relativity, fluid mechanics, cosmology, quantum mechanics. This course has a laboratory component. Admission to this course is by invitation only.
PHYS 124. Physics and Frontiers II - Electricity and Magnetism (4)
Time-independent and time-dependent electric and magnetic fields. The laws of Coulomb, Gauss, Ampere, and Faraday. Microscopic approach to dielectric and magnetic materials. Introduction to the usage of vector calculus; Maxwell’s equations in integral and differential form. The role of special relativity in electromagnetism. Electromagnetic radiation. This course has a laboratory component. Prereq: PHYS 123 or consent of department. Coreq: MATH 122 or MATH 124.

PHYS 196. Energy and Society (3)
Global and national perspectives on the problems of energy supply and demand, global warming, oil cartels, solar, nuclear and wind energy, energy history, politics and economics of fossil fuels, and alternative energy sources. Cross-listed as GEOI 196, HSTY 196, and POSC 196.

PHYS 203. Analog and Digital Electronics (4)
Elements of both analog and digital electronics from the practical viewpoint of the experimental physicist: AC circuits, linear and non-linear operation of op-amps, logic gates, flip-flops, counters, display, memory, transducers, A/D and D/A conversion. Laboratory work involves quantitative investigation of the operation of all these elements, together with projects that explore their combination. Prereq: PHYS 122 or PHYS 124.

PHYS 204. Advanced Instrumentation Laboratory (4)
Principles of experimental design; limits of resolution via band-width, thermal noise, background signals; data acquisition and control by computer; computer simulation; signal processing techniques in frequency and time domains, FFT, correlations, and other transform methods; counting techniques. Applications include lock-in amplifiers, digitizing oscilloscopes and data acquisition systems. Prereq: PHYS 203 and PHYS 221.

PHYS 208. Instrumentation and Signal Analysis Laboratory (4)
AC circuit theory, Fourier series, discrete Fourier series. Fourier integral, discrete Fourier integral; analysis in time and frequency domains, correlation, cross-correlation and other transform techniques; computer control of experiments via IEEE488 interface; advanced instrumentation; DMM, arbitrary waveform generator, multiplexing and digitizing oscilloscopes; experimental design, noise; design, construction, and testing of a lock-in amplifier. Prereq: PHYS 221 and ENGR 210.

PHYS 221. Introduction to Modern Physics (3)
Concepts in special relativity, statistical mechanics and quantum mechanics. Applications to atomic structure, and selected topics in nuclear, condensed matter physics, particle physics, and cosmology. Prereq: PHYS 116 or PHYS 122 or PHYS 124.

PHYS 250. Mathematics, Physics, and Computing (3)

PHYS 301. Advanced Laboratory Physics I (4)
Problem solving approach with a range of available experiments in classical and modern physics. Emphasis on experimental techniques, data and error analysis, and the formal presentation of the work performed. Prereq: PHYS 204.

PHYS 302. Advanced Laboratory Physics II (4)
Several projects using research-quality equipment in contemporary fields of experimental physics. Each requires reading appropriate literature, choosing appropriate instrumentation, performing data acquisition and analysis, and writing a technical paper. Topics include particle counting techniques, neutron activation, gamma-ray spectroscopy, a range of condensed matter experiments including temperature dependent properties between 10 and 350 K, modern optics, ultrahigh vacuum surface science. Prereq: PHYS 301.

PHYS 309. Selected Physics Experiments (4)
An introduction to analog electronics and experimental physics. The first few weeks focus on DC and AC circuits, including circuit elements and measurements including nonlinear elements and operational amplifiers. The remainder of the semester includes selected experiments from classical and modern physics with an emphasis on experimental techniques, data and error analysis and the formal presentation of work. Prereq: PHYS 116 or PHYS 122 or PHYS 124.

PHYS 310. Classical Mechanics (3)
Lagrangian formulation of mechanics and its application to central force motion, scattering theory, rigid body motion, and systems of many degrees of freedom. Prereq: PHYS 221 and either MATH 223 or MATH 227.

PHYS 313. Thermodynamics and Statistical Mechanics (3)

PHYS 315. Introduction to Solid State Physics (3)
Characterization and properties of solids; crystal structure, thermal properties of lattices, quantum statistics, electronic structure of metals and semiconductors. Prereq: PHYS 331.

PHYS 316. Introduction to Nuclear and Particle Physics (3)
The physics of nuclei and elementary particles; experimental methods used to determine their properties; models and theories developed to describe their structure. Prereq: PHYS 331.

PHYS 317. Engineering Physics Laboratory I (4)
Laboratory course for engineering physics majors. Emphasis is on experimental techniques, data and error analysis, and written and oral presentation of work. Four experiments drawn from classical and modern physics are carried out. These emphasize condensed matter, material and optical physics. Experiments include electric fields, resistivity of materials, optical interference, chaotic systems, and spectroscopy. Design of data analysis systems and software is required. Prereq: PHYS 208.

PHYS 318. Engineering Physics Laboratory II (4)
Laboratory course for engineering physics majors. Several projects using research-quality equipment in contemporary fields of experimental physics. Open-ended experiments each require reading appropriate literature, designing the experiment, performing data analysis, and writing a technical paper. Topics are drawn from areas of modern physics, and concentrate on condensed matter, material, and optical physics. Prereq: PHYS 317.

PHYS 324. Electricity and Magnetism I (3)
First half of a sequence that constitutes a detailed study of the basics of electromagnetic theory and many of its applications. Electrostatics and magnetostatics of free space, conductors, dielectric and magnetic materials; basic theory illustrated with applications drawn from condensed matter physics, optics, plasma physics, and physical electronics. Prereq: PHYS 116 or PHYS 122 or PHYS 124.

PHYS 325. Electricity and Magnetism II (3)
(Continuation of PHYS 324.) Electrodynamics, Maxwell’s equations, electromagnetic waves, electromagnetic radiation and its interaction with matter, potential formulation of electromagnetism, and relativity. Prereq: PHYS 324.

PHYS 326. Physical Optics (3)
Geometrical optics and ray tracing, wave propagation, interaction of electromagnetic radiation with matter, interference, diffraction, and coherence. Supplementary current topics from modern optics such as nonlinear optics, holography, optical trapping and optical computing. Prerequisite(s) may be waived with consent of department. Prereq: PHYS 122 or PHYS 124.

PHYS 328. Cosmology and the Structure of the Universe (3)
(See ASTR 328.) Cross-listed as ASTR 328.

PHYS 329. Independent Study (1-4)
An individual reading course in any topic of mutual interest to the student and the faculty supervisor.

PHYS 331. Introduction to Quantum Mechanics I (3)
Quantum nature of energy and angular momentum, wave nature of matter, Schroedinger equation in one and three dimensions; matrix methods; Dirac notation; quantum mechanical scattering. Two particle wave functions. Prereq: PHYS 221.

PHYS 332. Introduction to Quantum Mechanics II (3)
Continuation of PHYS 331. Spin and fine structure; Dirac equation; symmetries; approximation methods; atomic and molecular spectra; time de-
dependent perturbations; quantum statistics; applications to electrons in metals and liquid helium. Prereq: PHYS 331.

PHYS 339. Seminar (1-3)
Conducted in small sections with presentation of papers by students and informal discussion. Special problem seminars and research seminars offered according to interest and need, often in conjunction with one or more research groups. Prereq: Consent of department.

PHYS 340. Teaching Electricity (2)
This lab-based course is directed at in-service and prospective teachers of science in the middle and high schools. The course content will cover the basics of electricity (current, voltage, power, energy, Kirchhoff’s laws and their relation to the laws of conservation of charge and energy, Ohm’s law). Some elements of magnetism will also be introduced, time-permitting. The sessions will be hands-on and activity-based. The sessions will also model and discuss teaching pedagogy such as cooperative learning, interactive lectures, learning styles, constructivism and inquiry-learning. The technology used will involve simple and cheap equipment that can be easily replicated in classrooms. Evaluation will be based on attendance, participation, pre- and post-tests, and journals.

PHYS 349. Methods of Mathematical Physics I (3)
Analysis of complex functions: singularities, residues, contour integration; evaluation and approximation of sums and integrals; exact and approximate solution of ordinary differential equations; transform calculus; Sturm-Liouville theory; calculus of variations. Prereq: MATH 224.

PHYS 350. Methods of Mathematical Physics II (3)
(Continuation of PHYS 349.) Special functions, orthogonal polynomials, partial differential equations, linear operators, group theory, tensors, selected specials topics. Prereq: PHYS 349.

PHYS 351. Physics Senior Project (3)
A two-semester course required for senior physics majors. Project based on experimental, theoretical, or teaching research under the supervision of a physics faculty member, possibly jointly with a faculty member from another department. Study of the techniques currently utilized in a specific research area and of the recent literature associated with the project. Experimental or theoretical work leading to meaningful results which are to be presented as a term paper and an oral report at the end of the second semester. Supervising faculty will review progress with the student on a regular basis and progress reports made twice each semester to the Physics Senior Committee to ensure successful completion of the work. Prereq: PHYS 302 or PHYS 309.

PHYS 353. Senior Engineering Physics Project (3)
A two-semester course required for senior engineering physics majors (3 credits each semester). The project will be in the student’s engineering physics concentration area and will be supervised by a faculty advisor who will review progress with the student on a regular basis. The project may be calculation, experimental or theoretical, and will address both the underlying physics and appropriate engineering design principles. The project requirements include short oral presentations twice each semester before the senior project committee and a term paper and an oral presentation at the end of the second semester. Prereq: PHYS 318.

PHYS 365. General Relativity (3)
This is an introductory course in general relativity. The techniques of tensor analysis will be developed and used to describe the effects of gravity and Einstein’s theory. Consequences of the theory as well as its experimental tests will be discussed. An introduction to cosmology will be given. Prereq: Consent of department.

Graduate Courses

PHYS 413. Classical and Statistical Mechanics I (3)
An integrated approach to classical and statistical mechanics. Lagrangian and Hamiltonian formulations, conservation laws, kinematics and dynamics, Poisson brackets, continuous media, derivation of laws of thermodynamics, the development of the partition function. To be followed by PHYS 414.

PHYS 414. Classical and Statistical Mechanics II (3)
A continuation of PHYS 413. Noninteracting systems, statistical mechanics of solids, liquids, gases, fluctuations, irreversible processes, phase transformations. Prereq: PHYS 413 and consent of department.

PHYS 415. Introduction to Solid State Physics (3)
(See PHYS 315.) For graduate students in engineering and science. (May not be taken for credit by graduate students in the Department of Physics.) Prerequisite may be waived with consent of department. Prereq: PHYS 331.

PHYS 423. Classical Electromagnetism (3)

PHYS 426. Physical Optics (3)
(See PHYS 326.)

PHYS 428. Cosmology and the Structure of the Universe (3)
(See ASTR 428.) Cross-listed as ASTR 428.

PHYS 431. Physics of Imaging (3)
Description of physical principles underlying the spin behavior in MR and Fourier imaging in multi-dimensions. Introduction of conventional, fast, and chemical-shift imaging techniques. Spin echo, gradient echo, and variable flip-angle methods. Projection reconstruction and sampling theorems; Bloch equations, T1 and T2 relaxation times, rf penetration, diffusion and perfusion. Flow imaging, MR angiography, and functional brain imaging. Sequence and coil design. Prerequisite may be waived with consent of instructor. Prereq: PHYS 122 or PHYS 124 or EBME 410. Cross-listed as EBME 431.

PHYS 439. Special Topics Seminar (1-3)
Intermediate level seminar for advanced undergraduate and beginning graduate students.

PHYS 441. Physics of Condensed Matter I (3)

PHYS 442. Physics of Condensed Matter II (3)
Continuation of PHYS 441. Lattice vibrations, thermal properties of solids, semiconductors, magnetic properties of solids, and superconductivity. Prerequisite may be waived with consent of department. Prereq: PHYS 441.

PHYS 449. Methods of Mathematical Physics I (3)
(See PHYS 349.) Additional work required.

PHYS 450. Methods of Mathematical Physics II (3)
(See PHYS 350.) Additional work required.

The experimental basis for modeling the electroweak and strong interactions in terms of fundamental fermions, quarks and leptons, and gauge bosons, photons, the weak bosons, and gluons; particle accelerators and detection techniques; phenomenology of particle reactions, decays and hadronic structure; space, time and internal symmetries; symmetries; symmetry breaking. Prereq: Consent of department.

PHYS 452. Empirical Foundations of the Standard Model II (3)
Continuation of PHYS 451. Tests of the predictions of the broken SU(2) x U(1) gauge-symmetric model of the electroweak interactions and the color SU(3) model of the strong interactions. Structure of the weak currents, the quark mixing matrix, and the gauge-boson couplings. Explorations of the Higgs sector and the coupling of the Higgs to quarks and leptons. Heavy quark physics. Calculation of hadronic processes using partonic distribution functions. CP violation, neutrino masses, fermion nonconservation, and possible extensions of the Standard Model. Prerequisite may be waived with consent of department. Prereq: PHYS 451.

PHYS 460. Advanced Topics in NMR Imaging (3)
(See EBME 460.) Cross-listed as EBME 460.

PHYS 465. General Relativity (3)
(See PHYS 365.) Additional work required.

PHYS 472. Graduate Physics Laboratory (3)
A series of projects designed to introduce the student to modern research techniques such as automated data acquisition. Students will be assessed as to their individual needs and a sequence of projects will be
established for each individual. Topics may include low temperature phenomena, nuclear gamma ray detection and measurement and optics.

PHYS 481. Quantum Mechanics I (3)
Quantum mechanics with examples of applications. Schroedinger method: matrix and operator methods. Approximation methods including WKB, variational and various perturbation methods. Applications to atomic, molecular and nuclear physics including both bound states and scattering problems. Applications of group theory to quantum mechanics. Prereq: Consent of department.

PHYS 482. Quantum Mechanics II (3)
Continuation of PHYS 481. Prerequisite may be waived with consent of department. Prereq: PHYS 481.

PHYS 491. Modern Physics for Innovation I (3)
The first half of a two-semester sequence providing an understanding of physics as a basis for successfully launching new high-tech ventures. The course will examine physical limitations to present technologies, and the use of physics to identify potential opportunities for new venture creation. The course will provide experience in using physics for both identification of incremental improvements, and as the basis for alternative technologies. Case studies will be used to illustrate recent commercially successful (and unsuccessful) physics-based venture creation, and will illustrate characteristics for success. Prereq: Permission of department.

PHYS 492. Modern Physics for Innovation II (3)
Continuation of PHYS 491, with an emphasis on current and prospective opportunities for Physics Entrepreneurship. Longer term opportunities for Physics Entrepreneurship in emerging areas including, but not limited to, nanoscale physics and nanotechnology; biophysics and applications to biotechnology; physics-based opportunities in the context of information technology. Prereq: PHYS 491.

PHYS 522. Nonlinear Optics (3)

PHYS 539. Special Topics Seminar (1-3)
Individual or small group instruction on topics of interest to the department. Topics include, but are not limited to, particle physics, astrophysics, optics, condensed matter physics, biophysics, imaging. Several such courses may run concurrently. Prereq: Permission of department.

PHYS 541. Quantum Theory of Solids I (3)

PHYS 544. Advanced Theory of Materials (3)

PHYS 566. Cosmology (3)
This course will provide an up-to-date introduction to our current understanding of the origin and evolution of the Universe and will make connections between our understanding of elementary particle physics and cosmology. Specific topics will include: General Parameters of Cosmology: Expansion, Lifetime, and Density of the Universe. The Early Universe, Constraints on Elementary Particles, Dark Matter and Dark Energy, Nucleosynthesis, Cosmic Microwave Background, Inflation, Stellar Evolution, Gravitational Waves, Baryogenesis. Some background in general relativity and particle physics phenomenology is recommended. Prereq: Consent of the department.

PHYS 579. Special Topics: Frontiers in Research (3)
In-depth examination of a cutting-edge topic of current research. New topic is selected each semester.

PHYS 581. Quantum Mechanics III (3)

PHYS 591. Gauge Field Theory I (3)
Noether’s theorem, symmetries and conserved currents, functional integral techniques, quantization, Feynman rules, anomalies, QED, electroweak interactions, QCD, renormalization, renormalization group, asymptotic freedom and assorted other topics. Prereq: PHYS 581 and consent of department.

PHYS 592. Gauge Field Theory II (3)
(See PHYS 591.) Prereq: PHYS 591.

PHYS 601. Research in Physics (1-9)

PHYS 651. Thesis M.S. (1-9)

PHYS 666. Frontiers in Physics (0)
Weekly colloquia given by eminent physicists from around the world on topics of current interest in physics.

PHYS 701. Dissertation Ph.D. (1-9)

PHYS 702. Appointed Dissertation Fellow (9)
For pre-college teachers who have taken PHYS 820 and who wish to develop similar courses for other teachers. Will involve working with students in PHYS 820 to help them improve their understanding of concepts, and working with the instructors on ways to make courses such as this more effective. Enrollment limited to five. Prereq: PHYS 820 and consent of department.

PHYS 840. Teaching Electricity (2)
This lab-based course is directed at in-service teachers of science in the middle and high schools. The course content will cover the basics of mechanics, oscillations and waves, sound, and light. The sessions will be hands-on and activity-based. The sessions will also model and discuss teaching pedagogy such as cooperative learning, interactive lectures, learning styles, constructivism and inquiry-learning. The technology used will vary from sophisticated computer-based labs to cheap, home-made experiments. The participants will also be trained in the machine shop on how to use tools to construct items for their own classrooms. Evaluation will be based on attendance, participation, pre- and post-tests, and journals. Prereq: Consent of department.

PHYS 840. Teaching Electricity (2)
This lab-based course is directed at in-service and prospective teachers of science in the middle and high schools. The course content will cover the basics of electricity (current, voltage, power, energy, Kirchhoff’s laws and their relation to the laws of conservation of charge and energy, Ohm’s law). Some elements of magnetism will also be introduced, time-permitting. The sessions will be hands-on and activity-based. The sessions will also model and discuss teaching pedagogy such as cooperative learning, interactive lectures, learning styles, constructivism and inquiry-learning. The technology used will involve simple and cheap equipment that can be easily replicated in classrooms. Evaluation will be based on attendance, participation, pre- and post-tests, and journals.

Department of Political Science

111 Mather House
Phone 216-368-2424; Fax 216-368-4681
Vincent E. McHale, Chair (vem@po,cwru.edu)

The study of political science is primarily concerned with governmental structures and processes in world societies, including who governs, why, and how. Faculty specialties in the department include American politics and governmental institu-
tions; violence and civil disorder; public policy analysis; international relations; the politics of world technology and resources; research methods, the political systems of Africa, Asia, Europe, and North America; political economy; and comparative politics with various regional concentrations. In its programs leading to the B.A., M.A., and Ph.D., the department makes a strong effort to relate the study of politics to students’ needs and concerns and tries to reflect in its courses both the excitement and seriousness of real-world politics. The study of political science can build a foundation for many types of future employment. Many political science majors are preparing for graduate study or law school. Others intend to pursue careers in journalism or teaching, in public administration, or jobs in private industry and business. Both the public and private sectors hold career possibilities for the political science major.

Faculty
Vincent E. McHale, Ph.D. (Pennsylvania State University)
Professor and Chair; Director, International Studies Program
Comparative politics; Europe; political sociology; methodology
Kenneth W. Grundy, Ph.D. (Pennsylvania State University)
Marcus A. Hanna Professor of Political Science
International relations; African politics
Robert H. Binstock, Ph.D. (Harvard University)
Joseph White, Ph.D. (University of California, Berkeley)
Kelly M. McMann, Ph.D. (University of Michigan)
Frances E. Lee, Ph.D. (Vanderbilt University)
American government; electoral politics; constitutional law
Kathryn C. Lavelle, Ph.D. (Northwestern University)
Assistant Professor
International relations; Africa; political economy; U.S. foreign policy; international organizations
Emery G. Lee III, Ph.D. (Vanderbilt University), J.D. (University of Maryland)
Assistant Professor
American government; political theory; public policy
Frances E. Lee, Ph.D. (Vanderbilt University)
American government, Congress, legislative policy-making
Kelly M. McMann, Ph.D. (University of Michigan)
American government; Congress; public policy; health and welfare policy
Robert H. Binstock, Ph.D. (Harvard University)
Henry R. Luce Professor of Aging, Health and Society, Department of Epidemiology and Biostatistics, School of Medicine; and Professor of Political Science
American government; public policy; health care and aging
Jonathon L. Entin, J.D. (Northwestern University)
Professor of Law; School of Law; and Professor of Political Science
American constitutional law; social science and the law
Laura Y. Tartakoff, J.D. (Case Western Reserve University); M.A. (Fletcher School, Tufts University)
Adjunct Associate Professor of Political Science
Constitutional law; civil liberties; comparative constitutionalism

Undergraduate Programs
Major
The major in political science leads to the Bachelor of Arts degree. While the specific courses to be taken are determined by the student’s interest, with approval of a faculty advisor, those majoring in political science must complete 30 hours of course work in the department, distributed as follows:
• Three hours of POSC 109
• Six hours of POSC courses at the 200 level
• Eighteen hours of POSC courses at the 300 level
• Three hours of a senior project, POSC 396
No more than six hours of independent study (i.e., POSC 395 and/or POSC 396 or POSC 397/398, Honors Program) may count toward the major. Independent study completed through the Washington Semester program or the Washington Center program is excluded from this limitation.

Minor
A minor in political science consists of 15 hours (5 courses) in the department, of which 9 hours must be at the 300 level. An elected minor sequence must be approved by a political science faculty advisor.

A minor in public policy is available to undergraduates in the College of Arts and Sciences and to undergraduates in the economics and management programs in the Weatherhead School of Management. The public policy minor consists of 15 credit hours, ordinarily including:
• ECON 205 and POSC 386
• One course from the following list of approved courses: HSTY 256, HSTY 358, POSC 308, POSC 310, POSC 385
• Two courses in a specific policy field (e.g., health care, the environment, business and the economy, science and technology policy, nonprofit and charitable organizations, social policy, etc.), as approved by the public policy minor advisor.

Sequences (Engineering Core Curriculum)
All sequences must include POSC 109 (3 hours), POSC 272 (3 hours), and one additional course (3 hours) selected in consultation with the department’s sequence advisor. Contact the department chair, for advice about all Case sequences.

Departmental Honors
A junior or senior political science major who has a minimum grade point average of 3.7 in political science courses and a 3.3 average overall, and who has completed all course work in the department except for six hours at the 300 level, may request permission to enroll in the Political Science Honors Program by contacting a Political Science faculty project advisor before registration for POSC 397. Completion of both courses in the two-semester sequence (POSC 397 and POSC 398) is mandatory for honors consideration. During the two semesters, the student carries out research and writes a substantial paper. (No other form of project is acceptable for Honors.) It is expected that the student will meet frequently with his or her project advisor throughout both semesters to discuss and evaluate the work in progress. The student’s work in POSC 397 will receive a grade of A, B, C, D, or F based on work completed to date; a letter grade of A, B, C, D, or F also will be assigned to POSC 398 upon completion of the project. Completion of the two-course sequence requires that the final paper be submitted to the project advisor at a specified time during the second semester, usually by the twelfth week of the semester. The student also is required to present his/her honors project at a special departmental colloquium to be held toward the end of each Spring semester. If the department judges the paper to be of high quality and if a political science GPA of 3.7 is maintained, the student will receive honors in political science upon graduation.
Integrated Graduate Studies

Application to the Integrated Graduate Studies program in political science must occur no later than the beginning of the second semester of the junior year, but preferably earlier. Upon completion of 90 undergraduate hours, the student must have satisfied all general requirements for the B.A., including at least 23 hours in the political science major, the General Education Requirements, and one minor program; and must have a 3.5 grade point average in political science courses and 3.3 overall. If admitted to the IGS program, the student will take 30 hours of graduate-level political science courses during the senior year, adhering to the departmental regulations governing the master’s degree program. If completed successfully, these hours will count simultaneously toward both degrees in political science. The B.A. will be awarded upon completion of all requirements for that degree, including total hours; the M.A. will be awarded upon successful completion of the 30 hours of graduate-level courses and the M.A. examination.

Graduate Programs

Master of Arts

Requirements for admission to the Master of Arts program in political science are three letters of recommendation from former instructors; a minimum score of 500 on each required segment of the Graduate Record Examination (GRE) (verbal, quantitative, analytical); for students from other countries, a minimum score of 550 on the Test of English as a Foreign Language (TOEFL), in addition to the minimum GRE scores indicated above; and transcripts of all undergraduate study, indicating completion of a Bachelor of Arts or Bachelor of Science degree program which included a grade point average of 3.2 overall and 3.5 in political science courses. The Master of Arts in political science is a broadly based program in which the student is expected to acquire and exhibit general knowledge and skills. Therefore, within the 30 hours of graduate-level course work (400 level and above) required for the political science Master of Arts, 12 hours must be distributed as follows:

- three hours in American government and politics;
- three hours in comparative politics; and
- three hours in international affairs.
- three hours of research methods

Among the remaining 18 hours of “electives,” the student may take courses oriented toward a general Master of Arts (i.e., covering the four broad areas listed above) or may elect to specialize in one of these or some other proposed and approved area. Excluding those hours taken to fulfill degree requirements in quantitative methods, a maximum of six hours may be taken outside the Department of Political Science, with prior approval, for specialized work related to the Master of Arts degree for which no political science course is appropriate. A maximum of nine hours of independent study (POSC 601) may count toward the degree. A minimum grade point average of 3.0 must be maintained throughout the Master of Arts program. Upon completion of no less than 30 hours and no more than 42 hours of Master of Arts course work, the student must request scheduling of the political science Master of Arts examination. The examination will cover the four broad areas listed above, the political science Master of Arts reading list, and any elected area of concentration. Complete information on the Master of Arts program in political science is available from the department office.

Doctor of Philosophy

Requirements for admission to the Doctor of Philosophy program in political science are three letters of recommendation from former instructors; a minimum score of 500 on each required segment of the Graduate Record Examination (GRE) (verbal, quantitative, analytical); for students from other countries, a minimum score of 550 on the Test of English as a Foreign Language (TOEFL), in addition to the minimum GRE scores indicated above; and transcripts of all prior undergraduate and graduate study, indicating a minimum grade point average of 3.3 for all previous undergraduate and/or graduate work.

All Ph.D. students must complete 45 hours of graduate-level courses, plus at least 18 hours of POSC 701, “Dissertation,” credit. The required 45 hours of doctoral courses taken before dissertation credits must be distributed as follows:

- 12 hours in primary subfield (American, comparative, or international relations)
- 9 hours in secondary subfield (one of the remaining two fields)
- 6 hours in the remaining subfield
- 6 hours in research methods
- 12 hours of electives

A maximum of 9 hours of independent study (POSC 601) may be undertaken. Electives and research methods courses may be taken outside of the department, but only with prior approval from his or her political science advisor.

Complete information for all aspects of the Doctor of Philosophy program in political science (e.g., comprehensive examination; dissertation requirements; etc.) is available in a special announcement from the department office.

Political Science (POSC)

Undergraduate Courses

POSC 109. The American Political System (3)
Introduction to the study of American politics, addressing the questions “Who rules?” and “Who benefits?” in the American political system. Explores the nature of constitutional limits, the role of public participation, the impact of pressure groups, and the influence of various governmental institutions on American political life.

POSC 196. Energy and Society (3)
Global and national perspectives on the problems of energy supply and demand, global warming, oil cartels, solar, nuclear and wind energy, energy history, politics and economics of fossil fuels, and alternative energy sources. Cross-listed as PHYS 196.

POSC 260. Introduction to Comparative Politics (3)
Comparison of selected national political systems organized around the concept of political development. Examination of the interrelationships between the cultural, social and economic characteristics of the nations and their government structure and political behavior.

POSC 272. Introduction to International Relations (3)
Survey of the principles of international relations, politics, law and organization; the rise, development and change of the nation-state system; development of international cooperation; methods of studying international relations.

POSC 301. Decision-Making in American Cities (3)
Localities are the primary interface with government and provide the basic psychological place identification for most Americans. The course will explore this assertion in the context of urban America today. How are decisions made in cities? Who shapes these decisions and why? What role is played by shifting demographics, race, and poverty? What can the individual do to influence local decision-making?

POSC 306. Nonprofit Public Policy and Advocacy (3)
Introduction to the institutions and processes that make up the political environment of nonprofit organizations in the United States, beginning with an examination of the role of civil society in a democracy and con-
continuing with the framing of issues, role of political entrepreneurs and organized interests, elections, the legislative process and strategies for influencing it, and the roles of executive institutions and the courts.

POSC 308. The American Presidency (3)
The sources, strategies and restraints of presidential leadership in the United States. Emphasis on problems of policy formation, presidential relations with Congress and executive agencies, and the electoral process.

POSC 310. The Legislative Process (3)
Legislative, representative, and other functions of Congress and state legislatures; legislative relations with the executive and with private interests; limitations of the legislature as a policy-making institution.

POSC 315. Black Americans and the Political Process (3)
An examination of the relationship between black Americans and the U.S. political process from three interconnected perspectives. First, the historical struggle that surrounded but excluded blacks in this country, from slavery to the 1954 Brown v. Board of Education ruling. Second, the ways in which blacks have participated directly in the political process in contemporary times. Third, the political implications of black separatist movements.

POSC 320B. The U.S. Midterm Elections (3)
Analysis of the midterm elections in the United States. Covers congressional and state elections in all regions, focusing on the issues, personalities, campaign strategies, and voter trends in this key electoral battle held between presidential elections.

POSC 320C. The Presidential Election (3)
Analysis of the upcoming presidential election in the United States. Focuses on the issues and personalities, polls and public opinion, campaign strategies, and electoral behavior. Offered every four years in conjunction with the United States presidential election cycle.

POSC 320D. Politics of the American South (3)
Analysis of forces that have transformed the political landscape of the American south since World War II, changing the region from an economically backward bastion of white supremacy to a prospering, biracial society fast on the way to rejoining the national mainstream.

POSC 325. American Constitutional Law (3)
An introductory survey of U.S. constitutional law. Special attention given to the historical, philosophical, and political dimensions of landmark Supreme Court cases. Judicial review, federalism, separation of powers, due process, and equal protection. Supreme Court's involvement in major political controversies: the New Deal, abortion, physician-assisted suicide, school desegregation, and affirmative action.

POSC 326. Comparative Constitutions (3)
Overview of ancient Greek and Roman constitution-making, medieval principles, emergence of modern constitutionalism, and the constitutionalist vision of the American and French Revolutions. Examination of contemporary constitutional issues and developments in countries such as Canada, France, Germany, Great Britain, Hungary, India, Switzerland, and the United States.

POSC 327. Civil Liberties in America I (3)
Supreme Court's interpretation of the First Amendment: liberty of religion through the establishment and free exercise clauses, freedoms of speech and the press, of assembly and association. The "pure tolerance" view examined against subversive speech, "fighting words," libel, obscenity, and commercial speech. Survey of content-neutral regulation, symbolic expression, and current efforts to limit expression (campaign speech codes and the feminist anti-pornography movement).

POSC 328. Topics in Civil Liberties (3)
Rights of the accused as outlined in the Fourth, Fifth, Sixth, and Eighth Amendments. Topics covered are (1) arrests, searches, and seizures, (2) the privilege against compelled self-incrimination, (3) the rights to counsel, confrontation, and jury trial, and (4) the prohibition against cruel and unusual punishments. Case-specific approach but presents interplay of history, philosophy, and politics as background of each topic.

POSC 334. Violence and the Political System (3)
Empirical analysis of various theories advanced in the cross-cultural explanation of factors which cause and mediate the occurrence of violence—revolutions, terrorism, and civil disorder—within the political system.

POSC 341. Elections, Voters, and Political Parties (3)
Examination of American political parties, their activities, organization, characteristics, and functions. Candidate strategies and electoral history viewed within the context of voter orientations and predispositions, stressing linkages between citizen and party and between party and government.

POSC 343. Public Opinion and American Democracy (3)
Examination of theories, concepts and empirical research related to attitudes and the political behavior of mass publics.

POSC 345. Psychology and Politics (3)
Application of various psychological concepts, theories, and methodologies to the study of politics.

POSC 346. Women and Politics (3)
Examination of the role of women in politics. Topics include: political socialization; sources and implications of gender difference in political participation (voting, candidacy, leadership); and the politics of "women's issues."

POSC 347. What Government Does: Its Roles and Its Limits (3)
Overview of range of functions that government actually performs. What government does is what makes it important to our lives; what government should do is the fundamental stake of politics; how and how well government can act is the central question for analysis of public policy. Therefore, the course can be seen as an introduction to the study of public policy, public administration, and political theory.

POSC 348. Political and Social Thought in the Machine Age (3)
Explores the responses of economist writers, philosophers, cultural critics, and public policy makers to changes in Western society wrought by industrialization, by focusing on their concerns with technological change. Cross-listed as HSTY 348.

POSC 349. Political Science Research Methods (3)
Research methods in political science and other social sciences. Research design, including development of hypotheses and operational measures, and evaluation of quantitative and qualitative methodologies. Useful for students going into graduate school, policy analysis, or consulting. Note: This course not available to students who previously took POSC 241.

POSC 351. Modern Political Thought (3)
Examination of a limited topic in the study of modern political thought. Topics vary.

POSC 352. American Political Thought (3)
Examination of the unique contribution to the science of government made by American political thinkers.

POSC 354. Political and Social Philosophy (3)
Justification of social institutions, primarily political ones. Such distinctions as that between de facto and legitimate authority; analysis of criteria for evaluation, such as social justice and equality; inquiry into theories of justification of the state; theory of democratic government and its alternatives. Readings from classical and contemporary sources. Prereq: PHIL 101. Cross-listed as PHIL 334.

POSC 355. Modern Political Ideologies (3)
Substance and nature of ideological thinking in the contemporary world via a survey of political "isms"—for example, liberalism, libertarianism, conservatism, fascism, socialism, and even more recent trends such as feminism, environmentalism, etc.

POSC 357. Democratic Politics: Theory and Practice (3)
Study of the theory and application of democracy. The concept of democracy will be examined from the Athenian model of contemporary debates over participatory and deliberative models. Then the concept will be applied to understanding issues of democratic practice and the study of politics in American, comparative, and international arenas. Finally, the course will address the potential effects, both good and ill, of technological innovation on democratic practices, such as "distance" participation, the Internet, and other communication technology.

POSC 360D. Politics of Change in Latin America (3)
Provides initial mastery of structure and process in the Latin American political environment. Examines critically some of the politically salient economic and social changes that have occurred in Latin American societies. The dynamics of political life in Latin America are related to the wider contexts of comparative politics and political sociology.
POSC 362. Politics of Central Asia (3)
Once an unfamiliar region to many people of the world, Central Asia took center stage in the fall of 2001 as a result of the U.S. campaign against terrorism. This course will introduce students to the politics of Central Asia, focusing on the region today composed of Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan, and Kazakhstan. We will review the nationalism, foreign relations, religion, ethnicity, and economics of the region.

POSC 364. Dictatorship and Democracy in 20th-Century Latin America (3)
Examination of political leadership in 20th-century Latin America, exploring the nature, causes, and consequences of dictatorship and democracy in the region, moving from the collapse of oligarchic rule and the emergence of populism in the 1930s and 1940s, to the end of democracy and establishment of military regimes in the 1960s and 1970s, and ultimately to the contemporary processes of democratization and economic liberalization.

POSC 365. Science, Technology, and Government (3)
Traces the development and influence of federal technology and science policies from colonial times to the present, with emphasis on the 20th century. Cross-listed as HSTY 366.

POSC 366. Government and Politics of Africa (3)
Comparative analysis of the political forces and organizations currently functioning in Africa, as well as a survey of the formal governmental institutions. Special emphasis on single-party rule, military rule, and the political ramifications of African socialism, tribalism and the problems of national integration.

POSC 367. Western European Political Systems (3)
Comparative analysis of sociopolitical systems of selected Western European industrial democracies, using North American systems as a point of comparison.

POSC 368. The People's Republic of China (3)
(See HSTY 383.) Cross-listed as HSTY 383.

POSC 370A. Political Economy (3)
Focus on debates concerning the proper relationship between political and economic systems, including conservative, liberal, and radical perspectives. The politics of international economics and the economics of international politics receive separate attention. The course concludes with study of “modern” political economy and the application of economic theory to the study of political systems.

POSC 370C. The United States and Asia (3)
Survey and analysis of U.S.-Asia relations in the post-World War II period. Focus specifically is on the interaction of politics and economics in the United States’ relations with Japan, China, and Southeast Asian countries. Topics will include the role of Asia in U.S. Cold War policies, the dynamics of U.S.-Japan alliance politics, post-Cold War issues involving U.S. foreign policy toward Asia, a history and analysis of economic conflict and cooperation, and an examination of the move toward Asia-Pacific “region-alism.”

POSC 370F. The Global Policy Agenda (3)
Examination of global pluralism, the idea that interest groups with policy preferences are as active on the global level as they are at the national and local levels. Focus on processes of the emergence of issues; formation of leadership groups and organizations; interlocking character of issues such as peace, population, natural resources, and environment; conflicts of value and perception; and development of new models of activity designed to find solutions to complex global problems.

POSC 370G. U.S. Intelligence and National Security (3)
Examination of the impact of the intelligence process on foreign policy making and superpower relations. Covers the life cycle of United States strategic intelligence from the collection of data to formulation of analytical judgments and the policy-level uses of intelligence. Emphasis on contemporary intelligence issues and processes, but includes the formative period of modern American intelligence in the World War II era.

POSC 370J. International Law and Organizations (3)
Study of international organizations and international law as two means for regulating and coordinating nation-state behavior. History of the two techniques will be traced, covering 19th century efforts at cooperation, the League of Nations and the United Nations, regional and specialized global organization. The functions of international law in global politics will be stressed, with primary focus on the evolving role of law in dealing with global problems, e.g., war, the environment, economic cooperation, and human rights.

POSC 370K. Nationalism, Ethnicity, and Religion in World Politics (3)
Examination of the post-Cold War surge in conflicts among nationalism, ethnic groups, and religions, with particular attention to the former Yugoslavia, Ireland, India, Africa, and the Middle East.

POSC 371. Natural Resources and World Politics (3)
Examination of the political causes and ramifications of the uneven distribution of the valuable natural resources for modern industrial societies. Strategic and military issues and the exploitation of the sea bed. Examination in some detail of selected commodity issues, including petroleum, copper and uranium.

POSC 372. The United Nations in the Post-Cold War World (3)
The United Nations has become the focus of a debate over its effectiveness as a global organization dedicated to promoting world peace. Some critics believe it is time for the U.N. to move forward in this regard, while others see the U.N. as anachronistic, bloated bureaucracy sorely in need of reform. This course will consider the United Nations from the perspective of powerful states such as the United States, as well as from the perspective of weaker ones, and also will consider areas such as peacekeeping, human rights, economic development, political reform, and the U.N.’s involvement with non-state actors such as terrorists.

POSC 374. Politics of Development in the Global South (3)
Exploration of the post-World War II emergence of the Global South nations of Africa, Asia, the Middle East, Latin America, and Eastern Europe, and the process and meaning of their entry into the world political arena.

POSC 375. Nuclear Weapons and Arms Control (3)
National and international problems concerning nuclear weapons, and the past and present attempts both to control their spread and to prevent their use. Topics covered include the science and technology of fission and fusion warheads and delivery vehicles; history, domestic policies, and international relations concerning nuclear weapons; and arms control treaties and their verification. Cross-listed as HSTY 377.

POSC 376. United States Foreign Policy (3)
Focus on U.S. foreign policy making with a dynamic network of executive and congressional actors and organizations; analysis of traditional and contemporary U.S. foreign policies from nuclear defense to current economic resource issues; future role of the United States in world affairs.

POSC 379. Middle East: Politics, Economics, and American Policy (3)
Examination of continuing conflicts, major trends, and internal political and economic developments affecting U.S. policy in the Middle East region. Discussions include human rights, petroleum economics, and Islamic politics.

POSC 384. Ethics and Public Policy (3)
Evaluation of ethical arguments in contemporary public policymaking discourse. That is, approaches to evaluating not only the efficiency of policy (Will this policy achieve its end for the least cost?) but also the ethics of policy (Are a policy’s intended ends ethically justified or “good,” and are our attempts to achieve those ends moral or “just”? Overview of political ideologies that supply U.S. political actors with their ethical or moral arguments when proposing and implementing public policy, followed by an application of these differing perspectives to selected policy areas such as welfare, euthanasia, school choice, drug laws, censorship, or others.

POSC 385. U.S. Bureaucratic Politics (3)
Analysis of the responsibilities, contributions, and activities of public bureaucracies with respect to their efficiency, responsiveness, and productivity.

POSC 386. American Public Policy Process (3)
Focus on the concepts and strategies concerned with moving the public policy process to action. Agenda-setting, issue definition, and feedback techniques will be a particular focus. Assessing political change, support, and obstacles also will be covered, as well as how policy systems operate...
with regard to different types of issues, such as regulatory, distributive, and redistributive policies, and in different configurations ranging from subgovernments to issue networks and advocacy coalitions.

**POSC 387. Comparative Public Policy in Advanced Industrial Societies (3)**
The study of comparative public policy focuses on three obvious questions: First, how do policies differ among countries? Second, why do policies differ? For example, what explains the differences in policies about health or the environment or energy or pensions? Third, what difference does it make? Is one set of policies better or worse than others? How can we tell? This course will consider each of these questions, focusing especially on the differences between the United States and other advanced industrial countries, and how these questions affect political and social life in those countries.

**POSC 395. Special Projects (1-6)**
Study of a topic of particular interest, or an approved internship. The student must submit to the departmental office a project prospectus form, approved and signed by the faculty supervisor, no later than the end of the second week of classes. The prospectus must outline the goals of the project and the research methodology to be used and is part of the basis for grading. The prospectus form is available from the departmental office. Open to juniors and seniors majoring in political science. Open to majors in other departments with consent of faculty. Prereq: Departmental prospectus form.

**POSC 396. Senior Project (3)**
Capstone experience for seniors in political science providing opportunity to do an in-depth, independent study paper on a topic of particular interest to them. This paper should demonstrate, and ideally even extend, the skills and expertise developed over the course of study in the department. Students must obtain approval from a faculty project advisor prior to registration and must list that professor's name on the registration form. The student must submit a project prospectus form to the departmental office outlining the goals of the project and the research methodology to be used, signed by the faculty project advisor. Prereq: Junior or senior political science major and departmental prospectus form.

**POSC 397. Honors Program I (3)**
The student must submit to the departmental office an honors project prospectus form, approved and signed by the faculty project supervisor, no later than the end of the second week of classes. The prospectus must outline the goals of the project and the research methodology to be used and is part of the basis for grading. The prospectus form is available from the departmental office. Contact department for eligibility information. Prereq: Departmental prospectus form.

**POSC 398. Honors Program II (3)**
Continuation of POSC 397. Prereq: Completion of POSC 397 and departmental prospectus form.

**Graduate Courses**

**POSC 401. Decision-Making in American Cities (3)**
(See POSC 301.)

**POSC 406. Nonprofit Public Policy and Advocacy (3)**
(See POSC 306.) Cross-listed as MAND 406.

**POSC 408. The American Presidency (3)**
(See POSC 308.)

**POSC 410. The Legislative Process (3)**
(See POSC 310.)

**POSC 420B. The U.S. Midterm Elections (3)**
(See POSC 320B.)

**POSC 420C. The Presidential Election (3)**
(See POSC 320C.)

**POSC 420D. Politics of the American South (3)**
(See POSC 320D.)

**POSC 425. American Constitutional Law (3)**
(See POSC 325.)

**POSC 426. Comparative Constitutions (3)**
(See POSC 326.)

**POSC 427. Civil Liberties in America I (3)**
(See POSC 327.)

**POSC 428. Topics in Civil Liberties (3)**
(See POSC 328.)

**POSC 429. Courts, Public Policy, and Social Change (3)**
Examines the social impact of law and the use of social research in the legal process; assesses efforts to use law to effect social reform, and empirical studies of legal processes and institutions. Cross-listed as LAWS 285.

**POSC 434. Violence and the Political System (3)**
(See POSC 334.)

**POSC 441. Elections, Voters, and Political Parties (3)**
(See POSC 341.)

**POSC 443. Public Opinion and American Democracy (3)**
(See POSC 343.)

**POSC 445. Psychology and Politics (3)**
(See POSC 345.)

**POSC 446. Women and Politics (3)**
(See POSC 346.)

(See POSC 347.)

**POSC 449. Political Science Research Methods (3)**
(See POSC 349.)

**POSC 451. Modern Political Thought (3)**
(See POSC 351.)

**POSC 452. American Political Thought (3)**
(See POSC 352.)

**POSC 454. Political and Social Philosophy (3)**
(See POSC 354.) Cross-listed as PHIL 454.

**POSC 455. Modern Political Ideologies (3)**
(See POSC 355.)

**POSC 457. Democratic Politics: Theory and Practice (3)**
(See POSC 357.)

**POSC 460D. Politics of Change in Latin America (3)**
(See POSC 360D.)

**POSC 462. Politics of Central Asia (3)**
(See POSC 362.)

**POSC 464. Dictatorship and Democracy in 20th-Century Latin America (3)**
(See POSC 364.)

**POSC 466. Government and Politics of Africa (3)**
(See POSC 366.)

**POSC 467. Western European Political Systems (3)**
(See POSC 367.)

**POSC 470A. Political Economy (3)**
(See POSC 370A.)

**POSC 470C. The United States and Asia (3)**
(See POSC 370C.)

**POSC 470F. The Global Policy Agenda (3)**
(See POSC 370F.)

**POSC 470G. U.S. Intelligence and National Security (3)**
(See POSC 370G.)

**POSC 470J. International Law and Organizations (3)**
(See POSC 370J.)

**POSC 470K. Nationalism, Ethnicity, and Religion in World Politics (3)**
(See POSC 370K.)

**POSC 471. Natural Resources and World Politics (3)**
(See POSC 371.)

**POSC 472. The United Nations in the Post-Cold War World (3)**
(See POSC 372.)

**POSC 474. Politics of Development in the Global South (3)**
(See POSC 374.)
Under the supervision of a mentor in the workplace who is committed to intellectual, personal and professional growth of the student. It occurs during a semester in which the workplace experience occurs. Prereq: Junior standing - must have at least one intervening semester in residence after PRAC 001.

**Department of Psychology**

109 Mather Memorial Building  
Phone 216-368-2686; Fax 216-368-4891  
Robert L. Greene, Chair

The Department of Psychology offers programs leading both to undergraduate (Bachelor of Arts) and graduate (Master of Arts and Doctor of Philosophy) degrees. Programs in psychology can be selected in preparation for graduate work in the field, or as background for a variety of human service-oriented professions, or to obtain general knowledge and understanding of behavior that is applicable in many different careers.

**Faculty**

Robert L. Greene, Ph.D. (Yale University)  
Professor and Chair  
Human memory and cognition  
Roy F. Baumeister, Ph.D. (Princeton University)  
Elisie B. Smith Professor of Liberal Arts  
Social psychology; personality research; behavioral correlates of self-esteem and self-monitoring; evaluation research  
Heath A. Demaree, Ph.D. (Virginia Tech)  
Assistant Professor  
Cerebral and psychophysiological bases of emotion  
Douglas K. Detterman, Ph.D. (University of Alabama, Tuscaloosa)  
Professor  
Human intelligence and mental retardation  
Julie J. Exline, Ph.D. (State University of New York, Stony Brook)  
Assistant Professor  
Social relationships; transgression; moral and religious issues  
Joseph F. Fagan III, Ph.D. (University of Connecticut)  
Lucy Adams Leffingwell Professor of Psychology  
Development of and individual differences in cognition, perception, and intelligence  
Grover C. Gilmore, Ph.D. (Johns Hopkins University)  
Professor  
Perceptual development and aging; visual information processing; memory; psychophysics  
T. J. McCallum, Ph.D. (University of Southern California)  
Assistant Professor  
Older adults; caregiving; ethnicity; stress and coping  
James C. Overholser, Ph.D. (Ohio State University)  
Professor  
Adult psychopathology; depression; suicide; personality disorders  
Sandra W. Russ, Ph.D. (University of Pittsburgh)  
Professor  
Creativity; affective development in children; personality assessment; coping mechanisms in children  
Elizabeth J. Short, Ph.D. (University of Notre Dame)  
Associate Professor  
Cognitive psychology; applied developmental; learning disabilities  
Milton E. Strauss, Ph.D. (Harvard University)  
Professor  
Adult psychopathology; schizophrenia; mental disorders of aging  
Lee A. Thompson, Ph.D. (University of Colorado, Boulder)  
Associate Professor  
Human behavior genetics; child development
Dianne M. Tice, Ph.D. (Princeton University)  
Professor  
Social psychology; personality theory; health psychology  
Eric Youngstrom, Ph.D. (University of Delaware)  
Assistant Professor  
Clinical child psychology

**Associate Faculty**

Stanley Althof, Ph.D.  
Associate Professor  
School of Medicine/University Hospitals  
Dennis Drotar, Ph.D.  
Professor  
School of Medicine/Department of Psychiatry  
Roland Holmes Foliart, Ph.D.  
Assistant Professor  
School of Medicine. Department of Psychiatry  
Howard Hall, Psy.D., Ph.D.  
Assistant Professor  
School of Medicine/Rainbow Babies and Children's Hospital  
William C. House, Ph.D.  
Associate Professor  
School of Medicine/MetroHealth Medical Center  
Barry Layton, Ph.D.  
Assistant Professor  
School of Medicine/MetroHealth Medical Center  
Marian Patterson, Ph.D.  
Associate Professor  
School of Medicine/Alzheimer Center/University Hospitals  
Lynn Singer, Ph.D.  
Professor  
School of Medicine/University Hospitals  
Terry Stancin, Ph.D.  
Associate Professor  
School of Medicine/MetroHealth Medical Center Hudson  
Thomas P. Swales, Ph.D.  
Assistant Professor  
School of Medicine/MetroHealth Medical Center  
Gerry Taylor, Ph.D.  
Professor  
School of Medicine/Department of Pediatrics  
Jane Timmons-Mitchell, Ph.D.  
Assistant Professor  
School of Medicine/Department of Psychiatry  
Kathleen Wells, Ph.D.  
Associate Professor  
Mandel School of Applied Social Sciences  
Carol Sue White, Ph.D.  
Associate Professor  
School of Medicine/MetroHealth Medical Center  
Peter J. Whitehouse, M.D., Ph.D.  
Professor  
School of Medicine/Department of Neurology  
Abraham Wolf, Ph.D.  
Assistant Professor  
School of Medicine/Department of Psychiatry  
James M. Yokely, Ph.D.  
Assistant Professor  
School of Medicine/Department of Psychiatry

**Adjunct Faculty**

Cameron Camp, Ph.D.  
Adjunct Professor  
Myers Research Institute  
Phyllis Dukes, Ph.D.  
Adjunct Assistant Professor  
Mental Development Center  
Robert Goldberg, Ph.D.  
Adjunct Assistant Professor  
Cleveland Veterans Administration Medical Center  
Bettina Katz, Ph.D.  
Adjunct Assistant Professor  
University Counseling Center  
Carolyn Landis, Ph.D.  
Adjunct Instructor  
Rainbow Babies and Children's Hospital  
Jeffrey Rosenbaum, Ph.D.  
Adjunct Assistant Professor  
Children's Aid Society/Beech Brook  
Philip Safford, Ph.D.  
Adjunct Professor  
Professor Emeritus, Kent State University  
Jes-James Sellers, Ph.D.  
Adjunct Assistant Professor  
University Counseling Center  
Jeremy Shapiro, Ph.D.  
Adjunct Assistant Professor  
The Guidance Centers  
Daniel A. Weinberger, Ph.D.  
Adjunct Assistant Professor  
Family Achievement Clinic/MetroHealth Medical Center  
Kenneth Weiss, Ph.D.  
Adjunct Assistant Professor  
V.A. Medical Center at Brecksville

**Clinical Faculty**

Karen Kernberg Bardenstein, Ph.D.  
Clinical Instructor  
Mark Loringer and Associates  
Robert Benjamin, Ph.D.  
Clinical Instructor  
Sagamore Hills  
Jeffrey Bolek, Ph.D  
Clinical Assistant Professor  
Health Hill Hospital for Children  
John Bolger, Ph.D.  
Clinical Instructor  
VA Medical Center, Brecksville  
Robert Chwast, Ph.D.  
Assistant Clinical Professor  
Rocky River Counseling  
Sandra L. Curry, Ph.D.  
Assistant Clinical Professor  
Lori E. D'Angelo, Ph.D.  
Clinical Instructor  
Hill House  
Jennifer Franklin, Ph.D.  
Clinical Instructor  
Beech Brook Children's Center  
Mathew A. Fuller, Ph.D  
Clinical Instructor  
Veterans Affairs Medical Center  
Douglas K. Grossman-McKee, Ph.D.  
Clinical Instructor  
The Progressive Company  
Tom Michael Hagersfeld, Ph.D.  
Clinical Assistant Professor  
Northcoast Behavioral Healthcare System  
Michelle Harris, Ph.D.  
Assistant Clinical Professor  
Belflower Center for the Prevention of Child Abuse  
Sally G. Hoyle, Ph.D.  
Clinical Instructor  
Beech Brook Children's Center  
Janice G. Katz, Ph.D.  
Clinical Instructor  
Northcoast Behavioral Healthcare System  
Susan M. Knell, Ph.D.  
Clinical Instructor  
Child Guidance Center of Greater Cleveland
Undergraduate Programs

The undergraduate programs in psychology are designed to provide broad education in the science of behavior. The curriculum consists of three levels: an introductory level that is a prerequisite for most other courses in the department; an intermediate level, covering the various substantive areas of psychology; and an advanced level that offers numerous unique opportunities for undergraduates to engage in specialized and individualized work.

Major

Students completing the B.A. may major in psychology. Psychology majors must complete 30 hours of course work in the department.

Required courses

- PSCL 101, General Psychology I (3)
- PSCL 282, Quantitative Methods in Psychology (3)

Three additional courses chosen from

- PSCL 315, Social Psychology (3)
- PSCL 352, Physiological Psychology (3)
- PSCL 353, Psychology of Learning (3)
- PSCL 355, Sensation and Perception (3)
- PSCL 357, Cognitive Psychology (3)
- PSCL 382, Psychological Measurement (3)
- PSCL 393, Experimental Child Psychology (3)

The remaining hours can be fulfilled by taking psychology electives chosen by the major and his or her advisor.

Minor (15 hours)

Required Course

- PSCL 101 (3 hours)

Electives

A minimum of four courses (12 hours) chosen by the student in consultation with his/her advisor. Practica and independent study are available to minors but cannot be used to satisfy the minor requirement.

Sequence for Engineering Core (9 hours)

The sequence reflects an emphasis on either the cognitive/biological or social/personal aspects of the field. All sequences must include PSCL 101 and two courses from one of the following groups:

- PSCL 101, 230, 300, 313, 315, 317, 321, 325
- PSCL 352, 353, 355, 357, 360

Cognitive/Biological Behavior: PSCL 352, 353, 355, 357, 360

Departmental Honors

Junior majors with a 3.0 overall grade point average and a 3.25 average in psychology are encouraged to apply to the department’s Honors Program. This program consists of one three-credit course PSCL 395, during which students carry out under faculty supervision an independent project in their area of interest. Satisfactory completion of a paper based on this research qualifies students to receive their degree with Honors in Psychology noted on their academic transcript. PSCL 375, Research Design and Analysis, is a prerequisite to PSCL 395.

Integrated Graduate Programs

The Department of Psychology participates in the Integrated Graduate Studies Program. Interested students should note the general requirements and the admission procedures in this bulletin and may consult the department for further information.

Graduate Programs

Graduate programs leading to the Doctor of Philosophy degree are offered in the fields of adult clinical, child clinical, experimental psychology, social psychology, and mental retardation research. The Master of Arts degree can be earned in the department as part of work toward a doctorate. Additional information about graduate work in psychology is available from the departmental office.

Psychology (PSCL)

Undergraduate Courses

PSCL 101. General Psychology I (3)
Methods, research, and theories of psychology. Basic research from such areas as psychophysiology, sensation, perception, development, memory, learning, psychopathology, and social psychology.

PSCL 102. General Psychology II (3)
The applications of psychological research in normal problems of adjustment. Topics include: coping with anxiety, romance and marriage, and interpersonal behavior.

PSCL 230. Child Psychology (3)
Basic facts and principles of psychological development from the prenatal period through adolescence. Prereq: PSCL 101.

PSCL 231. Child Psychology Practicum (1)
The course will involve three hours per week of practicum experience at either the Church of the Covenant day care center or the Mental Development Center School. Student will be given an orientation to child development in the context of a preschool program. Prereq: PSCL 101. Coreq: PSCL 230.

PSCL 282. Quantitative Methods in Psychology (3)
The theory and application of basic methods used in the analysis of psychological data. Not available for credit to students who have completed STAT 201 or ANTH 319.

PSCL 300. Interdisciplinary Psychology (3)
This course draws on information from different fields of inquiry to address broad psychological questions about the human condition. Topics may include identity, cultural change, finding meaning in life, the nature of evil, love and family, death, and happiness. Intended for students who like to think, the course will emphasize learning how to cross disciplinary boundaries in pursuit of fundamental insights. Prereq: PSCL 101.

PSCL 313. Psychology of Personality (3)
The development and organization of personality; theories of personality and methods for assessing the person; problems of personal adjustment.
PSCL 315. Social Psychology (3)  

PSCL 317. Health Psychology (3)  
Examines psychological processes that affect physical health. Covers the physiological factors affecting the immune system, chronic physical disorders, pain, compliance with prescribed medical treatments, the effects of stress and coping, the effects of the patient-physician interaction, and the psychological aspects of the hospital and the health care systems. Prereq: PSCL 101.

PSCL 321. Abnormal Psychology (3)  

PSCL 325. Psychotherapy and Personality Change (3)  
Three methods of psychotherapy (behavioral, psychoanalytic, and client-centered) are discussed. The therapy techniques and the manner by which personality change is effected are examined. Prereq: PSCL 101.

PSCL 329. Adolescence (3)  
Psychological perspectives on physical, cognitive, and social development. Prereq: PSCL 101.

PSCL 334A. Seminar and Practicum: Preschool and Daycare (3)  
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prereq: PSCL 230.

PSCL 334C. Seminar and Practicum: Hospitalized Children (3)  
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prereq: PSCL 230.

PSCL 335A. Seminar and Practicum: Preschool and Daycare (3)  
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prereq: PSCL 230.

PSCL 335C. Seminar and Practicum: Hospitalized Child (3)  
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prereq: PSCL 230 and Junior or Senior standing.

PSCL 338. Seminar and Practicum in Adolescence (3)  
(See EDUC 338.) Cross-listed as EDUC 338 and SOCI 338.

PSCL 339. Seminar and Practicum in Adolescents (3)  
(See SOCI 339.) Prereq: PSCL 230. Cross-listed as SOCI 339.

PSCL 344. Developmental Psychopathology (3)  
This course will focus on the interplay of biological, psychological, familial, and social determinants of disorders ranging from autism to delinquency and bulimia. Prereq: PSCL 230 or PSCL 321.

PSCL 350. Behavior Genetics (3)  
Examines the impact of both nature and nurture on human behavior. Basic quantitative genetic methodology will be covered. Current family, twin and adoption studies in the areas of personality, intelligence, alcoholism, criminality, and psychopathology will be reviewed. Prereq: PSCL 101.

PSCL 352. Physiological Psychology (3)  
The nervous system as it relates to behavior. Prereq: PSCL 101.

PSCL 353. Psychology of Learning (3)  
The basic methods in the study of learning. The major theories proposed to account for the learning process. Development of the fundamental concepts and principles governing the learning process in both humans and lower animals. Prereq: PSCL 101.

PSCL 355. Sensation and Perception (3)  

PSCL 357. Cognitive Psychology (3)  

PSCL 360. Laboratory and Seminar in Human Experimental Psychology (3)  
Methods of research in human learning, cognition, and perception will be examined through seminar discussions and laboratory experiments.

PSCL 369. Adult Development and Aging (3)  
An overview of concepts and research relating to adult development and aging. The lifespan perspective will be used in examining major developmental paradigms. Personality and cognitive lines of development will be traced across the lifespan. Data from both longitudinal and cross-sectional studies will be analyzed. Both normal and pathological aging will be discussed. Special emphasis will be given to areas of cognitive deterioration in aging. Implications for optimal adult development and aging will also be discussed.

PSCL 370. Human Intelligence (3)  
Survey of individual differences in human intellect including construction and administration of intelligence tests, theories and models of intelligence, and the role of heredity and environment in intelligence and the development of intelligence. This course will also examine the relationships of cognitive abilities to intelligence and human to artificial intelligence. Prereq: PSCL 101.

PSCL 375. Research Design and Analysis (3)  
Conceptual and methodological issues confronted by the behavioral scientist conducting research. Major experimental designs and statistical procedures. Intuitive understanding of the mathematical operations. Prereq: PSCL 282.

PSCL 382. Psychological Measurement (3)  

PSCL 388. Human Sexual Behavior (3)  
Sex is approached as a form of personal and interpersonal behavior. A broad range of theories from social psychology will be used to explain human sexual behavior, and these will be evaluated by using facts and findings from recent research studies. Topics include sexual relationships, gender differences, promiscuity, rape and coercion, finding and choosing sex partners, sexual risk-taking, harassment, sexual identity and orientation, cultural influences and differences, evolution of sexual motivations, prostitution, pornography, and love. Prereq: PSCL 101 and PSCL 315.

PSCL 390. Seminars in Psychology (1-3)  
Surveys of special subject areas. Topics vary in response to faculty and student interests. Small group discussion. Prerequisite depends on content.

PSCL 393. Experimental Child Psychology (3)  
The development of behavior from birth to adolescence. Growth of basic processes such as perception, learning, memory, intelligence, and language in the light of current theoretical models. Prereq: PSCL 101.

PSCL 395. Honors Program (3)  
Supervision in carrying out an independent research study in the student’s area of interest. Prereq: PSCL 375.

PSCL 397. Independent Study (1-3)  
Individual study involving specific programs of reading, research, and special projects. Prereq: PSCL 101.

Graduate Courses

PSCL 400. Ethics for Professional Researchers (3)  
Ethical principles applied to topics including authorship, plagiarism, grants, ownership of intellectual property, conflict of interest, harassment, and treatment of animal or human subjects.

PSCL 401. Sensation and Perception (3)  
The role of sensory and perceptual processes in adjustment. Theories and experimental work dealing with such topics as nativism vs. empiricism, perception without awareness, perception and personality, effects of drugs on personality, effects of drugs on perception, pathology of perception. Limited to graduate students.
PSCL 402. Cognition and Information Processing (3)
Aspects of cognition beyond the area of sensation and perception, involving symbolic processes, especially problems of meaning, conceiving, reasoning, judging, and thinking.

PSCL 403. Physiological Foundations of Behavior (3)
Fundamental neurological processes controlling behavior.

PSCL 404. Learning Theory (3)
The research literature in learning: theoretical formulations of contemporary learning theorists. Limited to graduate students.

PSCL 405. Personality Theory (3)
General problems and systematic points of view in the analysis of personality. Limited to graduate students.

PSCL 407. Research Design and Quantitative Analysis I (3)
Intermediate research design and statistical analysis used in psychological research. Statistical inference from single variables, elementary principles of probability, correlation and regression. Prereq: PSCL 282.

PSCL 408. Research Design and Quantitative Analysis II (3)

PSCL 409. Advanced Social Psychology (3)
Major theories, methods, and problem areas of social psychology. Psychological development of the individual group structures and dynamics.

PSCL 410. Developmental Psychology (3)
The research literature and theoretical formulation in the area of developmental psychology. Limited to graduate students.

PSCL 412. Measurement of Behavior (3)

PSCL 417. Multivariate Data Analysis (3)
Major statistical techniques used in experimental and survey research containing more than one dependent variable. Techniques discussed include multiple regression, canonical correlation, multivariate analysis of variance, discrimination analysis, cluster analysis and factor analysis. Prereq: PSCL 408.

PSCL 418. History and Systems (3)
Historical antecedents of modern psychology.

PSCL 424. Clinical Interviewing (3)
Introduction to diagnostic and therapeutic interviewing.

PSCL 425. Methods of Assessment I (3)
Limited to graduate students in clinical psychology. Prereq: Graduate standing in psychology with department permission.

PSCL 426. Methods of Assessment II (3)
Methods of psychological assessment, emphasizing personality and family function in childhood and adulthood. Prereq: Limited to Grad students in Clinical Psychology. Requires approval of the Director of Clinical Training.

PSCL 427. Special Assessment Methods with Children with Multiple Problems (3)

PSCL 429. Practicum in Assessment I (1)

PSCL 430. Practicum in Assessment II (1)
Prereq: Approval of the Director of Clinical Training. Coreq: PSCL 426.

PSCL 435. Vision: Molecules to Perception (3)
(See NEUR 435.) Prereq: NEUR 402 or consent of instructor. Cross-listed as NEUR 435.

PSCL 444. Developmental Psychopathology (3)
This course will focus on the interplay of biological, psychological, familial, and social determinants of disorders ranging from autism to delinquency and bulimia.

PSCL 453. Seminars in Psychology (1-3)
A special problem or topic. Content varies with student and faculty interest. Recent offerings: creative thinking in research, community psychological, evaluation of community processes, experimental and computer methods, consultation, and psychoanalytic ego psychology. Prereq: Graduate standing in CLINICAL Psychology or consent of department.

PSCL 469. Psychology of Aging (3)
Normal psychological development in later life; psychological development in the oldest old; definitions and assessment of successful aging.

PSCL 497. Graduate Independent Study (1-3)
Independent research and reading programs with individual members of the faculty.

PSCL 501. Pediatric Psychology I (1-3)
Seminar on current research topics, research design and methodological issues related to pediatric psychology. Introductory lectures provide an overview of research populations, methods, and practical issues appropriate to research with pediatric populations.

PSCL 502. Seminar: Pediatric Psychology (1-3)
Seminar examining specific topics in pediatric psychology. Topics will deal with issues of infant development. Infants at risk for disability, neuropsychology and learning disabilities, and childhood psychopathology. Prereq: Limited to Graduate students in Psychology department.

PSCL 524. Advanced Psychopathology (3)
Theoretical issues and current research data bearing on major patterns of psychological disturbance.

PSCL 525. Professional Issues in Clinical Psychology (3)
Consideration of legal and ethical principles in research and practice in clinical psychology and contemporary controversies in professional psychology. Prereq: Graduate standing in Psychology.

PSCL 527. Principles of Intervention (3)
Review of principles of psychological change, models of intervention, and process/outcome research related to intervention.

PSCL 529A. Practicum in Intervention I: Behavior Therapy (1)
Prereq: Graduate standing in clinical psychology.

PSCL 529C. Practicum in Intervention II: Psychodynamic (1)
Prereq: Graduate standing in clinical psychology.

PSCL 530A. Practicum in Intervention I: Behavior Therapy (1)
Prereq: Graduate standing in clinical psychology.

PSCL 530C. Practicum in Intervention II: Psychodynamic (1)
Prereq: Graduate standing in clinical psychology.

PSCL 531A. Seminar in Intervention I: Behavior Therapy (2)
Theoretical issues and research on psychological interventions. Prereq: Graduate standing in clinical psychology.

PSCL 531C. Seminar in Intervention I: Psychodynamic (2)
Theoretical issues and research on psychological interventions. Prereq: Graduate standing in clinical psychology.

PSCL 532A. Seminar in Intervention II: Behavior Therapy (2)
Theoretical issues and research on psychological interventions. Prereq: Graduate standing in clinical psychology.

PSCL 533. Case Seminar in Psychodynamic Psychotherapy (1)
Weekly case conference for students enrolled in PSCL 530C.

PSCL 535. Child and Family Intervention (2)
A course for advanced clinical graduate students that covers psychodynamic and cognitive behavioral approaches for working with children and adolescents and systems approaches for working with families.

PSCL 536. Intervention with Parents and Couples (2)
A course for advanced clinical graduate students that covers various approaches to working with parents and couples and special topics in family therapy such as ethnicity and nontraditional families.

PSCL 537. Child and Family Case Seminar I (1)
Clinical graduate students in child and family field placements present and receive group supervision on ongoing cases.

PSCL 538. Child and Family Case Seminar II (1)
Clinical graduate students in child and family field placements present and receive group supervision on ongoing cases.
Department of Religion

111 Mather House
Phone 216-368-2210; Fax 216-368-4681
William E. Deal, Chair (wed@po.cwru.edu)

The academic study of religion at Case Western Reserve University is multicultural, non-sectarian, and both disciplinary and interdisciplinary. Students examine a range of past and present cultures and societies using methods and approaches drawn from the humanities, arts, social sciences, and sciences, all of which sharpen critical and evaluative skills. Religious beliefs, institutions, and practices are studied with emphasis placed on the critical problems and possibilities inherent in the theories, methods, and technologies employed. The academic study of religion, combined with appropriate courses in other fields, provides an excellent background for any professional career including law, engineering, medicine and health care professions, journalism, and social work, and for graduate studies in a number of fields. A major in Religion provides a well-rounded liberal arts education or can be combined conveniently with a second major. Minors or sequences in Religion complement and broaden any field chosen as a major.

Faculty

William E. Deal, Ph.D. (Harvard University)
Severance Associate Professor of the History of Religion and Chair
Buddhism; Chinese and Japanese religions; methodology of religion;
etics; religion and culture

Alice Bach, Ph.D. (Union Theological Seminary [NY])
Archbishop Paul J. Hallinan Associate Professor of Catholic Studies
Literary and cultural studies of the Bible, feminist thought, film
studies; religion and culture

Timothy K. Beal, Ph.D. (Emory University)
Harkness Professor of Biblical Literature
Biblical studies; Near Eastern studies; environmental studies;
religion and culture; gender studies

Peter J. Haas, Ph.D. (Brown University)
Abba Hillel Silver Professor of Jewish Studies
Jewish literature and thought; Jewish ethics; science and religion;
religion and culture

Associate Faculty

Thomas Csordas, Ph.D. (Duke University)
Professor of Anthropology; and Professor of Religion
Comparative religion; religion and culture

Stephen G. Post, Ph.D. (University of Chicago)
Associate Professor of Biomedical Ethics, School of Medicine; and
Associate Professor of Religion
Biomedical ethics; American religious thought; philosophy of
religion

Undergraduate Programs

The Department of Religion offers a major and a minor in Religion—as well as a Departmental Honors Program—for students pursuing the Bachelor of Arts degree. Humanities and social science sequences are offered for B.S. degree students in Engineering. Both the major and minor programs acquaint the student with the texts and traditions of the ancient Near East, Judaism, Christianity, and Asian religions, as well as cultural and social aspects of religion. Majors are encouraged to participate in study abroad programs. Where appropriate, courses are designed to utilize Internet and other technological resources, cultural institutions in University Circle, and the cultural diversity of greater Cleveland. Several 300-level courses may be taken for graduate credit by fulfilling additional course requirements, and

Undergraduate Program

Undergraduate or graduate courses with public policy content are offered through the departments of anthropology, geological sciences, history, political science, and sociology in the college of arts and sciences; through the Department of Economics and other departments of the Weatherhead School of Management; through the Schools of Law, Medicine, and Nursing; and through the Mandel School of Applied Social Sciences and the Mandel Center for Nonprofit Organizations. Students can engage with policy issues through both courses and the extracurricular programming of the Center for Policy Studies and other university bodies.

An undergraduate minor is available to undergraduates in the College of Arts and Sciences and in the economics and management programs housed within the Weatherhead School of Management. The requirements are in four categories, listed below. Substitutions can be made under exceptional circumstances, at the discretion of the Minor Advisor.

Minor - Hours: 15

A. The policy process: POSC 386
B. Economic analysis: ECON 205
C. Policy making institutions: one course selected from HSTY 256, 358, 400; POSC 308, 310, 384, 385
D. Two courses on a particular field of public policy selected with the approval of the advisor

Public Policy Program

222 Mather House
Phone 216-368-2426
Joseph White, Academic Representative and Minor Advisor
(jxw87@po.cwru.edu)

Program Faculty

Joseph White, Ph.D. (University of California at Berkeley)
Director, Center for Policy Studies, and Luxenberg Family Professor of Public Policy

Robert H. Binstock Ph.D. (Harvard University)
Professor of Epidemiology and Biostatistics, School of Medicine

David C. Hammack, Ph.D. (Columbia University)
Hiram C. Haydn Professor of History

Alexander P. Lamis, Ph.D. (Vanderbilt University)
Associate Professor of Political Science

Emery G. Lee, Ph.D. (Vanderbilt University) J.D. (Case Western Reserve)
Assistant Professor of Political Science

Frances E. Lee, Ph.D. (Vanderbilt University)
Associate Professor of Political Science

Rhonda Y Williams, Ph.D. (University of Pennsylvania)
Assistant Professor of History

Department of Religion

111 Mather House
Phone 216-368-2210; Fax 216-368-4681
William E. Deal, Chair (wed@po.cwru.edu)

The academic study of religion at Case Western Reserve University is multicultural, non-sectarian, and both disciplinary and interdisciplinary. Students examine a range of past and present cultures and societies using methods and approaches drawn from the humanities, arts, social sciences, and sciences, all of which sharpen critical and evaluative skills. Religious beliefs, institutions, and practices are studied with emphasis placed on the critical problems and possibilities inherent in the theories, methods, and technologies employed. The academic study of religion, combined with appropriate courses in other fields, provides an excellent background for any professional career including law, engineering, medicine and health care professions, journalism, and social work, and for graduate studies in a number of fields. A major in Religion provides a well-rounded liberal arts education or can be combined conveniently with a second major. Minors or sequences in Religion complement and broaden any field chosen as a major.

Faculty

William E. Deal, Ph.D. (Harvard University)
Severance Associate Professor of the History of Religion and Chair
Buddhism; Chinese and Japanese religions; methodology of religion;
etics; religion and culture

Alice Bach, Ph.D. (Union Theological Seminary [NY])
Archbishop Paul J. Hallinan Associate Professor of Catholic Studies
Literary and cultural studies of the Bible, feminist thought, film
studies; religion and culture

Timothy K. Beal, Ph.D. (Emory University)
Harkness Professor of Biblical Literature
Biblical studies; Near Eastern studies; environmental studies;
religion and culture; gender studies

Peter J. Haas, Ph.D. (Brown University)
Abba Hillel Silver Professor of Jewish Studies
Jewish literature and thought; Jewish ethics; science and religion;
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B. Economic analysis: ECON 205
C. Policy making institutions: one course selected from HSTY 256, 358, 400; POSC 308, 310, 384, 385
D. Two courses on a particular field of public policy selected with the approval of the advisor
qualified students may pursue the M.A. degree under the Integrated Graduate Studies Program (IGS). The Department of Religion also contributes courses to and supports a number of the college’s interdisciplinary programs and centers such as Asian Studies, Women’s Studies, Environmental Studies, International Studies, the Samuel Rosenthal Center for Judaic Studies, and the College Scholars Program.

Major

Students majoring in Religion must complete a minimum of 30 semester hours of work in the Department. Courses required of all majors are RLGN 102: Introduction to the Study of Religion and at least three hours of RLGN 399/499: Major/Minor Seminar (repeatable up to six hours). In addition, majors must complete three courses in one of the three areas described below, one course in each of the other two areas outside of the area of concentration, and three elective courses. A list of courses assigned to each area of concentration is available from the Department. Additionally, majors are encouraged to develop interdisciplinary competency by taking courses in other departments relevant to their area of concentration. Majors are urged to take a second language related to their interests and concentration.

Area 1: Religious Texts and Traditions

Courses in Area 1 focus on the critical study of religious texts and traditions and their historical development. These courses encourage critical reflection on the methods and theories employed to study them. Interpretive perspectives include those drawn from the academic study of religion and other disciplines in the arts and humanities, social sciences, and natural sciences.

Area 2: Religion and Culture

Courses in Area 2 examine ways that religious discourses and practices are woven into larger webs of culture and are related to other elements within those webs. Through analysis of a wide range of cultural productions, both ancient and contemporary, from visual culture to popular media, these courses focus on the complex ways that religion takes form within particular cultural contexts, and conversely, helps to form cultural artifacts.

Area 3: Religion in Society

Courses in Area 3 investigate the various ways that people practice their religious beliefs within their own social groups and sustain their traditions within the larger society. Within this area are courses on the tensions between religion and science, ethics across religious boundaries and within religious traditions, and how religious groups affect political, economic, and social issues within local and world communities. Some courses in this area offer opportunities for working with social service and advocacy agencies in the community.

Minor

Students minoring in Religion must complete 15 semester hours of work in the Department. Courses required of all minors are RLGN 102: Introduction to the Study of Religion and three hours of RLGN 399/499: Major/Minor Seminar. Nine hours of course work must be chosen in consultation with a departmental advisor. These courses must demonstrate diversity in the study of religion.

Sequences (Engineering Core)

Sequences normally include three courses that demonstrate diversity in the study of religion. Approval for sequences must be obtained from the departmental advisor. In selecting courses, attention will be given to religious pluralism and diversity of approaches to the academic study of religion.

Departmental Honors

Students who are majoring in Religion and have an overall grade point average of 3.5 and also a grade point average of 3.5 in Religion courses may apply for the honors program. Honors candidates enroll in RLGN 395: Honors Research each semester during their senior year. A year-long honors project must be accepted by a member of the Department faculty and formally approved by a majority of the full-time faculty members in the Department. The approval must be granted not later than the end of the first semester. A faculty committee awards departmental honors upon satisfactory completion, defense, and acceptance of the senior project, provided that the required grade point averages are maintained.

Research

Faculty members in the Department are engaged in scholarly research, writing, editorial projects, and leadership roles in professional societies.

Religion (RLGN)

Undergraduate Courses

RLGN 102. Introduction to the Study of Religion (3)
Introduction to the critical study of religion and of the religious dimension of life.

RLGN 105. Aspects of Jewish and Middle Eastern Religions and Cultures (1)
This mini-course explores a variety of topics in Jewish and Middle Eastern religions and cultures. A one-credit course, repeatable up to three times, taught by distinguished Rosenthal Fellows visiting from Hebrew University in Jerusalem. Intended for students and others interested in an introduction to religion and culture. Participation in lectures and discussions and a final exam are required.

RLGN 115. Ethical Problems in Local Perspective (3)
This course examines contemporary ethical problems—including abortion, racism, suicide, capital punishment, bioethics, and just war theory—in light of their impact on the local Cleveland community. Most of us are aware of the national conversation around these issues; this course explores how local communities and institutions address and deal with these ethical problems. Prereq: Priority given to first and second year students; permit required.

RLGN 201. Literature and History of Ancient Israel (3)
The Hebrew Bible in the light of history and religion of Israel and the ancient Near East.

The literature of the New Testament in its historical, ideological, and religious setting.

RLGN 203. Introduction to Judaism (3)
The beliefs, doctrines, and institutions of classical Judaism; their origin and development.

RLGN 204. Introduction to Asian Religions (3)
Principal Asian religious traditions based on a study of classical sources. Classical Chinese thought, Hinduism, and Buddhism. Readings include selections from the works of Confucius, Mencius, Mo Tzu, Lao Tzu, Chuang Tzu, the Mahabharata, the Bhagavad Gita, and the early Buddhist canon.

RLGN 206. Religion and Ecology (3)
Historical and cross-cultural introduction to religious perspectives on nature and ecology, including Jewish, Christian, Hindu, Buddhism, and Native American texts and ritual practices. Themes include: ecology of change and complexity, urban ecology, wilderness, and ecological crises.

RLGN 207. Religion and Feminism (3)
Examination of feminist perspectives on religion, such as the status of women in Western and non-Western religions, the nature and purpose of religious beliefs and practices from the standpoint of religious and non-religious feminists, the current status of feminist philosophies of religion,
and the efforts of feminists to transform traditional religions and to create new religions.

**RLGN 208. Introduction to Western Religions (3)**
Basic introduction to the three great monotheistic religions of the Western World: Christianity, Judaism, and Islam. All three of these religious traditions trace their roots to the faith of Biblical Israel as revealed by a series of prophets including Noah, Abraham, and Moses. Each absorbed the philosophy and science of the Greco-Roman world and went on both to influence and struggle with each other. Many of the religious problems of the contemporary world, from Afghanistan to the Middle East to Yugoslavia, can be traced to tension within and between these religious groups.

**RLGN 215. Religion In America (3)**
Survey of religious histories in North America, from the trans-Bering migrations to the present. Drawing from a variety of approaches such as social history, ritual studies, and institutional and doctrinal histories, this course charts the religious development of various groups including Native Americans, African Americans, Euro-Americans, and others.

**RLGN 217. Buddhism (3)**
The development of Buddhism. The life and teaching of the Buddha, the formation of the early Buddhist church, the schools of Hinayana Buddhism and Abhidharma philosophy, Nagarjuna and the emergence of Mahayana Buddhism, the spread of Buddhism to China, the transformation of Buddhist thought in China, Zen Buddhism, the spread of Buddhism to the West.

**RLGN 223. Religious Roots of Conflict in the Middle East (3)**
The course is about the rhetoric and symbols used by various voices in the Middle East in the ongoing debate about the future shape of the region. For historical and cultural reasons, much of the discourse draws on religious symbolism, especially (although not exclusively) Islamic, Jewish and Christian. Because of the long and complex history of the region and the religious communities in it, virtually every act and every place is fraught with meaning. The course examines the diverse symbols and rhetorical strategies used by the various sides in the conflict and how they are understood both by various audiences within each community and among the different communities.

**RLGN 231. Modern Judaism (3)**
Jewish thought since the 18th century, with focus on religious reform movements, Zionist theory, and formulation of Jewish identity.

**RLGN 235. Religion and Visual Culture (3)**
Cross-cultural introduction to complex relations between religion and seeing. Study of visual culture, sacred iconography, calligraphy, film, mass media, and avant-garde fashion. Extensive use of cultural resources in University Circle.

**RLGN 240. The Heavens in Religion and Science (3)**
Review of the relationships between scientific descriptions of the natural world and the religious and ethical implications drawn from those in Western civilizations. Introduction to the close cooperation between religion and science in the West until the modern period and review of the breakdown of that relationship in the past 200 years.

**RLGN 241. Religious Experience and the Life Sciences (3)**
Examination of religious experience and beliefs in face of advances in the life sciences, especially neuroscience and evolutionary biology. Relation of religion and science, contemporary issues, history of discussions and debates.

**RLGN 250. Religion and the Arts in Scotland (3)**
Explore relations between religion, literature, and the visual arts in Scotland at the University of Glasgow’s Centre for the Study of Religion, Literature and the Arts. The single course has three units: (1) Religion and Film, (2) Religion and Literature, and (3) Religion and Visual Arts. Class sessions will be supported by readings, film screenings, and field trips to several museums and religious buildings in Glasgow and Edinburgh (including the Kelvingrove Gallery, the Modern Art Museum, the National Gallery, and the St. Mungo Museum of Religious Art and Life). In addition, there will be an optional trip to the Isle of Iona, the site of one of the first monasteries in Britain. The course is structured to encourage open discussion, and take full advantage of its cultural context. Evaluation is based on class preparation and participation, a journal of critical reflections, and a final research paper.

**RLGN 254. The Holocaust (3)**
History of racism in European society from 18th to 20th century; investigation, from perspectives of history, psychology, literature, philosophy, and religion, of how bureaucracy could exterminate six million Jews; responses of individuals, groups, institutions, and nations to deliberate extermination of nearly a whole people. Cross-listed as HSTY 254.

**RLGN 266. Bible in Fiction - Fiction in the Bible (3)**
Examination of use of biblical themes, tropes, and characters in modern fiction and popular culture, e.g., films, librettos, songs. Readings include Genesis, Exodus, Numbers, Judges, 1-2 Samuel, haggadic Midrashim, Jewish folktales, and modern fiction.

**RLGN 270. Introduction to Gender Studies (3)**
This course introduces women and men students to the methods and concepts of gender studies, women’s studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, and art history. It is the required introductory course for students taking the women’s studies major. Cross-listed as WMST 201.

**RLGN 271. Bioethics: Dilemmas in Research and Clinical Practice (3)**
(See BETH 271.) Cross-listed as BETH 271.

**RLGN 275. Jerusalem Perspectives (3)**
Topics in the religious, cultural, and historical legacy of past and present Middle Eastern societies. The course is taught by Fellows of the Samuel Rosenthal Center who are faculty members of the Hebrew University in Jerusalem. Course repeatable for credit up to four times.

**RLGN 280. Religion and Politics in the Middle East (3)**
An in-depth look at the relationship between politics and religion in the Middle East. Students will spend the first week on campus and the last three weeks in Israel, where time will be divided between classroom teaching, guest lectures, and “field trips” to important sites. Students will have the opportunity to interact directly with members of the region’s diverse religious groups within the political, social, and cultural contexts in which they live. A final research paper will be required. Knowledge of Hebrew is not necessary.

**RLGN 300. Archaeology of Biblical Israel (3)**
Religious and social world of biblical Israel as recovered by archaeology and interpreted with aid of comparative history and anthropology.

**RLGN 301. History and Ritual in Religion (3)**
Religious traditions, including those of the Ancient Near East, as they change throughout history. Selected historical personalities and events that accompany the formulation and reformulation of traditions. Changes such as the rise of literacy in oral society, relationship between agrarian and nomadic societies, and devolution of centralized power serve as case studies for religious transformation.

**RLGN 303. Japanese Religions (3)**
Thematic and historical survey of major Japanese religious ideas and institutions. Emphasis on translated readings in primary texts. Issues covered include Shinto and Buddhist traditions, religion and state, and role of religion in modern Japan.

**RLGN 306. Interpreting Buddhist Texts (3)**
Readings in translation of major texts from the Buddhist tradition. Special emphasis on problems of textual interpretation, historical context, Buddhist conceptions of the sacred, and Buddhist ethics. Prereq: RLGN 102 or RLGN 204 or RLGN 217 or RLGN 303 or RLGN 341.

**RLGN 308. Problem of Historical Jesus (3)**
Understanding of Jesus by nascent Christianity and by modern scholarship.

**RLGN 314. Jews and Christians in Germany (3)**
Jewish and Christian self-understandings and attitudes toward each other in Germany from the late nineteenth century to the present. Special attention to the history of modern anti-Semitism and Jewish responses to it, particularly as a factor in the Nazi period.

**RLGN 315. Heresy and Dissidence in the Middle Ages (3)**
Survey of heretical individuals and groups in Western Europe from 500 to 1500 A.D., focusing on popular rather than academic heresies. The develop
opment of intolerance in medieval society and the problems of doing history from hostile sources will also be explored. Cross-listed as HSTY 315.

RLGN 316. Modern Religious Thought: 1800 to the Present (3)
A survey of some major religious thinkers of Europe and North America from roughly 1800 to the present. A chronological examination of classical texts of theology and philosophy of religion of this period, with consideration of significant themes: Given the advance in modern rational thought, how can we understand traditional religion? What is the relationship between religion and reason? Religion and history? Religion and culture? Religion and experience? Is the attempt to modernize faith misguided or necessary to prevent faith from being captive to outmoded cultural assumptions?

RLGN 317. Recent Religious Thought (3)
A survey of the variety of forms of religious thought that have emerged in Europe and North America since roughly 1960. A loosely chronological examination of major religious thinkers of this period, treating such questions as: What does it mean to have faith in the modern age? In the postmodern age? What aspects of religious tradition can modern and postmodern thinkers dispense with and still be “religious?” How has the feminist critique of gender affected traditional faith? Are those who have sought to modernize religion correct, or has that project been completely mistaken?

RLGN 319. The Crusades (3)
(See HSTY 319.) Cross-listed as HSTY 319.

RLGN 325. Justice, Religion, and Society (3)
The ways in which several 20th-century American religious figures, both North and South American, have interpreted their religion as requiring them to struggle for a better society by using direct action to deal with issues of poverty, peace, and social justice. Introduction to writings of prominent social justice activists such as Dorothy Day, Daniel Berrigan, Thomas Merton, and others. Course includes service learning within the Cleveland area via association with structured institutions and programs engaged in social justice and urban poverty issues in order to investigate these from the inside.

RLGN 330. Classical Jewish Religious Thought (3)
The thought of some major biblical and Rabbinic writings and of the classic age of medieval Jewish philosophy.

RLGN 332. Jewish Experience in America (3)
Religious, political, and social history of Jews in America from 17th century to the present. Special attention to the question, “How have Jews responded to the openness of American society?” including the definition of Jewish theology in contrast to Christianity, the special culture of Eastern European immigrants, and the struggle of Jewish women to assert Jewish commitments against the tide of assimilation in the late 20th century.

RLGN 333. Philosophy of Religion (3)
Topics include: classical and contemporary arguments for God’s existence; divine foreknowledge and human freedom; the problem of evil and theodicy; nature and significance of religious experience; mysticism; varieties of religious metaphysics; knowledge, belief and faith; nature of religious discourse. Readings from traditional and contemporary sources.

RLGN 334. Issues in American Catholicism (3)
Exploration of issues and tensions facing Roman Catholics in America nearly 40 years after the Second Vatican Council, with emphasis on church polity, structure, and reforms on local and national levels as culture and society change. Considers subsidiarity and conciliarity mandated by Vatican II documents; new models for Church governance; culturally diverse local churches; and varying agenda of conservative and liberal Catholic groups in America. The challenges to Rome and to America of the emerging role of women, the declining numbers of priests, and the increase in lay leadership.

RLGN 341. Religion and Postmodernism (3)
Consideration of the impact of postmodern thought on the study of religion. Examination of how recent critical theory informs our understanding of religious texts and religious themes in contemporary literature, arts and film. Utilizing the theories of Foucault, Derrida, Kristeva, and others, the class will explore such postmodern concerns as narrative, textuality, the author, ideology, gender, and rhetoric.

RLGN 345. Religion and Horror (3)
This seminar explores relations among religion, horror, and the monstrous in ancient scripture and contemporary horror. Course readings, discussions, and research projects approach the subject from two distinct but related directions: first, a focus on elements of horror and the monstrous in biblical and related ancient mythic and ritual texts; second, an examination of religious dimensions in the modern horror, especially as found in representations of monstrosity in literature and film. Prereq: RLGN 102 or permission of department.

RLGN 350. Jewish Ethics (3)
An exploration of Jewish moral and ethical discourse. The first half of the course will be devoted to studying the structure and content of classical Jewish ethics on issues including marriage, abortion, euthanasia and social justice. Students will read and react to primary Jewish religious texts. The second half of the course will focus on various modern forms of Judaism and the diversity of moral rhetoric in the Jewish community today. Readings will include such modern thinkers as Martin Buber and Abraham Joshua Heschel.

RLGN 356. Religion and Film (3)
Study of the cultural use of biblical figures, especially in film: movies as myth; place of myths in American culture; how cinematic images continue the polarization of biblical images and intertwine them with the American myth.

RLGN 372. Anthropological Approaches to Religion (3)
The development of, and current approaches to, comparative religion from an anthropological perspective. Topics include witchcraft, ritual, myth, healing, religious language and symbolism, religion and gender, religious experience, the nature of the sacred, religion and social change, altered states of consciousness, and evil. Using material from a wide range of world cultures, critical assessment is made of conventional distinctions such as those between rational/irrational, natural/supernatural, magic/religion, and primitive/civilized. Prereq: ANTH 102 or consent of department. Cross-listed as ANTH 372.

RLGN 373. History of the Early Church: First Through Fourth Centuries (3)
Explores the development of the diverse traditions of Christianity in the Roman Empire from the first through the fourth centuries C.E. A variety of New Testament and extra-Biblical sources are to be examined in translation. Emphasis is placed on the place of Christianity in the larger Roman society, and the variety of early Christian ideals of salvation, the Church, and Church leadership. Cross-listed as HSTY 303.

RLGN 374. Reformation Europe, 1500-1650 (3)
Origins and development of Protestantism, the Catholic counter-reformation, and the interaction between secular power and religious identification in Christian Europe. Cross-listed as HSTY 309.

RLGN 388. Topics in Religion (3)
Critical assessment of selected topics of historical or current interest. Project must be accepted by a member of the department faculty prior to registration.

RLGN 392. Independent Study (1-3)
Up to three semester hours of independent study may be taken in a single semester. Must have prior approval of faculty member directing the project. Prereq: Consent of department.

RLGN 395. Honors Research (3)
Intensive study of a topic or problem leading to the writing of an honors thesis. By department approval only. Maximum six credits. Prereq: Consent of department chair.

RLGN 399. Major/Minor Seminar (3)
Capstone course primarily for majors and minors in Religion. Allows students to interact with peers and faculty, reflect critically, and integrate their learning experiences. Prepares students to continue their learning in the discipline and in the liberal arts. Subject matter varies according to student and faculty needs and perspectives. May be repeated once for up to six credit-hours.

Graduate Courses

RLGN 400. Archaeology of Biblical Israel (3)
(See RLGN 300.)
The major in sociology has been designed to serve the different needs of students majoring in other social sciences, natural sciences, or humanities. Surveys show sociology majors to be among those with the highest rates of acceptance to professional schools. Sociology preparation for admittance to law school or medical school. Sociology coursework, a minor, or second major in sociology, also provides excellent preparation for students majoring in other social sciences, natural sciences, or humanities.

**Faculty**

Eva Kahana, Ph.D. (University of Chicago)  
*Pierce T. and Elizabeth D. Robson Professor of Humanities and Chair*

- Sociology of aging; medical sociology; social factors in stress and coping.
- Gary Deimling, Ph.D. (Bowling Green State University)  
*Professor*

  - Family sociology; sociology of aging; medical sociology; research methods.
- Brian Gran, Ph.D. (Northwestern University)  
*Assistant Professor*

  - Sociology of law; political sociology; comparative sociology; health care policy.
- Susan W. Hinze, Ph.D. (Vanderbilt University)  
*Assistant Professor*

  - Medical sociology; social inequality, sex and gender.
- Kyle Kercher, Ph.D. (University of Washington)  
*Associate Professor*

  - Quantitative methodology; aging/social gerontology.
- Richard A. Settersten, Ph.D. (Northwestern University)  
*Associate Professor*

  - Adult development and aging; theory; social policy; life course methods.
- Eleanor P. Stoller, Ph.D. (Washington University)  
*Selab Chamberlain Professor of Sociology*

  - Sociology of aging; medical sociology; race, class and gender.

**Associate Faculty and Lecturers**

- David E. Beigel, Ph.D. (University of Maryland at Baltimore)  
*Henry Zucker Professor, Mandel School of Applied Social Sciences; Professor of Sociology*

  - Family; social networks; caregiving; mental health.
- Robert Binstock Ph.D. (Harvard University)  
*Medical sociology; social inequality, sex and gender.*

**Undergraduate Programs**

**Major**

The major in sociology has been designed to serve the different educational goals of undergraduates: general education, pre-
professional training, postgraduate employment, and preparation for graduate school. The major requires a minimum of 30 hours of work. All majors complete the common core requirements: (12 hours):

- SOCI 112 Introductory Sociology
- SOCI 303 Research Methods
- SOCI 300 Sociological Theory
- STAT 201 or PSCL 282 Statistics

plus 18 hours of electives, consisting of any six courses in sociology. SOCI 375, Independent Study, is available to selected majors in their junior or senior year.

**Minor**

The minor consists of 15 credit hours in sociology, including:
- SOCI 112 Introductory Sociology
- SOCI 300 Sociological Theory

plus three additional electives, of which at least two must be 300 level courses.

**Sequences for Engineering Core**

Sociology provides the computer science or engineering student a perspective for understanding society. All sociology sequences leading to a sociology degree must include SOCI 112, Introduction to Sociology (3 credits) ands SOCI 113, Critical Problems in Modern Society (3 credits). In addition, students choose two courses from one of the following three sequences: Modern Society: SOCI 208, Dating, Marriage and Family, SOCI 222, Gender in U.S. Society, SOCI 302, Race and Ethnic Minorities, SOCI 310, The Individual in Society Social Problems: SOCI 204, Criminology, SOCI 333, Sociology of Deviant Behavior and SOCI 349, Social Inequality Health and Aging: SOCI 311, Health, Illness and Social Behavior, SOCI 313, Sociology of Stress and Coping; SOCI 319, Sociology of Institutional Care, SOCI 369, Aging in American Society

**Departmental Honors**

Juniors majoring in sociology with a 3.0 overall GPA and a 3.4 GPA in sociology are invited to apply for the department’s Honors Program, which consists of an intensive, year-long investigation of a research problem under the guidance of a faculty member. Students will earn credit through registration in SOCI 397 and SOCI 398. Admission to honors work is by faculty approval.

**Honor Society**

The opportunity to join Alpha Kappa Delta (AKD), the sociology honors fraternity, is available to selected juniors and seniors. (Membership requires a 3.4 GPA in sociology and a 3.2 GPA overall.)

**Integrated Graduate Studies**

The Department of Sociology participates in the Integrated Graduate Studies Program. Students in the program are able to obtain B.A. and M.A. degrees simultaneously. Interested students should note the general requirements and the admission procedures in the appropriate section of this bulletin and may consult the department for further information.

**Graduate Program**

The Department of Sociology offers graduate training leading to the Doctor of Philosophy degree. Students may petition for a Master of Arts degree once they fulfill the requirements outlined below. Sociology of aging and medical sociology are the major areas of emphasis in the department. A formal concentration in research methods is also offered as a complement to these areas.

**Master of Arts**

To receive the Masters of Arts degree a student must successfully complete 30 credit hours of course work. Required courses for the degree are SOCI 400, 401, 406, 407, 443, 469, and either 413 or 419; and three general electives in sociology. In addition, the student must pass written comprehensive examinations in Social Theory and Research Methods.

**Doctor of Philosophy**

The Doctor of Philosophy degree is awarded upon the completion of all requirements of the School of Graduate Studies and the following departmental requirements: Completion of 66 credit hours past the Bachelor of Arts degree, including 18 credits of 701 (dissertation hours). Required courses are SOCI 400, 401, 406, 407, 443, 469, two additional electives in research methods, two additional electives in medical sociology, two additional electives in aging, and four general electives in sociology. In addition, students must pass three comprehensive examinations (Social Theory; Research Methods; Aging/Medical) and successfully defend the dissertation. To obtain the concentration in Research Methods, students must take SOCI 406; 407; two courses from among 414, 473, and 509; and two additional electives.

A predoctoral training program in Health Research and Aging sponsored by the National Institute of Aging has been offered in conjunction with the Elderly Care Research Center of the Department of Sociology.

**Research Programs**

**The Elderly Care Research Center**

Funded research projects of the center focus on theory-based and public policy relevant issues in aging and medical sociology. Current projects relate to physical and mental health outcomes of stress, coping, cancer survivorship and adaptation to frailty and life-threatening illness in late life. The center is recipient of an NIA Merit Award for a long-term study of very old residents of a retirement community. This research seeks to understand health promotion, proactive adaptation, and maintenance of wellness in late life. Major research projects focusing on medical sociology deal with life-threatening illness, caregiver burden, and physician-patient interactions. The center serves as a laboratory for student research. Collaborative and cross-national research involves colleges from other disciplines and universities in Israel, Hungary, Britain, and Germany.

**Sociology (SOCI)**

**Undergraduate Courses**

- **SOCI 112B. Introduction to Sociology: Human Interaction (3)**
  How can so many different people who have competing ideals and lifestyles live together in harmony? What makes one organization successful and another one fold? This course examines such questions from the social scientist’s viewpoint. Topics include: how people learn to be human, families, markets and economic institutions, class structures, crime and deviant behavior, aging, self-identity, and social change.

- **SOCI 113. Critical Problems in Modern Society (3)**
  Focus is on major social problems present in large, complex, industrial societies. Topics include environmental problems, poverty, drug addiction, social deviance, and alienation.

- **SOCI 203. Human Development: Medical and Social (3)**
  Social influences on health and illness across the lifespan. Social determinants of health and health behavior, and delivery of health care. Guest lectures from the medical school and other health care providers address professional practice issues across the lifespan. Issues include: new ap-
proaches to birthing; adolescent substance abuse: myths and realities of AIDS; risk factors of diseases in middle age; menopause, cognition and aging-Alzheimer’s disease; problems in care of elderly; medical ethic of death and dying. Cross-listed as HDEV 203.

SOCI 204. Criminology (3)
What is crime and to what extent does crime affect you? This course will investigate the nature and extent of crime, theories on the causes of crime, types of crime and criminals, and the efforts society makes to cope with and prevent criminal behavior.

SOCI 208. Dating, Marriage, and Family (3)
What is the family today? How has it changed over the last century? How will it change in the future? This course aims to answer these questions as it explores the influences of work, education, government, health and religion on today’s changing families. The course considers the factors that affect mate selection. It also examines parenting, roles of husbands and wives, and family dysfunction, and divorce.

SOCI 222. Gender in U.S. Society (3)
The focus of this course is on unique and convergent experiences of men and women in U.S. society. Different social expectations and opportunities encountered by men and women in the context of marriage and the family, work settings, and in informal organizations will be addressed. Legislation and social policy dealing with gender issues will be considered. Cross-listed as WMST 222.

SOCI 255B. Social Change in the ’60s (3)
The events of the 1960s in our country challenged the values and assumptions upon which most social institutions were previously based. A sociological analysis of the major social movements and broad societal changes that emerged during that time will enable students to understand not only this most confusing period of U.S. society, but the foundations of our current social context as well.

SOCI 269. Young and Old Face the 21st Century (3)
Examines prospects and problems of the young and old as a window into the 21st century. An intergenerational perspective is used to highlight opportunities for cooperation and conflict between young and old who face the future together. This approach represents a shift in thinking about aging as relevant only to the old, to a view that aging is relevant to the future of all individuals, families, and societies.

SOCI 300. Modern Sociological Thought (3)
The most profound commentary of industrial society began in the middle of the nineteenth century with thinkers such as Durkheim, Marx, and Max Weber. Students will read the work of these scholars as it appeared in the original sources. They thoughtfully address concepts such as social integration and alienation, crime and punishment, and the social impact of modernization. The course is of special relevance to students in the social sciences, but is also recommended for students in other fields who wish to understand the social context in which professional lives will be conducted. Prereq: SOCI 112B.

SOCI 302. Race and Ethnic Minorities in American Society (3)
Has the United States become a melting pot of ethnic groups or does it remain a salad bowl? American society is uniquely diverse in its ethnic and racial composition. This diversity has influenced much of American history and had substantial impact on the structure of social organization of present day society. This course familiarizes students with basic concepts of race and ethnicity, relevant theories and their applications to critical issues. Prereq: SOCI 112B.

SOCI 303. Social Research Methods (3)
Principles of making causal inferences about human behavior; problem formulation and research design; measurement of sociological concepts; data collection and analysis methods; evaluation of research findings. Prereq: SOCI 112B.

SOCI 310. The Individual in Society (3)
This course focuses on the relationship between individuals and the societies in which they live. Influences of values and culture on individuals’ selves and identities are discussed as well as how individuals attach meaning to personal life experiences and histories in the context of society at large. Prereq: SOCI 112B.

SOCI 311. Health, Illness, and Social Behavior (3)
This course considers the role of social factors (e.g., poverty, occupational and family structure) on health and illness. Discussion will concentrate on the role of health promotion (e.g., anti-smoking campaigns), social behavior and lifestyle in health and health care use. Considerable attention is given to understanding health careers and professions and their role in the health of societies and individuals. Prereq: SOCI 112B.

SOCI 313. Sociology of Stress and Coping (3)
This course will focus attention on human stress throughout the lifespan and its role in personal health and well-being. There have been exciting advances in recent years in understanding the nature of stress in everyday life as well as elements of extreme stress. Trauma is experienced by many people due to normative events such as illness and bereavement or natural and man-made disasters such as crime or war. Coping strategies and social supports which ameliorate negative impact of stress will be considered. Prereq: SOCI 112B.

SOCI 314. Qualitative Methods/Field Research (3)
Students explore the theoretical foundations of qualitative social research. The course is designed to introduce and provide experience with a range of data generation strategies and analytic skills. The ethnographic techniques of semi-structured interviewing and participant-observation receive particular attention. Prereq: SOCI 112B.

SOCI 319. Sociology of Institutional Care (3)
This course focuses on converging issues of theory, research, and practice in general hospitals, mental hospitals, nursing homes, hospices, and correctional institutions. The ecology of institutions and the adaptation of individuals within institutions will also be considered. There will be field trips to institutional facilities. Prereq: SOCI 112B.

SOCI 326. Women in Societies in the Modern World (3)
Participation of women in both family and economic institutions in developed and developing societies around the world. Prereq: SOCI 112B or permission of program director. Cross-listed as WMST 326.

SOCI 333. Sociology of Deviant Behavior (3)
Sociological approaches to causes of deviant behavior, and social psychology of deviance are studied. Illustrations range from juvenile delinquency to scientific misconduct and cover both criminal and noncriminal forms of deviance. Prereq: SOCI 112B.

SOCI 338. Seminar and Practicum in Adolescence (3)
(See EDUC 338.) Cross-listed as EDUC 338 and PSCL 338.

SOCI 339. Seminar and Practicum in Adolescents (3)
(See SOCI 338.) Cross-listed as PSCL 339.

SOCI 349. Social Inequality (3)
Theoretical approaches to understanding of contemporary inequality is considered in terms of income, wealth, education, occupational standing, occupational prestige, status categories, racial, ethnic, religious, age, and gender groupings. Prereq: SOCI 112B.

SOCI 355. Special Topics (3)
One or more sections each semester focusing on selected areas of study in sociology.

SOCI 355E. Religion in American Society (3)
Religion has played a profound role in American society. This course looks at religion first from the perspective of major sociological theories (functionalism, conflict theory, etc.). Following these broad perspectives, the history of religion is examined from a religious economies/marketplace perspective. The course concludes with a consideration of the role of religion in individuals’ lives. Prereq: SOCI 112B.

SOCI 355F. Science Technology and Society (3)
Interactions between technology and society. Selected technologies (computers, automobiles, television, pesticides, energy sources, biomedical innovations, factories) serve as case histories. Consequences of technological changes in pattern of work and social life. Major focus on American society, but also patterns of technological change in other cultures. Prereq: SOCI 112B.

SOCI 360. Criminal Justice and Law (3)
Overview of criminal justice system and procedures and problems concerning police, prosecutors, courts, and corrections. Covers society’s
ways of protecting dependent groups and insuring justice, evolution of the current legal system, and relationships between the law and moral behavior. Prereq: SOCI 112B or consent of department.

**SOCI 361. The Life Course (3)**

Individual experiences and transitions over the life course are considered as the result of societal, cultural, psychological, biological, and historical influences. Developmental issues of childhood, adolescence, young adulthood, middle years and late life are discussed in the context of social expectations, challenges, and opportunities. Emphasis is placed on theoretical readings. Prereq: SOCI 112B.

**SOCI 365. Health Care Delivery (3)**

Health care in the U.S. may be approaching a critical cross-road. Limiting care to older persons and the chronically ill has been proposed as a means to combat rising costs and limited access to health care. What are the alternatives to health care rationing? Socialized medicine? National health insurance? This course deals with issues of cost, quality, and access to health care in the United States and other societies. It considers how solutions by other societies can provide directions for the organization of health care in the U.S. Prereq: SOCI 112B.

**SOCI 369. Aging in American Society (3)**

Considers the position and participation of aged adults in American society. Sociological perspectives through which to interpret the aging process and old age; social policies; intergenerational relations; lifestyles and how they affect participation of the aged in American society; dying and death serve as major themes. Prereq: SOCI 112B.

**SOCI 370. Family Structure and Process (3)**

This course focuses on the conduct, conflicts and triumphs encountered in everyday living by families. Examines how families from different historical periods, classes and races experience life. Attention will be given to the sense of variety inherent in family forms and intrafamilial experiences. Using sociological, theoretical and historical perspectives, learn why the family is often blamed for major societal problems. Prereq: SOCI 112B.

**SOCI 372. Work and Family: U.S. and Abroad (3)**

Covers the impact on human lives of the interface between work and family: the different ways gender structures the experience of work and family depending upon racial and ethnic background, social class, age, and partner preference; the impact of historical context on work-family experiences; work-family policies in the United States and other countries. Prereq: SOCI 112B and junior/senior standing. Cross-listed as WMST 372.

**SOCI 375. Independent Study (1-3)**

Prereq: SOCI 112B and SOCI 300.

**SOCI 391. Practicum in Human Development (3)**

Students design a project in consultation with the Human Development program coordinators and a faculty supervisor from the School of Medicine, one of the other professional schools, or the College of Arts and Sciences. The faculty supervisor may be chosen by the student or recommended by the program coordinators. Students meet periodically with program coordinators in a seminar to review practicum experiences and place them in a theoretical context. Prereq: PSCI 250 and HDEV 203. Cross-listed as HDEV 391.

**SOCI 397. Honors Studies (3)**

Intensive investigation of research or conceptual problem; original work under supervision of faculty member. Limited to senior majors. Prereq: Senior status.

**SOCI 398. Honors Studies (3)**

Intensive investigation of research on conceptual problem; original work under supervision of faculty member. Limited to senior majors.

**Graduate Courses**

**SOCI 400. Development of Sociological Theory (3)**

This course examines in detail the works of the major social theorists of the 19th and 20th centuries. It is intended to integrate their ideas with the social and historical milieu from which they were born. Questions of intergroup conflict vs. cooperation, interactions between economic, familial, religious, and political institutions, and the development of the self as a function of larger social processes are addressed. Such cel-
data; and making comparisons in human development. Prereq: SOCI 406 or equivalent.

SOCI 496. Public Policy and Aging (3)
(See EPBI 408.) Cross-listed as EPBI 408.

SOCI 500. Advanced Social Theory (3)
This course focuses on problems and issues relevant to contemporary social theorizing. As such, it deals with the rational roots of mainstream sociological thought and its relation to practice. Attention will also be paid to critical theory, hermeneutics, and current feminist thinking. Prereq: SOCI 400 and SOCI 401.

SOCI 509. Problems of Data Analysis (3)
Research in social epidemiology, health service research and other applied fields increasingly demands an understanding of research methodology. This seminar exposes to state of the art analyses of social science data including: data preparation, factor analysis, regression and structural equation modeling. Students are provided the opportunity to interpret and critically evaluate the methodology used in journal articles, with an emphasis on data analytical techniques. Students will analyze data sets using SPSS and EQS. Prereq: STAT 401, SOCI 406, and SOCI 407 or permission of department.

SOCI 601. Reading and Research (1-9)
Individual study and/or project work.

SOCI 701. Dissertation Ph.D. (1-18)

Department of Statistics

323 Yost Hall
Phone 216-368-6941; Fax 216-368-0252
Wojbor Woyczynski, Chair

Statistics links mathematics to other disciplines to understand uncertainty and probability in the abstract and in the context of actual applications to science, medicine, actuarial science, social science, management science, business, engineering, and to contemporary life. As technology brings advances, the statistical theory and methodology required to do them justice becomes more challenging: higher dimensional, dynamic, or computer-intensive. The field of statistics is rapidly expanding to meet the three facets of these challenges: the underlying mathematical theory, the data analysis and modeling methodology, and the interdisciplinary collaborations and new fields of application.

Faculty

Wojbor Woyczynski, Ph.D. (Wrocław University, Poland)
Professor and Chair

Stochastic models, probability, random fields, time series, dynamics of chaotic processes, nonlinear diffusion, turbulence

Nidhan Choudhuri, Ph.D. (Michigan State University)
Assistant Professor

Bayesian nonparametric, empirical likelihood, bootstrap, multivariate spline

Paula FitzGibbon, M.S. (Miami University)
Lecturer

Joseph Sedransk, Ph.D. (Harvard University)
Professor

Bayesian inference, Sample survey theory, methodology and applications

Nell Sedransk, Ph.D. (Iowa State University)
Professor

Topologic foundations for statistical inference, Bayesian design and inference, spatial statistics, Inference for complex systems

Lajos Takacs, Ph.D. (Budapest University)
Professor Emeritus

Stochastic processes, probability, queuing systems

Jiayang Sun, Ph.D. (Stanford University)
Associate professor

Methodologies of statistical computing and modern data analysis, semiparametrics, statistics and applications

Adjunct Faculty
Mary H. Regier, Ph.D. (University of California at Berkeley)
Adjunct Professor

Undergraduate Programs

Students in statistics begin with a foundation in mathematics, then add statistical theory plus intensive modern data analysis and a concentration in a field of each student’s choice where statistics is used. The goal is to develop an appreciation of each facet of the discipline and a mastery of technical skills. This prepares students to enter a growing profession with opportunities in the academic, governmental, actuarial, and industrial spheres. For the undergraduate student looking toward graduate school, the course of study within these guidelines easily incorporates additional mathematics in preparation for the more abstract mathematical level of graduate courses. The more specialized option in actuarial science expands the basic program in statistics to incorporate topics from operations research and numerical analysis which are fundamental to actuarial theory and computation. This actuarial option includes the course work necessary to prepare for Courses 1-5 of the Society of Actuaries Exams.

All undergraduate majors begin with a foundation in mathematics and a core of courses in mathematical statistics, courses in statistical methodology and courses in modern data analysis. Each student’s program is individualized by the choice of an applied field of concentration according to the student’s own talents and interests and by the choice of appropriate STAT electives which may be drawn from offerings by the Statistics Department and from suitable offerings by other departments at the University. The Senior Project option also allows students either to work in a research setting or to participate in interdisciplinary collaboration or in industrial consulting along with a statistics faculty member. The B.A. degree offers flexibility and the chance to pursue a wider range of interests. It also offers the possibility of expanding the interdisciplinary aspect of the program to complete the requirements for majors in two fields. Some examples of particularly attractive double majors combine statistics with computer science, biology (molecular, organismal or ecology), psychology, economics, accounting, or management science.

The B.S. degree adds a laboratory science requirement. For students seriously interested in basic science, a natural science is the logical choice as a focus for the application, and the B.S. degree is the logical choice of program.

Bachelor of Science in Statistics

The B.S. degree in statistics requires a minimum of 124 hours, including at least 68 hours of approved course work, including 27 hours in statistics, the remainder in related disciplines and a substantive field of application, to satisfy the following requirements:

1. MATH 121, 122, 223, 224, and 201 or equivalent;
2. ENGR 131 or ECMP 251 or approved alternate; plus an additional higher numbered course in computation from ENGR or ECMP offerings or EPBI 414 or EPBI 420;
3. STAT 325 and 326, STAT 345 and 346;
4. At least 15 hours of courses in statistical methodology to be chosen from statistics courses numbered 300 and higher offered by the Statistics Department, or approved courses in statistical methodology or probability taught in
biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. At least 6 hours must be in STAT courses; STAT 243 and 244 may be counted;

(5) Two approved courses (or more) numbered 300 or above in an approved discipline outside statistics;

(6) A combined total of 12 hours (or more) in ASTR, BIOL, CHEM, GEOL, PHYS which may be counted toward a major in that field including at least one of PHYS 121 and 122, CHEM 105 and 106 plus 113, CHEM 107 and 108 plus 113, BIOL 110 and 210 plus 211, BIOL 110 and 220 plus 221. Students are strongly encouraged to include advanced expository or technical writing courses in their programs.

**Bachelor of Arts**

The B.A. degree in statistics requires a minimum of 120 hours, including at least 56 hours of approved course work, including 27 hours in statistics, the remainder in related disciplines and a substantive field of application, to satisfy the following requirements:

1. MATH 121, 122, 223, 224, and 201 or equivalent;
2. ENGR 131 or ECMP 251 or approved alternate; plus an additional higher numbered course in computation from ENGR or ECMP offerings or EPBI 414 or EPBI 420;
3. STAT 325 and 326, STAT 345 and 346;
4. At least 15 hours of courses in statistical methodology to be chosen from statistics courses numbered 300 and higher offered by the Statistics Department, or approved courses in statistical methodology or probability taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. At least 6 hours must be in STAT courses; STAT 243 and 244 may be counted;
5. Two approved courses (or more) numbered 300 or above in an approved discipline outside statistics.

Students are strongly encouraged to include advanced expository or technical writing courses in their programs. Students may pursue a B.A. with double major in statistics and a related field from within the College of Arts and Sciences. In this case, the substantive field requirement (No. 5 above) is waived.

**Bachelor Degrees - Option in Actuarial Science**

The actuarial program leading to a either a B.A. or a B.S. in statistics requires 30 hours in statistics and actuarial studies and must satisfy the requirements for the appropriate degree program with the following modifications of requirements (4) and (5) of the B.A. or B.S. program:

### Prototype Programs - Statistics Course Work

#### Statistics B.A. Program

**Year 1**

**Fall**
- MATH 121
- CMPS 131
- ENGL 150
- GER: Science
- GER: Social Science
- Physical Education Requirement

**Total: 16 hours**

**Spring**
- MATH 122
- GER: Arts and Humanities
- GER: Science
- GER: Social Sciences
- Free Elective
- Physical Education Requirement

**Total: 16 hours**

**Year 2**

**Fall**
- MATH 223
- STAT 243
- GER: Arts and Humanities
- GER: Social Sciences
- Free Elective

**Total: 15 hours**

**Spring**
- MATH 224
- MATH 201
- STAT 244
- GER: Arts and Humanities
- GER: Global and Cultural Diversity

**Total: 15 hours**

**Year 3**

**Fall**
- STAT 345
- EPBI 420
- Substantive Field Requirement
- GER: Arts and Humanities
- Free Elective

**Total: 15 hours**

**Spring**
- STAT 346
- STAT Elective
- Substantive Field Requirement
- Free Elective
- Free Elective

**Total: 15 hours**

**Year 4**

**Fall**
- STAT 325
- STAT Elective
- Free Elective
- Free Elective
- Free Elective

**Total: 15 hours**

**Spring**
- STAT 326
- STAT 395
- STAT 391
- Free Elective
- Free Elective

**Total: 13 hours**
(4) At least 12 hours of courses in statistical methodology to be chosen from statistics courses numbered 300 and higher offered by the Statistics Department, or approved courses taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. At least 6 hours must be in STAT courses; STAT 243 and 244 may be counted;

(5) STAT 317 and STAT 318. Students ordinarily can expect to be prepared to take Courses 1-3 of the Society of Actuaries Exams upon graduation.

Minor in Statistics
A minor in statistics requires a minimum of 15 hours of approved course work in statistics. The minor must satisfy the requirements below and must include a minimum of 9 credits in courses from the Statistics Department offerings.

(1) STAT 243 and 244 or STAT 345 and 346 or other approved sequence
(2) STAT 208 or STAT 312 or STAT 313 or STAT 332 or STAT 333 or STAT 325
(3) Two approved elective courses in statistics numbered 300 or above.

Combined Bachelor-Master Degrees
The combined bachelor-master degrees in statistics require a minimum of 21 hours beyond the bachelor’s degree requirements. In total, 42 hours must be in statistics, including an M.S. thesis or M.S. research project, with the remainder (either 41 or 26 hours for B.S. or B.A., respectively) in approved course work in related disciplines and a field of application. In addition to the B.S. or B.A. requirements, a combined degree program must include:

(1) STAT 455 and three semesters of STAT 491;
(2) One semester of STAT 495
(3) M.S. research project (STAT 621) or M.S. Thesis (STAT 651);
(4) At least 6 additional hours of courses in statistical theory and methodology (making a total of 21 hours including at least 4 STAT courses numbered 400 or higher) to be chosen from Statistics Department offerings numbered 300 and higher, or approved courses in statistical methodology or probability taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. Students are strongly encouraged to include advanced expository or technical writing courses in their programs.

Statistics
B.S. Program

Year 1

Fall
MATH 121
MATH 122
ENGR 131
ENGL 150
GER: Science
GER: Social Sciences
Physical Education Requirement
Total: 16 hours

Spring
GER: Arts and Humanities
GER: Science
GER: Social Sciences
Free Elective
Physical Education Requirement
Total: 16 hours

Year 2

Fall
MATH 223
STAT 243
GER: Arts and Humanities
GER: Social Sciences
Free Elective
Total: 15 hours

Spring
MATH 224
MATH 201
STAT 244
GER: Arts and Humanities
GER: Global and Cultural Diversity
Total: 15 hours

Year 3

Fall
STAT 345
EPBI 420
Substantive Field Requirement
GER: Arts and Humanities
Science Requirement
Total: 15 hours

Spring
STAT 346
STAT Elective
Substantive Field Requirement
Free Elective
Science Requirement
Total: 15 hours

Year 4

Fall
STAT 325
STAT Elective
STAT 391
Free Elective
Free Elective
Free Elective
Total: 16 hours

Spring
STAT 326
STAT 395
STAT 391
Free Elective
Free Elective
Free Elective
Total: 16 hours
Graduate Programs

The department offers programs leading to the Master of Science and to the Doctor of Philosophy degrees. Graduate assistantships both with teaching responsibilities and with research duties are available to qualified applicants.

The dual core of the M.S. program is mathematical statistics and modern data analysis with the option of a special Entrepreneurial Track. Expanding from this core, students develop technical facility in a variety of statistical methodologies. This breadth of competence is designed to equip graduates to go beyond the appropriate choice of method for implementation and to be able to adapt these techniques and to construct new methods to meet the specific objectives and constraints of new situations.

Statistics

Combined B.S.—M.S. Program

Year 1

Fall
MATH 121
ECMP 251
ENGL 150
GER: Science
GER: Social Sciences
Physical Education Requirement
Total: 16 hours

Spring
MATH 122
GER: Arts and Humanities
GER: Science
GER: Social Sciences
Free Elective
Physical Education Requirement
Total: 16 hours

Year 2

Fall
MATH 223
STAT 243
STAT GER: Arts and Humanities
GER: Social Science
Science Requirement
Total: 15 hours

Spring
MATH 224
MATH 201
STAT 244
GER: Arts and Humanities
Science Requirement
Total: 15 hours

Year 3

Fall
STAT 345/445
EPBI 420
Substantive Field Requirement
GER: Arts and Humanities
Free Elective
Total: 15 hours

Spring
STAT 346
STAT Elective
Substantive Field Requirement
GER: Global and Cultural Diversity
Free Elective
Total: 15 hours

Year 4

Fall
STAT 425
STAT Elective
STAT 491 (1)
Free Elective
Free Elective
Free Elective
Total: 16 hours

Spring
STAT 426
STAT Elective
STAT 491 (1)
Free Elective
Free Elective
Free Elective
Total: 16 hours

Year 5

Fall
STAT 455
STAT Elective
STAT 491 (1)
Free Elective
Total: 10 hours

Spring
STAT Elective
STAT Elective
STAT 651
STAT 491 (1)
STAT 495 (3)
Total: 13 hours
Master of Science in Statistics

The M.S. degree in statistics requires a minimum of 27 hours of approved course work in statistics and related disciplines and an M.S. research project or a thesis. Each student’s program is developed in consultation with the Director of Graduate Studies or a senior faculty mentor and must satisfy the following requirements:

1. STAT 425 and 426;
2. STAT 445 and 446;
3. STAT 455
4. STAT 495 (3 credits);
5. M.S. research project (STAT 621) or M.S. Thesis (STAT 651);
6. A minimum of 6 hours of approved graduate level statistics electives.
7. STAT 491 (0 credits)

The goals of this program are to give each student a balanced view of statistical theory and the application of statistics in practice or in substantive research and at the same time to have the student develop a broad competence in statistical methodology. The required core course work reflects this balance. The first two requirements are for full-year sequences in data analysis and theory; and the third develops the theory underlying linear modeling. The requirement for applications of statistics will be satisfied through intensive participation in the Consulting Forum; selecting an M.S. research project provides additional exposure. Graduate students are also required to participate in a forum or seminar to gain experience in written and oral presentation. The remainder of each student’s program is individualized to address the more specialized statistical demands of the selected field of concentration or the focus of multi disciplinary work. Each student may choose either the applied research project or the thesis option depending on individual interests. In either case the student can expect to work with a faculty mentor in undertaking a significant task which will culminate in polished written and oral presentations; in many cases the work will be suitable for presentation at professional society meetings or publishable in a substantive literature. A student coming to school from a position as professional statistician might choose a statistical problem arising in the workplace as the basis for an M.S. research project. A student intending to continue graduate work toward a Ph.D. might choose an M.S. research project to explore the intimate relationship of statistics to substantive fields. Alternatively, either student might choose the thesis option to tailor methodology to a new setting or to make a first essay at mathematical statistical research.

Master of Science in Statistics
Entrepreneurial Track

The Master of Science in Statistics-Entrepreneurial Track (MSS-ET) is a professional degree designed to provide training in statistics focused on developing data analysis and decision-making skills in industrial/government/consulting environments where uncertainties and related risks are present. It expand our basic Master of Statistics program by creating a professional-type track which provides some business training. The Entrepreneurial Track provides instruction and real business-world experience to students who have a background in statistics and a vision for new and growing ventures.

The minimum number of hours required for the MSS-ET program is 27. A typical curriculum to be followed is listed below but variance could be granted at departmental discretion.

Year 1
Data Analysis I
Theoretical Statistics I
New Venture Creation

Year 2
Statistical Computing
Elective
or Actuarial Science I
or Actuarial Science II
Linear Models
MS Project
or Experimental Design
Consulting Forum/Internship
Consulting Forum w/Practicum/Internship

The required New Venture Creation and Technology Entrepreneurship courses will be offered by the Weatherhead School of Management. Students on internships will sign up for the Consulting Forum sequence. In addition, students are required to participate in an intensive 1 week annual workshop on the industrial use of statistics from the management perspective. The up to 30 hour (no credit) workshop will take place during the Fall or Spring undergraduate breaks.

Doctor of Philosophy in Statistics

The focus of the doctoral program is on research and the plan of study emphasizes the theory of statistics so that graduates from this program will be able both to extend the theoretical basis for

Statistics
M.S. Program

Year 1
Fall
STAT 425
STAT 445
STAT Elective
STAT 491 (0)
Total: 9 hours

Spring
STAT 426
STAT 446
STAT Elective
STAT 491 (0)
Total: 9 hours

Year 2
Fall
STAT 455
STAT 495
STAT Elective
Total: 9 hours

Spring
STAT Elective (Optional)
STAT Elective (Optional)
STAT 621 or STAT 651
Total: 9 -10 hours
statistics and to bring statistical thought to scientific research in other fields. The objective of preparing students to collaborate in interdisciplinary work demands breadth as well, so advanced knowledge of a substantive field and participation in the collaborative experience are also integral to the program.

Students planning to enter the doctoral program in statistics should obtain information from the departmental office. Plans of study are prepared individually by the graduate student and a faculty advisor to develop the talents and interests of each student.

Statistics (STAT)
Undergraduate Courses

STAT 201. Basic Statistics for Social and Life Sciences (3)
Designed for undergraduates in the social sciences and life sciences who need to use statistical techniques in their fields. Descriptive statistics, probability models, sampled distributions. Point and confidence interval estimation, hypothesis testing. Elementary regression and analysis of variance. Not for credit toward major or minor in Statistics.

STAT 207. Statistics for Business and Management Science I (3)
Organizing and summarizing data. Mean, variance, moments. Elementary probability, conditional probability. Commonly encountered distributions including binomial, Poisson, uniform, exponential, normal distributions. Central limit theorem. Sample quantities, empirical distributions. Reference distributions (chi-square, t, F-distributions). Point and interval estimation; hypothesis tests. Prereq: MATH 122 or MATH 120 or equivalent.

STAT 208. Statistics for Business and Management Science II (3)

STAT 243. Statistical Theory with Application I (3)

STAT 244. Statistical Theory with Application II (3)

STAT 312. Basic Statistics for Engineering and Science (3)
For advanced undergraduate students in engineering, physical sciences, life sciences. Comprehensive introduction to probability models and statistical methods of analyzing data with the object of formulating statistical models and choosing appropriate methods for inference from experimental and observational data and for testing the model’s validity. Balanced approach with equal emphasis on probability, fundamental concepts of statistics, point and interval estimation, hypothesis testing, analysis of variance, design of experiments, and regression modeling. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122 or equivalent.

STAT 313. Statistics for Experimenters (3)
For advanced undergraduates in engineering, physical sciences, life sciences. Comprehensive introduction to modeling data and statistical methods of analyzing data. General objective is to train students in formulating statistical models, in choosing appropriate methods for inference from experimental and observational data and to test the validity of these models. Focus on practicalities of inference from experimental data. Inference for curve and surface fitting to real data sets. Designs for experiments and simulations. Student generation of experimental data and application of statistical methods for analysis. Critique of model; use of regression diagnostics to analyze errors. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122 or equivalent.

STAT 317. Actuarial Science I (3)
Practical knowledge of the theory of interest in both finite and continuous time. That knowledge should include how these concepts are used in the various annuity functions, and apply the concepts of present and accumulated value for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, duration, asset/liability management, investment income. capital budgeting, and contingencies. Valuation of discrete and continuous streams of payments, including the case in which the payment period differs from the payment period will be considered. Application of interest theory to amortization of lump sums, fixed income securities, depreciation, mortgages, etc., as well as annuity functions in a broad finance context will be covered. Topics covered include areas examined in the American Society of Actuaries Exam 2. Prereq: MATH 120 or MATH 126 or equivalent.

STAT 318. Actuarial Science II (3)
Theory of life contingencies. Life table analysis for simple and multiple decrement functions. Life and special annuities. Life insurance and reinsurance for life insurance. Statistical issues for prediction from actuarial models. Topics covered include areas examined in the American Society of Actuaries Exam 3. Prereq: STAT 317 and one of the following: STAT 207, 312, 345, or equivalent.

STAT 325. Data Analysis and Linear Models (3)
Basic exploratory data analysis for univariate response with single or multiple covariates. Graphical methods and data summarization, model-fitting using S-plus computing language. Linear and multiple regression. Emphasis on model selection criteria, on diagnostics to assess goodness of fit and interpretation. Techniques include transformation, smoothing, median polish, robust/resistant methods. Case studies and analysis of individual data sets. Notes of caution and some methods for handling bad data. Knowledge of regression is helpful. Prereq: Permission of department.

STAT 326. Multivariate Analysis and Data Mining (3)
Extensions of exploratory data analysis and modeling to multivariate response observations and to non-Gaussian data. Singular value decomposition and projection, principal components, factor analysis and latent structure analysis, discriminant analysis and clustering techniques, cross-validation, E-M algorithm, CART. Introduction to generalized linear modeling. Case studies of complex data sets with multiple objectives for analysis. Prereq: STAT 325.

STAT 332. Statistics for Signal Processing (3)

STAT 333. Uncertainty in Engineering and Science (3)
Phenomena of uncertainty appear in engineering and science for various reasons and can be modeled in different ways. The course integrates the mainstream ideas in statistical data analysis with models of uncertain phenomena stemming from three distinct viewpoints: algorithmic/computational complexity; classical probability theory; and chaotic behavior of nonlinear systems. Descriptive statistics, estimation procedures and hypothesis testing (including design of experiments). Random number generators and their testing. Monte Carlo Methods. Mathematica notebooks and simulations will be used. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122.

STAT 345. Theoretical Statistics I (3)
Topics provide the background for statistical inference. Random variables; distribution and density functions; transformations, expectation.
Common univariate distributions. Multiple random variables; joint, marginal and conditional distributions; hierarchical models, covariance. Distributions of sample quantities, distributions of sums of random variables, distributions of order statistics. Methods of statistical inference. Prereq: MATH 122 or MATH 223.

STAT 346. Theoretical Statistics II (3)

STAT 391. Statistics Student Seminar (1-3)
Seminar run collaboratively by students to investigate an area of current research, the topic chosen each semester. All students participate in presentation of material each semester. Recommended for all students majoring in statistics in their senior year. Emphasis on written and oral presentation of statistical summaries, reports and projects. Prereq: Statistics major or minor and nine credits of approved Statistics courses numbered 240 or above.

STAT 395. Senior Project in Statistics (3)
An individual project done under faculty supervision involving the investigation and statistical analysis of a real problem encountered in university research or an industrial setting. Written report. Prereq: Permission of department.

Graduate Courses

STAT 401. Statistics for Social and Life Sciences (3)
Principles and practice of data presentation and basic models including analysis of variance and multiple linear regression. Content includes analysis of discrete data in contingency tables, sensitivity and specificity, odds ratios, tests of goodness of fit, display and summarization of data, hypothesis testing, and interval estimation. Taught in case-based format with individual and/or collaborative student projects. Primarily for graduate students in nursing and health sciences. Not for credit toward undergraduate major or minor in Statistics or for credit toward any graduate degree in Statistics. Prereq: STAT 201.

STAT 412. Statistics for Design and Analysis in Engineering and Science (3)
For graduate students (primarily) and advanced undergraduates in engineering, physical sciences, and life sciences. After basic statistical concepts are reviewed, the remainder of the course consists of a comprehensive introduction to statistical methods of designing experiments and analyzing data. The general objective is to train students in statistical modeling and in the choice of experimental designs to use in scientific investigations. A variety of experimental designs are covered, and regression analysis is presented as the primary technique for analyzing data from designed experiments, and in discriminating between various possible statistical models. The course is oriented toward graduate students engaged in or embarking on research. Prereq: MATH 122 (an introductory statistics course is recommended).

STAT 413. Reliability and Calibration (3)

STAT 414. Industrial Statistics (3)
Introduction to statistical methods and techniques that are being used in industry, and especially in various company-wide quality improvement programs such as Six Sigma. The course covers control charts and process capability with considerable breadth and depth. The classical and alternative approaches that have been used in designing industrial experiments are also covered extensively. Linear regression, analysis of means (ANOM), and evolutionary operation (EVOP) are other techniques that are covered. Prereq: STAT 312 or equivalent.

STAT 417. Actuarial Science I (3)
(See STAT 317.)

STAT 418. Actuarial Science II (3)
(See STAT 318.)

STAT 425. Data Analysis and Linear Models (3)
Basic exploratory data analysis for univariate response with single or multiple covariates. Graphical methods and data summarization model-fitting using S-plus computing language. Linear and multiple regression. Emphasis on model selection criteria, on diagnostics to assess goodness of fit and interpretation. Techniques include transformation, smoothing, median polish, robust/resistant methods. Case studies and analysis of individual data sets. Notes of caution and some methods for handling bad/biased data. Knowledge of regression is helpful. Prereq: Permission of department.

STAT 426. Multivariate Analysis and Data Mining (3)
(See STAT 326.)

STAT 427. Statistical Computing (3)
Basic topics in statistical computing: floating point arithmetic; seminumerical computation including generation and test of random numbers, Monte Carlo methods, variance reduction methods, stochastic models and simulation studies; numerical computation including numerical linear algebra, optimization and root-finding, numerical integration; some graphical and symbolic computations, special topics in statistical computing: resampling methods, EM algorithms, Gibbs sampling and projection pursuit. Prereq: STAT 345 or STAT 425 or permission of department.

STAT 432. Statistics for Signal Preocessing (3)

STAT 433. Uncertainty in Engineering and Science (3)
Phenomena of uncertainty appear in engineering and science for various reasons and can be modeled in different ways. The course integrates the mainstream ideas in statistical data analysis with models of uncertain phenomena stemming from three distinct viewpoints: algorithmic/computational complexity; classical probability theory; and chaotic behavior of nonlinear systems. Descriptive statistics, estimation procedures and hypothesis testing (including design of experiments). Mathematica notebooks and simulations will be used. Random number generators and their testing. Monte Carlo methods. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Graduate students are required to do an extra project. Prereq: MATH 223 or MATH 122.

STAT 437. Stochastic Modeling of Scientific Data (3)
Introduction to stochastic modeling of data. Emphasis on models and statistical analysis of data with a significant temporal and/or spatial structure. Markovian and semi-Markovian models, point processes, point cluster models, queuing models, likelihood methods, estimating equations. Note: Restricted to declared graduate and undergraduate majors and minors in Statistics and Biostatistics only. Prereq: STAT 333 or STAT 433 (preferred) or STAT 325, STAT 425, or STAT 445, or permission of department.

STAT 445. Theoretical Statistics I (3)
Topics provide the background for statistical inference. Random variables; distribution and density functions; transformations, expectation. Common univariate distributions. Multiple random variables: joint, marginal and conditional distributions; hierarchical models, covariance. Distributions of sample quantities: distributions of sums of random variables, distributions of order statistics. Methods of statistical inference. Graduate students are responsible for mathematical derivations, and full proofs of
STAT 446. Theoretical Statistics II (3)

STAT 448. Bayesian Theory with Applications (3)
Principles of Bayesian theory, methodology and applications. Methods for forming prior distributions using conjugate families, reference priors and empirically-based priors. Derivation of posterior and predictive distributions and their moments. Properties when common distributions such as binomial, normal or other exponential family distributions are used. Hierarchical models. Computational techniques including Markov chain Monte Carlo and importance sampling. Extensive use of applications to illustrate concepts and methodology. Prereq: STAT 445.

STAT 453. Time Series and Wavelets I (3)

STAT 455. Linear Models (3)

STAT 466. Theory and Methods of Experimental Design (3)

STAT 468. Sampling from Finite Populations: Theory and Applications (3)
Introduction to the theory and methodology of sampling from finite populations. Simple random, stratified random, systematic and multistage cluster sampling. Linear, ratio and regression estimators. Methodology for handling missing data, inference for small geographical areas or for small subpopulations, inference for quantiles. Application to large-scale personal interview and telephone surveys. Prereq: STAT 345 or STAT 445. Cross-listed as EPBI 447.

STAT 471. Special Topics in Statistics (1-3)
Topics in specialized areas of statistical theory and methodology, with emphasis on recent advances in theory and development of new methodology. Topics may change from year to year. Number of credit hours for the class will be predetermined each semester based on the material to be presented. Prereq: Permission of department.

STAT 476. Advances in Statistics and Modeling (1-3)
Topics in specialized areas of statistics and stochastic modeling, with emphasis on recent advances in theory and formulation of models. Investigation of new areas of application for statistical or stochastic models. Topics may change from year to year. Number of credit hours for the class will be predetermined each semester based on the material to be presented. Prereq: Permission of department.

STAT 491. Graduate Student Seminar (1-2)
Seminar run collaboratively by graduate students to investigate an area of current research, the topic chosen each semester. All graduate students participate in presentation of material each semester. Satisfies requirement for every full-time graduate student to enroll in a participatory seminar every semester while registered in any graduate degree program. Prereq: Graduate standing.

STAT 495A. Consulting Forum (1-3)
This course unifies what students have learned in their course work to apply their knowledge in consulting. It recognizes the fact that the essence of the statistical profession is continuing interaction with practitioners in the sciences, engineering, medicine, economics, etc. The course presents the views of prominent experts in the field as obtained from the literature and other sources. The responsibilities of the consultant and the client are discussed. Sample consulting problems are presented, and strategies for solving them are provided. Prereq: STAT 325 or STAT 425.

STAT 495B. Consulting Forum with Practicum (1-3)
This course is designed to provide a hands-on experience with statistical consulting under the guidance of the instructor. It will include discussion of practical aspects of consulting such as the entrepreneurial nature of this activity. The students will become involved in actual consulting projects generated in a collaborative environment. Statistical problems, together with their substantive background, will be presented by individuals from the private sector (e.g., from industry) and/ or University faculty and students. Selected problems will be addressed in a collaborative fashion: i.e., by a team involving graduate students from the Statistics Department, the course instructor, and scientists. Some of these problems may lead to collaborative research or entrepreneurial ventures. Prereq: STAT 325 or STAT 425; STAT 495A or consent of department.

STAT 525. Advanced Data Analysis (3)
Topics drawn from resampling methods (including bootstrapping), MCMC (Gibbs sampling), nonparametric curve and surface fitting, kernel density estimation, projection pursuit, mixture models, time series (time permitting), approaches to model uncertainty, models for repeated measures and structural-functional models, statistical inference for large systems, modern data analysis techniques. Prereq: STAT 426 or permission of department.

STAT 527. Advanced Statistical Computing (3)
Special topics drawn from statistical computing, complex system and dynamic computation. Oriented to research. Prereq: STAT 427.

STAT 537. Advanced Stochastic Modeling of Scientific Data I (3)
Spatial statistics. Theory and techniques for spatial or spatial-temporal relationships in high dimensional data, point pattern analysis, estimation of spatial covariance either stationary or non-stationary in space, applications to environmental sciences. Characterizations and solutions for mapping problems, for image reconstruction, for analysis of fractal spatial-temporal processes with particular application to environmental sciences. Prereq: STAT 446 and STAT 457, or permission of department.

STAT 538. Advanced Stochastic Modeling of Scientific Data II (3)

STAT 545. Advanced Theory of Statistics I (3)

STAT 546. Advanced Theory of Statistics II (3)
STAT 547. Advanced Theory of Statistics III (3)
Development of empirical process theory with application to censored data with random, fixed or arbitrary censoring mechanism. Characterization of quantile processes, spacings and large deviations as empirical processes. Asymptotic results for nonparametric regression, bootstrap and other resampling estimators. Prereq: STAT 546.

STAT 553. Time Series and Wavelets II (3)
Advanced topics in time series including nonstationary series, nonlinear models. In-depth development and application of wavelet theory. Wavelets as computational tool. Extensive use of computing to illustrate and investigate modeling with wavelets. Prereq: STAT 453 and STAT 446 and MATH 491, or permission of department.

STAT 555. Generalized Linear Models (3)

STAT 571. Advanced Topics in Statistics (1-3)
For advanced graduate students. Topics in specialized areas of statistical theory and methodology, with emphasis on recent advances in theory, developments of new methodology and definition of new research questions. Topics may change from year to year. Number of credit hours for the class will be predetermined each semester based on the material to be presented. Prereq: Permission of department.

STAT 576. Advanced Topics in Modeling (1-3)
Advanced topics in specialized areas of statistics and stochastic modeling designed to define new research directions drawing on recent advances in theory and model formulation. Focus on statistical issues arising in the application of statistical or stochastic models to new substantive research efforts. Topics may change from year to year. Number of credit hours for the class will be predetermined each semester based on the material to be presented. Prereq: Permission of department.

STAT 591. Statistical Research Seminar (1-3)
Seminar to prepare and explore current research topics presented by faculty and invited statistics colloquium speakers. Graduate students lecture on background material for colloquia using recent publications. Following each colloquium, students lead discussion and clarify further the contributions of the research. Newer students are paired with senior students; colloquium assignments coincide with students’ research interests insofar as possible. Attendance at statistics colloquia is required. Satisfies requirement for every full-time graduate student to enroll in a participatory seminar every semester while registered in any graduate degree program. Number of credit hours will be determined by prior agreement with the instructor and depends on the extent of the student’s responsibility. Prereq: Permission of department.

STAT 601. Reading and Research (1-9)
Individual study and/or project work. Prereq: Permission of department.

STAT 621. M.S. Research Project (1-9)
Completion of statistical design and/or analysis of a research project in a substantive field which requires substantial and/or nonstandard statistical techniques and which leads to results suitable for publication. Written project report must present the context of the research, justify the statistical methodology used, draw appropriate inferences and interpret these inferences in both statistical and substantive scientific terms. Oral presentation of research project may be given in either graduate student seminar or consulting forum. Prereq: Permission of department.

STAT 651. Thesis M.S. (1-18)
(Credit as arranged.) May be used as alternative to STAT 621 (M.S. Research Project) in fulfillment of requirements for M.S. degree in Statistics. Prereq: Permission of department.

STAT 701. Dissertation Ph.D. (1-18)
(Credit as arranged.) Prereq: Permission of department.

STAT 702. Appointed Dissertation Fellow (9)
Career Opportunities

Acting
Actor education in the Department of Theater Arts prepares majors for acting career opportunities in the American theater and in theater education. Graduates are currently employed nationally and regionally. The Graduate Acting Program collaboration between the University and The Cleveland Play House provides a unique alliance between one of the oldest theater programs in the United States and the nation’s first regional theater.

Stage Design and Technical Theater
Employment opportunities for stage designers and technicians continue to be ample; demand for the services of the talented, well-trained designer and technician is constant. One aspect of the job market is in college or university theater, where qualifications include the required M.F.A. degree or, in rare instances, equivalent professional experience. Careers also may be pursued in regional theater, as well as in areas of film, television, and industrial scenic design.

Dance Training Program
Graduates of the dance program are currently employed as modern dance company members (regionally and nationally), company directors/choreographers, dance production managers, and dance educators in state and private universities. Others have pursued specialized advanced training and work as dance therapists.

Undergraduate Programs
An undergraduate major in the department can lead to the Bachelor of Arts degree. The Bachelor of Arts program is a diverse course of study in all the basic crafts of the theater: acting, dance, design, costuming, playwriting, and theater history. The undergraduate program is designed to integrate the various elements of theater to prepare students to pursue their chosen field of specialization after graduation. This degree requires 42 to 60 semester hours in theater and is available with areas of concentration in acting, dance, general theater, dramatic writing and design/technical theater.

Bachelor of Arts
The Bachelor of Arts program in theater offers concentrations in general theater, acting, contemporary dance, or design/technical theater, and dramatic writing.

Websites:
Drama: http://www.cwru.edu/artsci/thtr/
Dance: http://Dance.cwru.edu

The following are the basic courses REQUIRED for all Theater majors.

(see listing for the course descriptions)

GENERAL THEATER: (27 hrs.)
THTR 101, 102, 103, 123, 124, 121, 122, 201. (18 hrs.)
At least 4 but not more than 8 hours of THTR 385/386 and 6 hours of English above the 300 level. The department strongly recommends Eng. 324 and 325.
Courses required by CONCENTRATION:

GENERAL THEATER: (27 hrs.)
THTR 223, 224, 228, 229, 329 or 323, 329, 331, 375, 312 or 327 Total hours, not including THTR 385/386 - 45

Total hours, not including THTR 385/386 - 45

DRAMA/TECH: (30 hrs.)
THTR 105, 223, 224, 228, 229, 331, 352, 380, 327 or 329, 424 or 440 Total hours, not including THTR 385/386 - 48

DRAMATIC WRITING: (30 hrs.)
THTR 223, 228, 229, 312, 314, 316, 327, 329, 331, 399 Total hours, not including THTR 385/386 - 48

All majors are encouraged to apply for Honors Studies, THTR 397 and 398 in their final year. This adds 6 hours to the total.

MINOR (for the B.A.)
Concentration for the Minor

Hours: 18
1. General Theater: THTR 101, 103, 123, 124, 223 or 224 or 352, and 228 or 229 or 327.
3. Design/Tech: THTR 105, 123, 124, two of the following: 223, 224, or 352, and one of the following: 228, 229, or 327.
4. Dramatic Writing: THTR: 101, 123, 124, 312, 316, 331

HUMANITIES SEQUENCE (for the B.S.-based Engineering Core)

Hours: 9
Note: All sequences must include THTR 123 or 124 and two additional courses selected in consultation with advisor.
Sample programs:
1. Acting THTR 123 or 124, 101, 102.
2. Stagecraft: THTR 123 or 124, 105, and 223 or 224.
3. Costume Crafts and History: THTR 123 or 124, 352, and one of the following: 228 229 or 327.

DANCE
The following are the basic courses REQUIRED for all Theater/Dance majors.
(see listing for course descriptions)

THTR 101, 160, 103, 104, 121, 122. (18 hrs.)
At least 4 but not more than 8 hours of THTR 385/386 and 6 hours of English above the 300 level. The department strongly recommends Eng. 324 and 325.
Courses REQUIRED for Dance Concentration: (31-35 hrs.)
THTR 189, 190, 205 and 204 or 260 and 261, 416, 423, 303, 304, 451, and one of the following: 413, 414, 415 and 455.

Total hours, not including THTR 385/386 - 49 - 51
All majors are encouraged to apply for Honors Studies, THTR 397 and 398 in their final year. This adds 6 hours to the total.

SUBSTITUTIONS MADE AT THE DISCRETION OF THE ACADEMIC REPRESENTATIVE

MINOR (for the B.A.)
Concentration for the Minor

Hours: 18
THTR 103, 104 (or 160, 161), 203, 204 (260 or 261), 303, 304.

SUBSTITUTIONS MADE AT THE DISCRETION OF THE ACADEMIC REPRESENTATIVE

HUMANITIES SEQUENCE (for the B.S.-based Engineering Core)

Hours 9
Sample Program in Dance:
THTR: 121, 122, and one of the following 103, 104, 160, 161
Departmental Honors

Majors wishing to graduate with Honors in Theater Arts must make WRITTEN application to the Head of Undergraduate Theater Studies no later than the final day of classes, second semester of their junior year. Students must have a minimum 3.25 overall gpa and a minimum 3.75 gpa in Theater Arts. Acceptance into the Honors program is contingent upon faculty support and recommendation by the head of Undergraduate Theater Studies and the department Chairperson. Those accepted register for THTR 397 and 398 (Honors studies) during their senior year, a total of 6 hours. The Honors project is defined as a production project in acting, dance, design, playwriting, directing, management, or educational outreach. A supporting paper discussing the concept, execution, and performance of the project must be filed with the Head of Undergraduate Theater Studies no later than one week following the project presentation. Preparation of the project will be supervised by a theater faculty member. This project may be accepted for Honors ONLY if it receives a grade of A from both the project advisor and the Head of Undergraduate Theater Studies. The grade of A must be received in both semesters. Students who meet the criteria receive the notation “Departmental Honors in Theater Arts” on their diplomas. Information about the structure and specific requirements of the honors project is available from the head of Undergraduate Theater Studies.

Graduate Program

Master of Arts

Although the Department of Theater Arts Graduate Programs are geared toward the Master of Fine Arts degrees, the appropriate candidate may select or be encouraged to direct their graduate studies in pursuit of the Master of Arts degree, a 30 hour degree program. The focus of the studies may include similar course work to the Master of Fine Arts while also facilitating particular studies that may be enhanced or assisted by related studies both within the Department of Theater Arts as well as with other complementary studies in other departments. The candidate’s program of study will be uniquely designed by the primary faculty of the designated program (i.e. Acting, Dance or Design) within the Department of Theater Arts. As required by the School of Graduate Studies, a minimum grade point average of 2.75 must be maintained.

M.A. candidates must complete a minimum of 30 hours following a recommended program similar to the courses suggested below. Modifications may be suggested by the principle faculty advisor.

1. Eighteen semester hours of acting including script analysis, implementation of acting theory, characterization, and Shakespeare.

2. Seven to twelve semester hours of movement chosen from period movement, stage combat, and commedia.

3. Ten to twelve semester hours of voice chosen from voice production, articulation, and interpretation, dialects, verse and lyric drama, and Shakespeare.

4. Twelve semester hours of performance theory and professional seminars.

5. Up to six semester hours, under advisement, in allied fields.


Contemporary Dance

1. Eighteen semester hours of dance technique.

2. Twelve semester hours of choreography.

3. Four semester hours (two each) of light and costume design.

4. Two semester hours of eurythmics, MUSC 501.

5. Three semester hours of contemporary dance history.

6. Two semester hours of music resources.

7. 12-15 semester hours under advisement from among kinesiology, pedagogy, and/or allied fields.

8. Six semester hours of creative thesis.

Required Total: 60 hours
Special Programs

The Marc A. Klein Playwriting Award
The Department of Theater Arts serves as the production agency for the Marc A. Klein Playwriting Competition, an annual national award designed to encourage and stimulate artistic growth among student playwrights, which features a cash prize of $1,000 and a full mainstage production. The Klein award has been responsible for the pre-professional production of a number of scripts that have moved on to Broadway, Off-Broadway, and regional theaters.

National Theater Institute
The Department of Theater Arts has an affiliation with the National Theater Institute, located in Waterford, Connecticut, for both their Moscow semester and the semester at NTI. This prestigious program gives our students the opportunity to be exposed to the best in concentrated theater training, as well as providing a different and unique cultural perspective. Full credit is available with no loss of scholarship aid. This is available for either semester. See the Director of Undergraduate Theater Studies for more information.

Junior Year Abroad
Many of our Drama students go abroad for either one semester at the BADA Program (British American Drama Academy) or a full year in many other programs. The BADA program is a conservatory based intensive in all aspects of actor training, with full credit transfer and no loss of financial aid. In Dance, there are opportunities for semesters abroad with the London Contemporary School of Dance and Yildiz University in Istanbul, Turkey. For more information on this and other programs, contact the Head of Undergraduate Theater Studies or the Academic Representative for Dance.

Theater Arts (THTR)

Undergraduate Courses

THTR 100. Introduction to Performance (3)
A course designed to provide the non-major or undeclared liberal arts major limited experience with a basic understanding of performance and the theater. Fundamentals in improvisation, vocabulary, and scene study are stressed. This course fulfills THTR 101 should the undeclared student select theater as his or her major or minor.

THTR 101. Acting I: Fundamentals (3)
This course is designed to expose the theater major or minor to the development of the actor’s basic tools. Relaxation, concentration, and improvisation are taught along with basic scene study work.

THTR 102. Acting II: Exploration of Craft (3)
This course continues the work begun in THTR 101 with emphasis on action, emotional life, and text analysis as the essential elements of the actor’s work. Prereq: THTR 101 and consent of department.

THTR 103. First-Year Modern Dance Techniques I (3)
Comprehensive perspective of theory established, through active participation, to serve individual development of normative movement principles in a broad spectrum of applications including theater movement, dance, and sports. Content is directly and fundamentally serviceable to subsequent specialized training applications of the actor, dancer, musician, athlete, physiotherapist, and educator.

THTR 104. First-Year Modern Dance Techniques II (3)
Continuation of THTR 103.

THTR 105. Introduction to Stagecraft (3)
An introduction to scenic construction and painting, hands-on oriented to workshop skills.

THTR 106. Dance in Culture - Ethnic Forms (3)
A lecture class designed to introduce dance as an art form and the many roles it plays in a variety of cultures. Focus will be on ethnic forms and primal cultures.

THTR 112. Dance in Culture (3)
Introduction to an historical and cultural overview of many different forms of dance from various cultures specifically selected to encompass geographic diversity and represent different periods in history. Basic craft elements of the structures of dance will be introduced to provide a foundation for viewing dance and developing a personal aesthetic.

THTR 123. Theater in Culture: From Shaman to Steam Engine (3)
An introductory exploration of theater forms and practice from their origins in ritual to the scripts and staging of 19th century Europe. In addition to material presented in lecture/discussion format, the class will attend local University and professional theater productions.

THTR 124. Theater in Culture: From Steam Engine to Cyberspace (3)
Using selected dramatic texts from the 19th century to present day, the course explores the roles of production participants and audiences in their historical, cultural, and contemporary contexts. Material is presented in lecture/discussion format, augmented by live theater performances and audio-visual resources.

THTR 160. Introduction to Ballet Technique I (3)
This introductory-level course offers the beginning ballet student the basic tenets and principles of ballet technique. Classwork will involve strong emphasis on proper alignment of the body, dynamic timings, and a command of ballet terminology.

THTR 161. Introduction to Ballet Technique II (3)
Continuation of THTR 160. Prereq: THTR 160 or consent of department.

THTR 189. Improvisation I (1)
Movement and dance structures designed to engage responsibility in group dynamics applied to challenge specific technical components which include time, effort, shape and kinetic awareness. Prereq: THTR 103.

THTR 190. Improvisation II (1)
Continuation of THTR 189. Prereq: THTR 189.

THTR 201. Movement for the Actor (3)
The course focuses on developing a kinesthetic awareness of the body and its use as a theatrically expressive instrument. Exercises will encompass development of flexibility, strength building, alignment, motor skills, and concentration. Prereq: THTR 101 or THTR 102 or consent of department.

THTR 203. Second-Year Modern Dance Techniques I (3)
For the performing arts student, normative movement principles are formally extended in both theory and application to include individual correction, modification of adaptation as foundational preparation for the subsequent specialized training needs of the actor, dancer, and singer. Prereq: THTR 103 and THTR 104.

THTR 204. Second-Year Modern Dance Techniques II (3)
Continuation of THTR 203. Prereq: THTR 103 and THTR 104.

THTR 223. Introduction to Scenic Design (3)
An introduction to visual design for the stage through established theories and knowledge of the theater as a physical space. Approaches practical problems of scenic design as well as professional potential of the field.

THTR 224. Introduction to Lighting Design (3)
A “ground up” guide to theatrical lighting for the stage. Focus made upon instrumentation, choices made in the design process, aesthetics of presentation. Combines theory with practical application.

THTR 228. Theater History I (3)
Acquaints the student with theatrical and dramatic realism in Europe, the United States, and Russia (1880s through 1960s).

THTR 229. Theater History II (3)
Modern periods in Western theater history, from the sixteenth century to the turn of the twentieth. The course investigates materials, texts, and artifacts of theaters from the Renaissance to the Modern era. Cross-listed as CMPL 229.
THTR 231. Acting III: Contemporary Technique (3)
An exploration of advanced contemporary acting technique based on the work of Michael Chekhov. Provides advanced acting students with the tools necessary to work effectively and consistently with contemporary texts, with emphasis placed on psychological gesture and geste. Prereq: THTR 101 and THTR 102 or consent of department.

THTR 232. Acting IV: Classical Technique (3)
An exploration of techniques to approach classical theater, emphasis on the works of Shakespeare. Presents the challenges of working with heightened language, classical texts, and provides skills necessary to transfer modern acting methods to these more poetic plays. Prereq: THTR 102 or consent of department.

THTR 260. Second Year Ballet Technique I (3)
In-depth exploration of principles and foundations of ballet technique as preparation for the specialized training needs of dancers.

THTR 261. Second Year Ballet Technique II (3)
Continuation of THTR 260.

THTR 303. Third-Year Modern Dance Techniques I (3)
For the dance major and advanced non-major. Durational formalities of dance technique as a contemporary American art form structure the aesthetic and technical challenges of development. Prereq: THTR 204.

THTR 304. Third-Year Modern Dance Techniques II (3)
Continuation of THTR 303.

THTR 306. Acting V: Camera Technique (3)
Acting for the Camera class with emphasis on how it differs from onstage work. Interviews, scenes, and exercises will be used to highlight the differences and similarities. Emphasis on contemporary works. Prereq: THTR 251 or THTR 232 or consent of department.

THTR 311. Audition Laboratory (1)
A discussion and practicum exploring the problems faced by an actor in various audition situations. Development of an audition repertory for the actor for stage, video and film. Prereq: Senior Theater major or consent of department.

THTR 312. Playwriting (3)
Theory and practice of dramatic writing, in the context of examples, classic and contemporary. Cross-listed as ENGL 305.

THTR 314. Advanced Playwriting (3)
Theory and practice of dramatic writing with special focus on the craft of writing a full-length play. Prereq: THTR 312 or consent of department.

THTR 316. Screenwriting (3)
A critical exploration of the craft of writing for film, in which reading and practical assignments will culminate in the student submitting an original full-length screenplay. Prereq: THTR 312.

THTR 327. American Theater and Playwrights (3)
Designed to provide students an overview of the development of theater in the United States and to familiarize them with the work and themes of selected American playwrights. Cross-listed as AMST 327.

THTR 329. Dramatic Literature (3)
Dramatic text analyzed in the context of theatrical production. Major analytical tools introduced.

THTR 331. Play Directing (3)
An examination of the fundamentals of directing a play, including history of the art, directoral text analysis, conceptual styles and approaches, and general problem solving. Course format is a combination of theoretical lecture and practical lab experiences, culminating in a directing project. Prereq: Upperclass status and permission of department.

THTR 334. Shakespeare: Histories and Tragedies (3)
(See ENGL 324.) Cross-listed as ENGL 324.

THTR 335. Shakespeare: Comedies and Romances (3)
(See ENGL 325.) Cross-listed as ENGL 325.

THTR 352. Costume Design and Construction (3)
Design and ornamentation of stage costumes and accessories. Laboratory. Prereq: THTR 123 and THTR 124 or consent of department.

THTR 375. Voice for the Stage I (3)
Development of the actor’s vocal instrument. Work in articulation, range, and flexibility. Prereq: Theatre major or consent of department.

THTR 376. Voice for the Stage II (3)
Continuation of THTR 375. Prereq: THTR 375.

THTR 380. Stage Management (3)
Designed to acquaint student with the numerous aspects of stage management.

THTR 385. Rehearsal and Production (1-3)
Practicum for students participating in production work in the Department of Theater Arts. Supervised laboratory experience in technical theater, construction techniques, scenery, costumes, lighting, and props; production; ticket office operations, promotion, publicity and public relations; house management; wardrobe responsibilities; stage management; assistant directing; and other production positions relating to the mainstage performances in Eldred Theater or Mather Dance Center. Students are recommended to take one credit hour per production, with a maximum of 8 credit hours allowed during their undergraduate career.

THTR 386. Rehearsal and Performance (1)
Practicum for students participating in performance in the Department of Theater Arts. relating to the mainstage productions at Eldred Theater or Mather Dance Center. This course may be repeated, for a maximum total of 2 credits.

THTR 397. Honors Studies I (3)
Individual projects in acting, design, dance, and directing. Prereq: Consent of department.

THTR 398. Honors Studies II (3)
Individual projects in acting, design, dance, and directing. Prereq: Consent of department.

THTR 399. Independent Study in Theater Arts (1-3)
Independent research and project work in areas of acting, design, voice, dance, theater history, playwriting, directing, theater pedagogy, or theater administration.

Graduate Courses

THTR 401. Advanced Stage Movement I (3)
This beginning class focuses on developing flexibility, alignment, strength, concentration and basic motor skills and serves as a base for the remaining three semesters. Yoga and Tai Chi exercises are used to develop flexibility and a relaxation of the breath. Elements of Decroux based corporeal mime technique will strengthen the student’s physical instrument as well as address alignment problems. Motor skills (articulations, inclinations and design work) will be developed with Decroux, as well as LeCoq based exercise. This work will be accompanied by Tai Chi and Aikido based chi energy work to develop the actor’s concentration. Prereq: Must be candidate in M.F.A. Acting program.

THTR 402. Advanced Stage Movement II (3)
Continuation of THTR 401. The course focuses on simplifying and empowering motor activity by continuing to connect breath to action to uncover relaxation within the given task, and beginning work in characterization. Strength, flow, energy and the shedding of intrusive mannerisms will be gained from a study of Tai Chi form, and LeCoq based neutral mask work. Following the neutral mask work, students will progress to character work through the use of Physical Acting techniques. Stage combat work continues. Prereq: THTR 401 or consent of department.

THTR 403. Advanced Stage Movement III (3)
The class focuses on expanding the actor’s physical and imaginative range which will enable students to support larger and bolder physical choices in characterization. Building upon the Neutral Mask work from the previous semester, the student will experience, through LeCoq based techniques, the Expressive Mask. Following this work, the students will experience the mask work of the commedia dell’arte and create and perform a commedia scenario. Stage combat work continues. Prereq: THTR 402 or consent of department.

THTR 404. Advanced Stage Movement IV (3)
This class gives the actor the advanced physical skills and techniques needed to encompass the demands of historical dramatic texts. The work will center around period movement for the theater. The actor will experience the philosophies of carriage and deportment; religious, scientific thought and art from particular historic periods most often encountered in the professional theater. Stage combat work continues. Prereq: THTR 403 or consent of department.
THTR 405. Improvisation I (1)
Movement and dance structures designed to engage responsivity in group dynamics applied to challenge specific technical components which include time and effort, shape, and kinetic awareness.

THTR 406. Improvisation II (1)
Continuation of THTR 405.

THTR 407. Fourth-Year Modern Dance Techniques I (1-3)
A logical progression of advanced technique. Performing skills assessed and developmentally stressed. Sections from repertory works learned. Prereq: THTR 403.

THTR 408. Fourth-Year Modern Dance Techniques II (1-3)
Continuation of THTR 407.

THTR 413. Choreography I (1-3)
Principles governing the dynamics of concrete and imagistic space applicable to stage values defined, differentiated, and tested through applied studies. Exercising the dual role of choreographer/performer, the sequencing is designed to enlarge active perception of space values, spatial dynamics, and relationships with spatial determinants. Introduced are the psychological principles involved in the development of one’s own creative process; involvement of these principles integrates the subsequent work in the choreography and production sequences.

THTR 414. Choreography II (3)
A perspective of choreographic craft elements through lecture and practical involvement with specified studies. Emphasized are the craft components of time structures. Prereq: THTR 413.

THTR 415. Choreography III (3)
Combining craft resources with emphasis on use of music. Music selections, historically categorized, are chosen for the purpose of analyzing metric and structural characteristics in accord with which choreography will be created. Prereq: THTR 414.

THTR 416. Choreography IV (3)
Use of properties, costumes, and scenic elements in both first and second function. (Northrop) applications challenge the functional and aesthetic appropriateness of conjoined choices. Dance structures fully developed under supervision. Prereq: THTR 415.

THTR 417. Fifth-Year Modern Dance Techniques I (1-3)
Performing skills enlarged to include rehearsal and performance of full repertory works. Adaptability, versatility, and fidelity to choreographic intention stressed. Prereq: THTR 408.

THTR 418. Fifth-Year Modern Dance Techniques II (1-3)
Continuation of THTR 417.

THTR 423. Light Design for Theatrical Dance (2)
Lecture-studio course in selecting fabrics, draping techniques, construction, and design for concert dance.

THTR 424. Stage Lighting (3)
Elements of stage lighting design and technology. Lighting, instruments, and operating procedures. Laboratory lighting experience with main stage productions. Laboratory requirement.

THTR 425. Sound Design I (3)
A study of classical, modern, and Renaissance theatrical forms, through primary and secondary source examination.

THTR 429. Theater History Seminar II (3)
Modern periods in Western theater history, from the eighteenth century to the turn of the twentieth. The course investigates materials, texts, and artifacts of theaters from the Renaissance to the Modern era.

THTR 430. Theater History Seminar III (3)
Theater historical research methods, literary critical approaches, and case studies.

THTR 431. Play Directing I (3)
Fundamentals of directing. Concept and development.

THTR 432. Scene Design I (3)
Special projects in mainstage design for theatrical settings.

THTR 433. Beginning Contemporary Dance I (1)
Through active participation, a comprehensive theoretical perspective on normative movement principles for the actor and singer. Prereq: Consent of department.

THTR 434. Beginning Contemporary Dance II (1)
Continuation of THTR 433. Prereq: THTR 443.

THTR 435. Principles and Philosophies of Normative Movement I (1-3)
Seminar and laboratory for assessment of kinesiological and biomechanical principles as related to dance. Assessment of current research will be implemented to affect cross-training protocols.

THTR 436. Principles and Philosophy of Normative Movement II (1-3)
Continuation of THTR 445. Prereq: THTR 445 or consent of department.

THTR 451. Costume Design and Construction for Dance (2)
Lecture and studio course in selecting fabrics, draping techniques, construction, and design for concert dance.

THTR 452. Costume and Construction (3)
Special projects in costuming for mainstage productions.

THTR 455. History of Modern Dance (3)
Origin and development of modern dance in its historical context.

THTR 456. Costume Design I (3)
Lecture-studio course. The study of costume design. Theory, technique, and principles of the fundamental approach to costume production. Prereq: THTR 352.

THTR 460. Ballet Technique for Modern Dance Students I (3)
Ballet Technique for Dancers will focus on developing the ballet skills required of the Modern Dance major. The technical level of the class will range from intermediate to advanced where applicable in barre work as well as center.

THTR 461. Ballet Technique for Modern Dance Students II (3)
Continuation of THTR 460. Prereq: THTR 460 or consent of department.

THTR 473. Graduate Voice Technique I (3)
Assessment of students’ current vocal and alignment skills. Laboratory for exploring new vocal and alignment habits supportive of healthy vocal functioning. Exploration of the body and voice as it relates to breath, articulation, resonance, and the healthy exhalation of sound. Prereq: Must be candidate in M.F.A. Acting program.

THTR 474. Graduate Voice Technique II (3)
Continued laboratory for the exploration of alignment and vocal skills supportive of healthy vocal functioning. Continued exploration of the body and voice as it relates to breath, articulation, resonance, and the healthy exhalation of sound. Emphasis on the physical and energetic skills needed to produce full-bodied, healthy sound capable of being heard and understood while acting in theatrical productions. Required of M.F.A. candidates in the Acting program. Prereq: THTR 473.

THTR 475. Voice for Stage: Shakespeare (3)
Development of skills needed to address the specific needs of Shakespeare in performance, including vocal skills, the use of breath, using imagery, and textual studies. Required of M.F.A. candidates in the Acting program.

THTR 479. American Stage Speech (2)
Designed to evaluate the graduate student actors’ current speech skills, to teach them a stage-appropriate dialect using the Skinner narrow IPA set, and to achieve a level of mastery over articulation and diction. Prereq: Course limited to first-year M.F.A. candidates in Acting Program.

THTR 485. Rehearsal, Performance and Production (1-3)
(See THTR 385.)

THTR 501. Text Analysis for the Actor (2)
An introduction to the craft of reading a theatrical text from an actor’s point of view. Methods for analyzing the action of a play will be applied to dramatic text so that the actor can learn to transform a one-dimensional text into a three-dimensional performance.

THTR 505. Music Resources for Contemporary Dance (3)
Resources in the various periods and styles of music for the dancer/choreographer. Study of the choreographic use of music.
THTR 509. Seminar: Introduction to Performance Theory (2)
Research seminar designed to acquaint the theater student with the major theoretical writings of performance theory. Readings on the creative process and archetypal mythology. Exploration of anthropological, psychological, and cultural sources of art and the theatrical impulse.

THTR 512. Graduate Audition Lab (1-2)
THTR 521. Advanced Problems/Design I (3)
For design graduates in Theater Arts.

THTR 522. Advanced Problems/Design II (3)
For design graduates in Theater Arts.

THTR 530. Ensemble Technique (1-2)
A practicum course structured to explore the use of ensemble dynamic techniques in a rehearsal/performance environment, as well as to develop a set of exercises which encourage and sustain the actor’s channels of interpersonal communication during a range of rehearsal and performance situations. Prereq: Must be candidate in M.F.A. Acting program.

THTR 531. Acting: Research and Performance I (3)
The various elements of the actor’s process considered on advanced levels. Integration of rehearsal discoveries into a practical performance situation. Limited to M.F.A. candidates.

THTR 532. Acting: Research and Performance II (3)
The various elements of the actor’s process considered on advanced levels. Integration of rehearsal discoveries into a practical performance situation. Limited to M.F.A. candidates.

THTR 533. Acting: Research and Performance III (3)
Sequential courses designed to explore the various elements of the actor’s process on advanced levels and to integrate the discoveries made into a practical performance situations. Limited to M.F.A. candidates. Prereq: THTR 531 or THTR 532.

THTR 534. Acting: Research and Performance IV (3)
Sequential courses designed to explore the various elements of the actor’s process on advanced levels and to integrate the discoveries made into a practical performance situation. Prereq: THTR 531 or THTR 532 or THTR 533.

THTR 535. Contemporary Dance Pedagogy (3)
The study and investigation of the approaches and methods of teaching contemporary dance. Detailed study is made of kinesthetic, oral, and creative factors in teaching of dance. Opportunity to assist and teach under supervision.

THTR 540. The Business of the Business (2)
This course covers the basic knowledge needed for an actor to plan and manage a career in the theater. Included is discussion of union rules and applications for AEA, AFTRA, and SAG. Discussion of basic marketing techniques, including development of an individual marketing plan for each student. Guest lecturers might include IRS experts on the actor’s process and archetypal mythology. Exploration of anthropological, psychological, and cultural sources of art and the theatrical impulse.

THTR 576. Advanced Voice Technique (3)
Vocal instruction individualized to the particular needs of advanced M.F.A. Acting students. This may include the exploration of dialect skills, developing the skills for extraordinary uses of the voice, the coaching of vocal performances, or continued exploration of skills necessary for classical and poetic texts. Required of M.F.A. candidates in the Acting program. Prereq: THTR 473 and THTR 474.

THTR 579. American Stage Speech II (3)
This course will continue the work begun in THTR 479 American Stage Speech, continuing the work on IPA, articulation, and general speech clarity for the stage. Exercises from the Berry and Rodenberg Schools of thought will be used in addition to the speech basics of Skinner. Prereq: THTR 479.

THTR 601. Special Projects (1-3)
(Credit as arranged.)

THTR 610. Professional Internship (1-4)
Involvement in intensive internships with professional theaters in the Cleveland area bridging academic and professional lives. Internships range from six weeks to one semester.

THTR 620. Advanced Role Analysis Preparation I (3)
Study and performance of scenes involving methods of approaching various types of plays and the specific problems they present to the individual actor. Analysis, action, characterization, and subtext. Open only to first-year M.F.A. Acting students enrolled in THTR 640. Coreq: THTR 640.

THTR 621. Advanced Role Analysis Preparation II (3)
Continued study and performance of scenes involving methods of approaching various types of plays and the specific problems they present. Prereq: THTR 620. Coreq: THTR 641.

THTR 630. Performance Studio (3)
A performance laboratory, ensemble-based practicum in which the student works to integrate effectively a wide range of performance skills culminating in a studio production. May be taken two times in the last two semesters of graduate study. Prereq: THTR 554.

THTR 640. M.F.A. Thesis Production I (3)
Preproduction conception in area of specialization researched and documented under appointed advisement, in accord with production syllabus, and subcommittee approval.

THTR 641. M.F.A. Thesis Production II (3)
Production implementation, post production evaluation/defense and advisory assessment.

THTR 642. Thesis Portfolio I (1)
Course designed specifically for candidates in the Master of Fine Arts program in Acting. Graduate students enroll for the course during their third year of study, although work spans three years of study, based on roles the M.F.A. actor has created. A portfolio is prepared, according to requirements set forth in the department’s M.F.A. Handbook, and is presented to the faculty during the spring semester of the third year, in a formal oral defense. Satisfactory completion of the portfolio and its oral defense are among the requirements for awarding the Master of Fine Arts degree. Course limited to M.F.A. candidates in the Acting program.

THTR 643. Thesis Portfolio II (1)
Course designed specifically for candidates in the Master of Fine Arts program in Acting. Graduate students enroll for the course during their third year of study, although work spans three years of study, based on roles the M.F.A. actor has created. A portfolio is prepared, according to requirements set forth in the department’s M.F.A. Handbook, and is presented to the faculty during the spring semester of the third year, in a formal oral defense. Satisfactory completion of the portfolio and its oral defense are among the requirements for awarding the Master of Fine Arts degree. Course limited to M.F.A. candidates in the Acting program.

THTR 644. M.A. Project (1-12)
Research and development of a Master of Arts project in Theater.

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**Washington Study Programs**

**Undergraduate Courses**

**WASH 001. Washington Semester (1-36)**
WASH 002A. Washington Center Internship (9)
Credit for internship experience taken as part of the Washington Center Program.

**WASH 002B. Washington Center - Politics and Public Policy Course (3)**
Credit for the Politics and Public Policy course taken as part of the Washington Center Program.
Undergraduate Program

The goal of the Women’s Studies Program is to educate students in interdisciplinary approaches to feminist theories of women, gender, culture, and society. Students are exposed to a variety of forms of critical thinking in relation to (1) the social construction of knowledge and philosophy; (2) approaches to science and medicine informed by “feminist empiricism” and “feminist standpoint” theories; (3) historicized and cross-cultural accounts of gender and gender inequality; (4) literary criticism; (5) contemporary theories of art, performance, language, jurisprudence, psychology and religion in the context of women’s experience; and (6) studies of the body as a focal point for theorizing relations among the arts and sciences.

Women’s studies encompasses an interdisciplinary program that prepares students to think critically and creatively within a framework employing gender as a central category of analysis. The program is set up to test and challenge the technologies and limitations of gender roles in a multitude of cultural and historical settings. It is designed to familiarize students with the analytical and hermeneutic tools of research and interpretation, and to create awareness of the ethical, political, and aesthetic dimensions of gender in history and culture. The program’s focus is the study of women cross-culturally and in history.

Major

The Women’s Studies Program offers a major leading to the Bachelor of Arts degree. It may be elected as a second major only. As a double major, the program offers a sound course of study, with a disciplinary concentration grounding the interdisciplinary program objective. To declare a women’s studies major, students must have already declared their first major. Up to six hours credits in required or elective courses for the first major may be applied to the women’s studies major, with the exception of two women’s studies core classes.

Required Courses (6 hours)

In the required two courses, students will become fluent in the tools of research and interpretation currently used in women’s studies. WMST 201 Introduction to Gender Studies (cross listed as HSTY 270/ENGL 270/PHIL 270, RLGN 270) and a capstone class in one of the following disciplines: ANTH 365 Seminar in Women and Gender Studies, ENGL 371 Topics in Women’s Studies, or HSTY 400 Seminar in Women’s Studies. Major courses: 24 credit hours in approved women’s studies courses, at least two from each of the three areas listed.

Minor

The program in women’s studies also offers an undergraduate minor. Fulfillment of the minor requires completion of eighteen credit hours according to the following course distribution:

- Introduction to Gender Studies (offered every fall and spring semester)
- Four cross-listed courses (see list below)
- Independent study

To help ensure a comprehensive course of study in a particular area of interest, the specific combination of courses and structure of the independent study must be approved by the program advisor.

Available approved courses:

ANTH 306 Anthropology of Childhood and the Family
ANTH 309 Child Abuse and Family Violence
ANTH 345 Ethnicity, Gender and Mental Health
ANTH 354 Women and International Health
Women’s Studies (WMST)

Undergraduate Courses

WMST 201. Introduction to Gender Studies (3)
This course introduces women and men students to the methods and concepts of gender studies, women’s studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, art history, and religion. It is the required introductory course for students taking the women’s studies major. Cross-listed as ENGL 270, HSTY 270, PHIL 270, and RLGN 270.

WMST 222. Gender in U.S. Society (3)
(See SOCI 222.) Cross-listed as SOCI 222.

WMST 232. Women in India (3)
(See HSTY 232.) Cross-listed as HSTY 232.

WMST 312. Women in the Ancient World (3)
(See CLSC 312.) Cross-listed as CLSC 312.

WMST 322. Feminist Theory, Women’s History, Gender History (3)
(See HSTY 322.) Cross-listed as HSTY 322.

WMST 326. Women in Societies in the Modern World (3)
(See SOCI 326.) Cross-listed as SOCI 326.

WMST 372. Work and Family: U.S. and Abroad (3)
(See SOCI 372.) Cross-listed as SOCI 372.

Graduate Course

WMST 422. Feminist Theory, Women’s History, Gender History (3)
(See WMST 422.) Cross-listed as HSTY 422.
Mandel Center for Nonprofit Organizations
The Mandel Center for Nonprofit Organizations, currently ranked among the top ten graduate business programs with a specialty in nonprofit organizations in the nation by U.S. News and World Report, offers the most comprehensive nonprofit leadership and management education programs in the United States. This university-wide academic center, founded in 1984, is a partnership of the Mandel School of Applied Social Sciences, the Weatherhead School of Management, the School of Law, and the College of Arts and Sciences. These schools have joined together to address the growing need for the professional education of leaders and managers of nonprofit organizations and to foster and disseminate research on the nonprofit sector. The Mandel Center’s mission is to enhance the effectiveness of nonprofit leaders and managers and the organizations they serve through education, research, and community service.

In pursuit of that mission, the Mandel Center offers the Master of Nonprofit Organizations (M.N.O.) degree, an executive M.N.O. degree option, a Certificate in Nonprofit Management (CNM), and several dual degree and credential programs in cooperation with its four partner schools. The Mandel Center also collaborates with the Executive Doctor of Management (EDM) program at the Weatherhead School of Management to offer practice-oriented nonprofit studies at the doctoral level. Policy and research issues in nonprofit leadership and management are addressed through research colloquia, affinity groups, conferences, and publications. The Mandel Center founded and continues to sponsor Nonprofit Management and Leadership, the first and foremost journal of nonprofit management in the United States. Finally, the Center provides leadership development services to the community of nonprofit organizations in the form of executive education, peer-to-peer learning, leadership roundtables, distinguished public lectures, and the Youth Philanthropy and Service (YPS) project.

Mandel Center Governing Secretariat

Mohsen Anvari
Dean, Weatherhead School of Management
Steve Bullock
The Bullock Group
Laura Chisolm
Professor, School of Law
Grover C. Gilmore
Dean, Mandel School of Applied Social Sciences
Henry Goodman
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Gerald Korngold
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Director of Publications and Alumni Affairs
Jennifer Shiner
Assistant Director of Youth Philanthropy and Service
Carol K. Willen, Ph.D.
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John Yankey, Ph.D.
Director of Community Services
Rebecca W. Zirm
Director of Recruitment and Admissions

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Hiram C. Haydn Professor of History
College of Arts and Sciences

Robert D. Hisrich, Ph.D. (University of Cincinnati)
A. Malachi Mixon III Chair in Entrepreneurial Studies and Professor
Weatherhead School of Management

Robert P. Lawry, J.D. (University of Pennsylvania)
Professor of Law
School of Law

Frances Lee, Ph.D. (Vanderbilt University)
Assistant Professor of Political Science
College of Arts and Sciences

Sharon Milligan, Ph.D. (University of Pittsburgh)
Associate Professor
Mandel School of Applied Social Sciences

Art Naparstek, Ph.D. (Brandeis University)
Grace Longwell Coyle Professor of Social Work
Mandel School of Applied Social Sciences

Duncan Neuhauser, Ph.D. (University of Chicago)
Professor of Epidemiology and Biostatistics
School of Medicine

John Orlock, M.F.A. (Pennsylvania State University)
Professor of Theater Arts
College of Arts and Sciences

Sue Pearlmuter, Ph.D. (University of Kansas)
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Mandel School of Applied Social Sciences

Vaughan Radcliffe, Ph.D. (University of Alberta, Canada)
Associate Professor of Accountancy
Weatherhead School of Management
Emeritus Program Faculty
Art Blum, D.S.W. (Western Reserve University)
Professor Emeritus
Mandel School of Applied Social Sciences

Mandel Center Programs
The Mandel Center offers graduate and executive education, research, publications, and community service programs of interest to practitioners and scholars of nonprofit organizations.

Master of Nonprofit Organizations (M.N.O.)
The M.N.O. degree is a comprehensive, multidisciplinary degree in the management of nonprofit organizations. The Mandel Center administers this professional degree, which is conferred jointly by the Weatherhead School of Management and the Mandel School of Applied Social Sciences.

The Center also offers an Executive Master of Nonprofit Organizations degree option for individuals with ten years of experience, either in a paid position or in a high-level volunteer capacity, and five years of managerial, supervisory, and/or professional experience in either a paid position or a significant, comparable, high-level volunteer capacity.

Certificate Program in Nonprofit Management (CNM)
An advanced credential which provides the practicing manager with knowledge in essential areas of nonprofit management and the environment of nonprofit organizations.

Leadership Education
Open enrollment workshops and training programs of interest to nonprofit managers, leaders, volunteers, and paid staff. The Mandel Center also works with nonprofit organizations to design programs to meet their special requirements.

Research
Colloquia, working paper series (that offers articles written by faculty and other scholars, practitioners of nonprofit management, and graduate students) and the quarterly, peer-reviewed journal Nonprofit Management and Leadership address practitioners and scholars. The Center also facilitates practitioner scholars to develop valid knowledge through several affinity groups comprised of scholarly practitioners in Northeast Ohio. The research program is especially strong in the fields of economic analysis, the history and current status of nonprofit organizations, the welfare state, law, strategic alliances and leadership for nonprofit organizations, human resource management for nonprofits, accounting, and foundations.

Distinguished Public Lectures
Distinguished Public Lectures bring nationally recognized leaders and scholars to the local community, thus providing a forum for discussion and debate about the issues of most concern to nonprofit organizations.

Conferences
Bring together scholars and professionals to discuss current issues of nonprofit research and practice.

Publications Program
Nonprofit Management and Leadership (NML) a quarterly, peer-reviewed journal focusing on issues of concern to nonprofit
organization managers and leaders, is intended as a resource for managers, executives, and scholars of the nonprofit sector. It is sponsored by the Mandel Center and published by Jossey-Bass Publishers, Inc. in San Francisco. Nonprofit Notes (NPN) is a newsletter designed to inform people about the work of the Mandel Center. NPN is published four times a year and is distributed nationally and internationally. A working paper series also offers articles written by faculty and other scholars, practitioners of nonprofit management, and graduate students.

Career Development and Management

The Career Development and Management office offers a number of services to enhance career exploration in the nonprofit sector. Assistance is available with resume writing, interview preparation and other search skills. Highlights include the Mentor Program, Externships and job search assistance. Career seminars are offered throughout the year and a job kiosk provides up-to-the-minute postings.

The Master of Nonprofit Organizations (M.N.O.)

The Master of Nonprofit Organizations is a rigorous professional degree. It is designed to produce leaders and managers in human services, cultural, educational, community development, religious, and other nonprofit organizations. The curriculum recognizes the special concerns of nonprofit organizations in such areas as:

- Management of volunteers and professionals
- Resource development and fund raising
- Governance by volunteer boards of trustees and directors
- Management of multiple sources and types of funding
- A unique legal and regulatory framework
- Special values of service, community, and charity
- The entrepreneurial character of nonprofit leadership
- Special ethical and moral issues
- Measurement of performance without a profit criterion

Standard M.N.O. Program

The M.N.O. degree is a 60-credit-hour program, including 33 hours of required course work, 12 hours from a menu of 10 “choice” courses, and an additional 15 hours of elective courses. Electives may be selected from either the “choice” courses or from an array of relevant courses offered by the University’s professional schools and the College of Arts and Sciences. One course (MAND 425) requires four all-day sessions of intensive study in January. Students may pursue the M.N.O. on a full- or part-time basis.

Executive M.N.O. Program Option

The Mandel Center also offers a 45-credit-hour Executive M.N.O. degree program option for candidates with demonstrably high potential as nonprofit leaders. Applicants to this program option should have ten years of professional and/or volunteer experience, five years of managerial and/or supervisory experience, and excellent academic qualifications. The foundation for this option is the curriculum of the 60-hour M.N.O. degree with an emphasis on the 33-credit “core” of the degree plus 12 credits of “choice” courses.

For further information, contact the Mandel Center’s Director of Recruitment and Admissions, Rebecca W. Zirm, at (216) 368-6025 or by e-mail at admissions@mncn.cwru.edu.

The M.N.O. curriculum covers many of the same areas as master’s degree curricula for business and governmental managers and leaders. Financial management, human resources management, marketing management, entrepreneurship, and research and analysis methods are emphasized, but the application and focus are within a nonprofit organizational context. In addition, the M.N.O. includes special areas of analysis such as nonprofit law, ethics, and the historical and social science basis of the nonprofit sector.

M.N.O. Program Structure

- 60 credit hours
- Two years full-time and varying sequences for part-time study
- Classes offered during the evening and occasional intensive sessions to accommodate working students and those seeking employment while in the program.

M.N.O. Curriculum (60 credits total)

Required Courses (33 credits)
MAND 401. Introduction to the Nonprofit Sector (3)
MAND 409A. Strategic Planning for Nonprofit Organizations: Practicum I (3)
MAND 409B. Strategic Planning for Nonprofit Organizations: Practicum II (3)
MAND 410. Quantitative Analysis for Nonprofit Leaders (3)
MAND 411. Nonprofit Leadership Dialogs: Major Issues and Trends (1)
MAND 416. Economics for Nonprofit Organizations (1.5) (Seven-week module)
MAND 420. Nonprofit Organization and Management (3)
MAND 425. Financial Accounting and Reporting for Nonprofit Organizations (2)
MAND 426. Financial Management for Nonprofit Organizations (3)
MAND 430. Managing Human Resources in Nonprofit Organizations (3)
MAND 436. Marketing for Nonprofit Organizations (1.5) (Seven-week module)
MAND 450. Law of Nonprofit Organizations (3)
MAND 495A. Decision Making for Nonprofit Leaders (3)
Choice Courses (12 credits)
MAND 405. Ethics and Professionalism for Nonprofit Leaders (3)
MAND 406. Nonprofit Public Policy and Advocacy (3)
MAND 407. Earned Income for Nonprofit Organizations (3)
MAND 408. Philanthropic Fundraising for Nonprofit Organizations (3)
MAND 422. Organizational Assessment & Program Evaluation in Nonprofit Organizations (3)
MAND 423. Government Funding for Nonprofit Organizations (3)
MAND 440. Management Information Systems for Nonprofit Organizations (3)
MAND 489. Trusteeship: The Governance of Nonprofit Organizations (3)

Elective Courses (15 credits)

Elective courses offer the opportunity to gain depth in a particular technical competency or in a given professional discipline or endeavor. Electives may be selected from either the “choice” courses or from an array of relevant courses offered by the University’s professional schools and the College of Arts and Sciences. A student may also engage in an independent study under faculty supervision. Current electives offered by the Mandel Center include:
MAND 486 Leading and Managing Nonprofit Arts and Cultural Organizations (3)
MAND 467. Cross-listed as SSWM 567.
MAND 469. Cross-listed as SSWM 569.
The Practica
The curriculum includes two practica. They stress experiential learning and teamwork under the supervision of faculty and in cooperation with participating nonprofit organizations in a variety of fields. This approach is designed to produce useful results for the participating organization as well as critical knowledge and experience for the student.

Part-Time Study
There are various options for part-time study in the M.N.O. program. Those interested should contact the Mandel Center for details.

Advanced Standing for Certificate Holders
Students who have completed the Certificate in Nonprofit Management (CNM) program with a high level of overall performance, hold an undergraduate degree from an accredited institution, and demonstrate the leadership potential required of master’s candidates may apply to the M.N.O. program and, if accepted, may be eligible for advanced standing, based on certificate course work completed with a grade of B or better. Entry into the M.N.O. program from the certificate program is not automatic.

Dual Degree Programs
The Mandel Center currently offers dual degree programs with the Mandel School of Applied Social Sciences, the School of Law at Case Western Reserve University and the Department of Music in the School of Graduate Studies. Students must apply and be accepted for each degree program to qualify.

M.N.O./M.S.S.A.
This program combines the Master of Nonprofit Organizations (M.N.O.) with the Master of Science in Social Administration (M.S.S.A.). It provides career preparation for a student with interests in nonprofit management, social service, and the social work profession.

Students beginning their studies in the M.S.S.A. program must apply to the M.N.O. program prior to completing 17 credits of M.S.S.A. courses. Students must finish one complete year of study in both the M.N.O. and M.S.S.A. programs (in either order) before they can mix courses in their final semesters of study.

• Dual degree students must receive the M.N.O. and M.S.S.A. degrees simultaneously to be granted credit for specific courses taken in the other program.

• M.N.O./M.S.S.A. students continue to register at their initial school of enrollment throughout the dual program.

For more information, contact the individual program directors:
Rebecca W. Zirm, Director of Recruitment and Admissions
Mandel Center for Nonprofit Organizations
Case Western Reserve University
10900 Euclid Avenue
11206 Euclid Avenue, Lower Level (visitors)
Cleveland, Ohio 44106-7167
(216) 368-2280
admissions@mcno.cwru.edu

M.S.S.A./M.N.O. Advisor
Mandel School of Applied Social Sciences
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7164
(216) 368-2280

M.N.O./J.D.
This program combines the Master of Nonprofit Organizations (M.N.O.) with the Doctor of Jurisprudence (J.D.). It provides preparation for students who desire to practice law within a nonprofit organizational context or serve as managers in nonprofit organizations.

Students in either program must be admitted to the other degree program to be granted dual degree status and receive credit for specific courses taken in the other program. New students can apply to both programs simultaneously. Several program study options are available. For more detailed information, contact the individual program directors:
Rebecca W. Zirm, Director of Recruitment and Admissions
Mandel Center for Nonprofit Organizations
Case Western Reserve University
10900 Euclid Avenue
11206 Euclid Avenue, Lower Level (visitors)
Cleveland, Ohio 44106-7167
(216) 368-6025
admissions@mcno.cwru.edu

J.D./M.N.O. Advisor
School of Law
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7148
(216) 368-3600

M.N.O./M.A.
This program combines the Master of Nonprofit Organizations (M.N.O.) with the Master of Arts in Music History (M.A.). It provides preparation for students who desire to blend a strong background in music and the arts with management in nonprofit organizations.

Students in either program must be admitted within the first year of study to the other in order to be admitted to dual degree status. New students may apply to both programs simultaneously. Several program study sequence options are available. For more detailed information, contact the individual program directors:
Rebecca W. Zirm, Director of Recruitment and Admissions
Mandel Center for Nonprofit Organizations
Case Western Reserve University
10900 Euclid Avenue
11206 Euclid Avenue, Lower Level (visitors)
Cleveland, Ohio 44106-7167
(216) 368-6025
admissions@mcno.cwru.edu

M.A./M.N.O. Advisor
Department of Music
Case Western Reserve University
Cleveland, Ohio 44106-7105
216-368-2400

General Provisions
In addition to the considerations indicated above, the following provisions apply to all dual degree programs:
1. Students must meet the admission requirements and standards of both programs and be accepted into each program. This may be done at the time of application, or within the first year of study in the M.N.O., M.A., M.S.S.A., or J.D. programs.
2. A specified amount of transfer credit will be granted for academic course work taken in each of the two programs.

3. Students must adhere to the specific requirements outlined for each degree program consistent with the dual degree agreement.

4. Degrees are conferred simultaneously.

Contact the Mandel Center or the appropriate professional school for specific curriculum, sequence options, and complete information about dual degree programs.

Certificate Program in Nonprofit Management (CNM)

The Certificate Program in Nonprofit Management (CNM) is designed for practicing leaders and managers in human service, fine and performing arts, cultural, educational, civic, religious, and other nonprofit organizations, who hold or aspire to senior-level executive positions.

The program provides knowledge in critical areas of management methodology and the operational environment of the nonprofit sector. The courses address the special concerns of the nonprofit sector in such areas as:

- Management of volunteers and professionals
- Resource development and fund raising
- Governance by volunteer boards of trustees and directors
- Management of multiple sources and types of funding
- A unique legal and regulatory framework
- Special values of service, community, and charity
- The entrepreneurial character of nonprofit leadership

CNM students must satisfactorily complete a set of five approved Mandel Center courses (15 credits), one of which must include MAND 401. They must also attend all meetings of the Nonprofit Leadership Dialogs series (MAND 411).

Admission criteria include demonstrated ability to master graduate-level course work, familiarity and experience with the nonprofit sector, and potential for executive-level management and leadership.

CNM students may take one or more courses per semester and usually complete the program in one year. Tuition and time for completion can vary depending on the courses selected. Classes are offered in a format that is designed to accommodate working students. Students who have completed the Certificate Program, and hold an undergraduate degree may apply for admission to the M.N.O. program. If acceptance is granted, CNM course work completed within five years of the date of application with a grade of "B" or better is applicable toward degree requirements for the Master of Nonprofit Organizations (M.N.O.) degree.

Certificates are awarded to students who satisfactorily complete all course work and comply with Mandel Center policies pertaining to the CNM program.

Financial aid is available to qualified CNM students in the form of scholarships. Contact the Mandel Center for details.

Degree/Certificate Programs

The Mandel Center currently offers degree/certificate programs (M.B.A./CNM, M.S.S.A./CNM, and J.D./CNM) with the Mandel School of Applied Social Sciences, the Weatherhead School of Management, and the School of Law at Case Western Reserve University. Students must apply and be accepted for each program independently to qualify.

M.B.A./CNM

M.B.A. students with a career focus in the management of nonprofit organizations may obtain a Certificate in Nonprofit Management (CNM) by completing an M.B.A. specialization in nonprofit management (nine credit hours) plus six credit hours of nonprofit management course work above their M.B.A. requirements. By enrolling in one additional course during each of the last two semesters of the M.B.A. program, full-time students may complete the M.B.A. and the CNM without extending their course of study or incurring additional tuition fees.

Credit Requirements for the M.B.A./CNM

Students in the dual program must fulfill 15 credits toward the CNM certificate and 63 or 47 hours (traditional or accelerated full-time curriculum) toward the M.B.A. degree. These students may double count nine credit hours of Mandel Center courses that have been approved for credit in both programs.

Courses in the CNM/M.N.O. curriculum currently approved for M.B.A. and CNM credit

There is one required course for the M.B.A./CNM, Introduction to the Nonprofit Sector. The most appropriate sequence of study would generally include Law of Nonprofit Organizations as well. In addition, students choose three courses selected from among the following:

- Community Organization and Development Strategies
- Decision Making for Nonprofit Leaders
- Earned Income for Nonprofit Organizations
- Ethics and Professionalism for Nonprofit Leaders
- Government Funding for Nonprofit Organizations
- International Non-Governmental Organizations
- Leadership for Nonprofit Organizations
- Leading and Managing Nonprofit Arts and Cultural Organizations
- Management of Community-Based Development
- Managing Human Resources in Nonprofit Organizations
- Nonprofit Organization and Management
- Nonprofit Public Policy and Advocacy
- Organizational Assessment and Program Evaluation in Nonprofit Organizations
- Philanthropic Fundraising for Nonprofit Organizations
- Strategic Planning for Nonprofit Organizations: Practicum I
- Strategic Planning for Nonprofit Organizations: Practicum II
- Trusteeship: The Governance of Nonprofit Organizations

Students wishing to propose any modification in the recommended sequence of study on the basis of prior course work, past experience, or professional interest must present a request, in writing, for consideration by the Weatherhead M.B.A./CNM faculty advisor.

Students pursuing the M.B.A./CNM are also expected to attend all meetings of the Mandel Center's Nonprofit Leadership Dialogs series.

M.S.S.A./CNM

The M.S.S.A./CNM combines the Master of Social Science Administration (M.S.S.A.) with the Certificate in Nonprofit Management. It provides excellent preparation for students who have a career focus in the management of economic and community development and nonprofit organizations.

The program consists of five courses that must include MAND 406. The remaining four courses are chosen in consultation with the M.S.S.A./CNM faculty advisor.

For more information, contact Rebecca W. Zirm, Director of Recruitment and Admissions, 216-368-6025 or by e-mail at admissions@mcno.cwru.edu.

J.D./CNM

The J.D./CNM combines the Doctor of Jurisprudence (J.D.) with the Certificate in Nonprofit Management. It provides preparation for students who desire to practice law as it relates to nonprofit
organizations, serve as managers of nonprofit organizations, or work in the field of planned giving.

For more information, contact Rebecca W. Zirm, Director of Recruitment and Admissions, 216-368-6025 or by e-mail at admissions@mcno.cwru.edu.

Facilities and Services

The Mandel Center for Nonprofit Organizations, Office of Educational Programs, is located in the Cleveland Hearing and Speech Center. Mandel Center classes are generally scheduled at the Weatherhead School of Management, the Mandel School of Applied Social Sciences, and the School of Law (Gund Hall). However, other campus facilities are also utilized.

Mandel Center students are entitled to full use of University facilities and services, including libraries, computer labs, career planning, and housing services. See the appropriate sections of this bulletin for details.

Admission

Master of Nonprofit Organizations

Requirements

Applicants with academic records from accredited institutions of higher education who submit a complete application will be considered for admission to the program. No previous academic work in business, management, or nonprofit studies is required.

Admission criteria include:
• Completion of a baccalaureate degree
• Evidence of potential for leadership and executive-level management of nonprofit organizations
• Experience and/or familiarity with nonprofit organizations
• Submission of official scores from the Graduate Management Admission Test (GMAT)

Detailed information about GMAT dates, registration, and score reporting is available by contacting:
Graduate Management Admission Test Educational Testing Service P.O. Box 6103, Princeton, New Jersey, 08541-6103 1-800-462-8669 or at http://www.gmat.org

Foreign Applicants

Foreign applicants whose previous college work was completed in non-English speaking countries are required to submit an official Test of English as a Foreign Language (TOEFL) and score 550 or better. For details, see “Students from Other Countries” in the front section of this Bulletin.

Application Procedure

Applications for the M.N.O. program are available from the Mandel Center for Nonprofit Organizations at Case Western Reserve University: (mailing address - 10900 Euclid Avenue, Cleveland, Ohio 44106-7167) (visitors' address - Cleveland Hearing and Speech Center, 11206 Euclid Avenue) (by phone at 216-368-6025 or on the web at http://www.cwru.edu/mandelcenter).

Applicants should arrange to have the following items on file at the Mandel Center for admission consideration:
• Completed application
• Non-refundable $25 application fee, made payable to the Mandel Center for Nonprofit Organizations
• Official transcript(s) of all academic work
• Two letters of recommendation
• Personal essay as outlined in application materials
• Official GMAT Test Scores

Applicants to the M.N.O. Program should submit the items listed above to:
Rebecca W. Zirm, Director of Recruitment and Admissions
Mandel Center for Nonprofit Organizations
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7167

Only completed applications will be processed.

For the fall semester, the application deadline for the M.N.O. program is June 1. Those requesting scholarship funding are encouraged to apply early. Applications for admission and financial assistance received after April 1 will be reviewed and considered monthly on the basis of space and fund availability.

Students accepted for admission begin the M.N.O. program with an orientation week in August, one week prior to the start of the fall semester.

Spring (January) admissions to the program are permitted. The deadline for applications for the spring semester is November 1.

Potential M.N.O. applicants who have not completed the full M.N.O. admissions process may apply for admission as a non-degree student through the Weatherhead School of Management and if admitted be eligible to take up to two courses (6 credits) in the M.N.O. curriculum, on a space-available basis. Contact the Director of Admissions, Weatherhead School of Management, for further information concerning the non-degree process. If a student applies and is accepted into the M.N.O. program, and has previously completed M.N.O. courses in a satisfactory manner, such courses may be credited toward the M.N.O. program requirements.

Advance Tuition Deposit

Students who are accepted for admission to the M.N.O. program must make a non-refundable tuition deposit of $150 at the time of acceptance to reserve a place in the entering class.

Waiver Policy

A total of six credit hours are eligible for waiver, subject to the following requirements:

Courses to be waived must have been taken from an accredited institution within five years of the date of application to the M.N.O. degree program. A grade of at least a “B” must have been earned.

A Mandel Center faculty member must make written approval of the waived course. Courses will not be waived based upon work experience. The final decision to waive a course rests with the instructor of the course in question. A student must register for and complete at least 54 credits toward the M.N.O. degree in residence at the University in addition to courses waived. A waived course will reduce degree requirements.

Transfer Credit

Courses granted transfer credit must be approved as applicable to the M.N.O. program. They must be taken at an accredited institution, and a grade of at least B must be earned (not counted in the GPA). Transfer credit is limited to six credits.

Substitution

An additional nine credits may be approved for substitute credit. Substitute courses replace required M.N.O. courses but do not reduce the total number of credits required to complete the program. Substitute courses must be selected and approved in accordance with a clearly defined written proposal consistent with student interests/needs and the M.N.O. program mission.
Certificate Program

Applications for the CNM program are available from the Mandel Center for Nonprofit Organizations at Case Western Reserve University: (mailing address - 10900 Euclid Avenue, Cleveland, Ohio 44106-7167) (visitors' address - Cleveland Hearing and Speech Center, 11206 Euclid Avenue) (by phone at 216-368-6025 or on the web at http://www.cwru.edu/mandelcenter). Applicants should arrange to have the following items on file at the Mandel Center for admission consideration:

- Completed application
- Non-refundable $25 application fee, made payable to the Mandel Center for Nonprofit Organizations
- Official transcript(s) of all academic work
- Two letters of recommendation. One should be from someone qualified to comment on the applicant’s nonprofit sector experience and career potential in nonprofit management.
- Personal essay as outlined in application materials
- Experience working with a nonprofit organization in a paid staff position, or in a responsible and substantial volunteer capacity.
- A record of academic achievement and the ability to do advanced academic work.

Applicants to the Certificate Program should submit the items listed above to:

Rebecca W. Zirm, J.D., Director of Recruitment and Admissions
Mandel Center for Nonprofit Organizations
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7167

Only completed applications will be processed.

Financial Information

Tuition

2002-2003 tuition charges for the M.N.O. degree and CNM program are $910 per credit or $10,920 per semester for full-time M.N.O. students taking 12 or more credits. The cost for the CNM program depends upon the number of credit hours taken. Tuition covers instructional costs and computer usage. Books and living expenses are separate student expenses. Tuition is due and payable according to the University’s tuition payment policy for each semester in which course work is undertaken.

Financial Aid

Applications for scholarship financial aid or assistance are available from the Mandel Center. Additional information about federal or other assistance may be obtained by contacting:

Financial Aid/Registration Coordinators Weatherhead School of Management
310 Enterprise Hall
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7245
216-368-3399 or 216-368-3821

Please Note: Initial scholarship and financial aid decisions are made in March and April for the following fall, so early application to the M.N.O. program is encouraged. Requests for financial assistance received after April 1 will be reviewed and considered monthly based on availability of funds.

Academic Regulations

Registration

Registration for the M.N.O. and CNM programs is through the Weatherhead School of Management. The Director of Education must approve all schedules prior to registration.

Refer to the Weatherhead School section of this Bulletin for information about course changes and withdrawals. For additional information about registration, contact the Mandel Center at (216) 368-8566.

Course Loads

Full-time graduate students normally register for no more than 15 or less than 9 credits per semester, and student enrollment is usually consistent with one of several recommended courses of full or part-time study.

Non-Degree Students

A maximum of two courses (6 credits) from the M.N.O. curriculum may be taken (subject to space available) by students admitted to non-degree status through the Weatherhead School of Management, providing that course prerequisite requirements are met. Contact the Director of Admissions at the Weatherhead School for information about registration, contact the Mandel Center at (216) 368-2030. (Note: non-degree students are not eligible for any financial aid.)

Retention and Graduation Requirements

M.N.O. Program

The retention requirements for continued study in the M.N.O. program are:

- Minimum GPA after 15 credit hours of study: 2.5
- Minimum GPA after 23 credit hours of study: 2.7
- Minimum GPA after 30 credit hours of study: 3.0
- Minimum GPA for graduation: 3.0

A student will be placed on academic probation after any semester in which the minimum GPA is not attained. A student who has not attained the minimum GPA in a particular semester will be allowed one additional semester to attain the minimum GPA in order to continue in the M.N.O. program.

A candidate for the M.N.O. degree must file an application to graduate not later than two months before the commencement at which the degree is expected. The filing of this application is the responsibility of the M.N.O. candidate. Contact the Registrar of the Weatherhead School of Management for complete information. Eligibility of the candidate to graduate at the time requested will be verified upon receipt of the application.

Time Limitation

All requirements for the M.N.O. degree must be completed within six years from the day of the student’s initial registration.

Certificate Program

Satisfactory completion of an approved set of five courses (15 credits), along with payment of all tuition and fees is required for graduation. Participants who complete all requirements will be awarded the Mandel Center Certificate in Nonprofit Management.

Transcripts

Official transcripts for course work completed may be obtained from the University Registrar’s Office, 110 Yost Hall.
Course Descriptions (MAND)

MAND 401. Introduction to the Nonprofit Sector (3)
An examination of the social history of nonprofit organizations in the United States, to develop an historical perspective and a sense of magnitude, scope, and functions of the nonprofit sector and its relationships with business and government. This course will explore the theoretical bases upon which social scientists have sought to understand the role of the nonprofit sector in our economy and in our political and social systems, and will explore the issues that will shape the future of the sector. Eligible for M.B.A. credit.

MAND 405. Ethics and Professionalism for Nonprofit Leaders (3)
This course is an application of ethical frameworks and analysis to nonprofit organizations. Using cases and essays, the course will help nonprofit managers become better equipped to address ethical problems and dilemmas in their work in the following areas: ethics of boards, ethics and leadership, ethics and organizational culture, professional ethics, and ethics and fundraising. Eligible for M.B.A. credit.

MAND 406. Nonprofit Public Policy and Advocacy (3)
This course is an introduction to the institutions and processes that make up the political environment of nonprofit organizations in the United States. The course will examine the role of civil society in a democracy, take a general overview of American political institutions and the cultural beliefs that undergird them, and examine the important elements of the public policy process: the framing of issues, the role of political entrepreneurs and organized interests, elections, the legislative process and strategies for influencing it, and the roles of executive institutions and the courts. Emphasis will be placed on the ways that nonprofit advocates can advance their goals in the public policy process. Cross-listed as POSC 406. Eligible for M.B.A. credit.

MAND 407. Earned Income for Nonprofit Organizations (3)
In this course, students will examine the entrepreneurial behavior of nonprofit-sector organizations in identifying new and varied sources of income to supplement the traditional contribution base. Using cases, students will explore the nontraditional sources of income that drive the tax-exempt sector, analyze data, and make management decisions. Eligible for M.B.A. credit.

MAND 408. Philanthropic Fundraising for Nonprofit Organizations (3)
This course will provide current and future nonprofit leaders with a detailed survey of the practices, principles, and process of fundraising, enabling them to effectively create, participate in, and manage fund development programs and staff. Successful fundraising is shown to be communication-based and built upon solid relationships with defined constituencies of donors and potential donors. Eligible for M.B.A. credit.

MAND 409A. Strategic Planning for Nonprofit Organizations: Practicum I (3)
This is the first of a two-course, integrated practicum series designed to provide "hands-on" experiences in planning for, designing, and conducting strategic planning in nonprofit organizations. Students will learn to assess organizational readiness, facilitate the design of strategic planning processes, create a variety of approaches involving key stakeholders, and finalize a planning design suited to organizational culture. Eligible for M.B.A. credit.

MAND 409B. Strategic Planning for Nonprofit Organizations: Practicum II (3)
This is the second of a two-course, integrated practicum series designed to provide "hands-on" experience in planning for, designing, and conducting strategic planning in nonprofit organizations. Student teams will continue to consult with their nonprofit organizations to implement the committee deliberation phase of the planning process designed during the first practicum. Eligible for M.B.A. credit.

MAND 410. Quantitative Analysis for Nonprofit Leaders (3)
This course is designed to give students a basic understanding and working knowledge of data analysis, statistical concepts, use of computers, research designs for program planning and evaluation, and quantitative techniques for problem solving. The intent is to ensure that executives and leaders are able to effectively utilize and interpret statistical data, technical reports, research findings, and evaluation studies, and employ basic quantitative methods in their own analysis of problems and policies.

MAND 411. Nonprofit Leadership Dialogs: Major Trends and Issues (1)
This course is intended to enable students to learn about major nonprofit leadership issues and trends through interaction and dialog with successful nonprofit leaders. It is also designed to provide outside nonprofit leaders with the opportunity to learn about the quality of the Mandel Center’s student body. Eligible for M.B.A. credit.

MAND 412. Leadership for Nonprofit Organizations (3)
This course examines leadership from nonprofit political, managerial, and sociological perspectives. Concepts of leadership will be applied to nonprofit organizations through case discussion, student experience, and class exercises. The course integrates theory-based and practice-based approaches and prepares students to participate in leader-follower dynamics in the nonprofit setting. Eligible for M.B.A. credit.

MAND 416. Economics for Nonprofit Organizations (1.5)
This seven-week course helps students of nonprofit organization management understand economic thinking and the economist’s tools, elasticity, public goods and the role of nonprofit organizations in a market economy, cross-subsidization and competition, and cost-benefit analysis.

MAND 420. Nonprofit Organization and Management (3)
This course will focus on theories of organizations and general concepts and principles of management, governance, and leadership. Organizational design, behavior, performance, and effectiveness will be studied, and the special character and management problems of nonprofit organizations will be highlighted and analyzed. Eligible for M.B.A. credit.

MAND 422. Organizational Assessment and Program Evaluation in Nonprofit Orgs. (3)
The course is designed to introduce students to the approaches to organizational assessment and evaluation of organizational issues and problems. The class will explore a variety of ways of viewing organizations, assessing their stage of development, look at factors that influence or interfere with their forward progress, review the dimensions essential to nonprofit organizations and explore some processes useful to enable change. In addition, the course will focus on the process of creating and measuring program outcomes. Eligible for M.B.A. credit.

MAND 425. Financial Accounting and Reporting for Nonprofit Organizations (2)
This course provides students with practical, hands-on understanding of, and experience with, government support of nonprofit 501(c)(3) organizations. Students learn about and utilize trends, tools, and techniques leading to successfully navigating the maze of government funding. The course will emphasize familiarity with sources of information, the development of effective proposal writing skills, government grant and contract management, government political processes, and an understanding of the culture of government grant review and grant making. Students will experience the advice, counsel, and wisdom of professionals involved with government grant writing review and funding. Eligible for M.B.A. credit.

MAND 426. Financial Management for Nonprofit Organizations (3)
This course provides students with practical, hands-on understanding of, and experience with, government support of nonprofit 501(c)(3) organizations. Students learn about and utilize trends, tools, and techniques leading to successfully navigating the maze of government funding. The course will emphasize familiarity with sources of information, the development of effective proposal writing skills, government grant and contract management, government political processes, and an understanding of the culture of government grant review and grant making. Students will experience the advice, counsel, and wisdom of professionals involved with government grant writing review and funding. Eligible for M.B.A. credit.

MAND 427. Government Funding for Nonprofit Organizations (3)
This course focuses on techniques and principles of financial management including budgeting, finance and investment decision making. Topics include budget formulation, analysis and planning, present value analysis, cost-effectiveness, cash flow analysis, portfolio management, and venture planning. Special emphasis will be given to the unique problems of nonprofits in capital formation, generating earned income, managing endowments, gifts and grants, and tax planning.
MAND 430. Managing Human Resources in Nonprofit Organizations (3)
Theories and principles of managing people in organizations are addressed in this course, including motivation theory and human resource development strategies. Particular attention is devoted to issues critical to nonprofit organizations, such as the management of volunteers, management of professionals, working with trustees, and staff/board relationships. Eligible for M.B.A. credit.

MAND 436. Marketing for Nonprofit Organizations (1.5)
This half-semester course helps students of nonprofit organization management understand marketing perspectives, products and services, the supply chain, marketing strategies, and concepts of value. Eligible for M.B.A. credit.

MAND 440. Management Information Systems for Nonprofit Organizations (3)
An examination of how the management of organizations in contemporary society can be understood as the managing of systems and operations that require the processing and analysis of information. Basic concepts and models of systems analysis, management information and decision systems, and operations management will be explained and applied to the analysis and control of organizational processes and the relationship of the organization to its environment. Computer-based models may be used to analyze problems, policies, and practices of organizations in a variety of nonprofit industries.

MAND 450. Law of Nonprofit Organizations (3)
This course provides the student with a basic grounding in the laws and regulations governing nonprofit organizations. Content will include the procedures for incorporating, reporting, and maintain tax-exempt status as a nonprofit organization, a familiarity with legal principles and research methods, and an overview of the legal regulatory, and policy issues facing contemporary nonprofit organizations. Eligible for M.B.A. credit.

MAND 467. Community Organization and Development Strategies (3)
(See SSWM 567.) Cross-listed as SSWM 567. Eligible for M.B.A. credit.

MAND 469. Management of Community Based Development (3)
(See SSWM 569.) Cross-listed as SSWM 569. Eligible for M.B.A. credit.

MAND 486. Leading and Managing Nonprofit Arts and Cultural Organizations (3)
This course addresses major issues affecting the leadership and management of arts organizations, the values and assumptions which have influenced arts organizations in the past, and current trends in society which may call those assumptions into question. Emphasis is given to issues of cultural sensitivity for leaders, managers and audiences as well as broadening the perspectives of future leaders so they may productively and creatively manage their institutions and careers. Eligible for M.B.A. credit.

MAND 489. Trusteeship: Governance of Nonprofit Organizations (3)
This elective course deals with the definition, history and concept of trusteeship, the areas of responsibilities of Boards of Trustees, the authority of Boards and the limits on its exercise, the organization of Boards and their committees, and the Board’s relationships with the Executive Director, the staff and the organization’s constituencies. Eligible for M.B.A. credit.

MAND 495A. Decision Making for Nonprofit Leaders (3)
This course introduces students to decision-making strategies and techniques appropriate for use by leaders and managers of nonprofit organizations. Students working in teams will consult with local organizations, analyzing their current situation, diagnosing problems and opportunities, creatively envisioning possibilities, evaluating potential improvements, and recommending appropriate decisions. Eligible for M.B.A. credit.

MAND 501. Special Problems and Topics (1-18)
An elective which provides the opportunity for an individualized, structured course of study in an area of special interest to the student. It is arranged by mutual agreement between the student and an appropriate faculty member. Prereq: Permission of instructor.
Mandel School of Applied Social Sciences
Mandel School of Applied Social Sciences (MSASS)

11235 Bellflower Road
Phone 216-368-2290; Fax 216-368-8670
Grover C. Gilmore, Ph.D., Dean and Professor

Mission Statement

MSASS provides and integrates professional social work education, research, and service to promote social justice and empowerment in communities through social work practice locally, nationally, and internationally.

A Tradition of Social Work

Consistently ranked among the nation’s foremost graduate schools of social work, MSASS counts among its alumni many prominent educators, government officials, accomplished practitioners, researchers, and chief executives of national and regional agencies. Faculty achievements in professional organizations, research, and agency consultation further extend the school’s reputation as an active participant in the advancement of social work practice. MSASS believes that advanced practitioners are strategists of change, working in partnership with others to enhance the caring capacity of communities. We are committed to preparing advanced practitioners able to understand the dynamics of problematic social situations and to identify the strengths and resources in individuals, families, and communities that offer the best hope of solutions. Our school is dedicated to developing leadership in the empowerment at all systems levels and in the ongoing struggle against discrimination and oppression. MSASS supports innovation and excellence in the service of building healthy communities. MSASS offers a course of study leading to a masters in Social Work called a Master of Science of Social Administration (M.S.S.A.), an advanced program for the Doctor of Philosophy in social welfare, several joint programs, and continuing education for professionals. The Master of Science in Social Administration (M.S.S.A.) is accredited by the Council on Social Work Education. Master’s students pursue their degree through a variety of study options, including full-time study, individualized part-time programs, and specialized study options for employed social workers.

Since its founding in 1916 as one of the nation’s first university-affiliated schools of social work, MSASS has been an innovator in professional education. The school’s long-standing dedication to community action has brought more than 300 organizations into a field education program of unusual scope. In every type of local and regional organization, students develop skills in direct practice, research, management, fund raising and community development. Continuing interests in international social work, policy analysis and occupational social work add breadth to a curriculum designed to offer students every opportunity for individualized and interdisciplinary study. The Mandel Center for Nonprofit Organizations offers advanced education in management and governance for leaders from every type of service organization throughout the United States. Its programs combine the perspectives of social science, law, and management for master’s students and Ph.D. fellows wishing to pursue careers in the nonprofit sector. An MSASS education is more than preparation. It is an opportunity to join a national network of

Scholars and practitioners who are shaping the course of social work in communities throughout the United States.

Administration

Grover Cleveland Gilmore, Ph.D. (Johns Hopkins University)  
Dean
Claudia J. Coulton, Ph.D. (Case Western Reserve University)  
Associate Dean for Research and Training
Wallace J. Gingerich, Ph.D. (Washington University)  
Chair of the Master Program
Victor K. Groza, Ph.D. (University of Oklahoma)  
Chairperson, Doctoral Program
Deborah Jacobson, Ph.D., (Tulane University)  
Director, Intensive Weekend Program
Sarah Andrews, M.S.S.A. (Case Western Reserve University)  
Director, Twelve-Month Advanced Standing Program
David Schrader, M.S.S.A., (Case Western Reserve University)  
Director, Development for Major Gifts, Foundations and Corporations
Pamela R. Carson, B.S., (Kent State University)  
Director, Development for Alumni and Allied Constituencies
Arthur S. Biagianti, M.S.S.A., M.S.L.S. (Case Western Reserve University)  
Director, Library
Nancy L. Graf, M.S.W., LISW (Boston College)  
Director, Continuing Education
Gerald A. Strom, M.S.W., LISW (Howard University)  
Director, Field Education
Sherry Jones, M.B.A.(Case Western Reserve University)  
Director of Budgets and Administration
Joan S. Horinka, M.B.A. (Case Western Reserve University)  
Director of Admissions & Communications
Sandra R. Bolton, B.A. (Ohio State University)  
Director, Financial Aid
Susan Freimark, M.A., L.P.C., (John Carroll University)  
Director of Career Development and Management
Debra Fields  
Registrar
Soad Mansour, ACSW, LISW  
Director of International Affairs for Social Welfare and Non-Governmental Organizations

Faculty

Sarah Andrews, M.S.S.A. (Case Western Reserve University)  
Instructor
David E. Biegel, Ph.D. (University of Maryland)  
Henry L. Zucker Professor of Social Work Practice
Craig Boitel, Ph.D. (Case Western Reserve University)  
Instructor
Pranab Chatterjee, Ph.D. (University of Chicago)  
Professor
Claudia J. Coulton, Ph.D. (Case Western Reserve University)  
Lillian F. Harris Professor of Urban Research and Social Change
Susan Lajoie Eagan, Ph.D. (Harvard University)  
Mandel Professor of Nonprofit Management
Kathleen J. Farkas, Ph.D. (Case Western Reserve University)  
Associate Professor
Jerry E. Floersch, Ph.D. (University of Chicago)  
Assistant Professor
Wallace J. Gingerich, Ph.D. (Washington University)  
Professor
Victor K. Groza, Ph.D. (University of Oklahoma)  
Professor
Deborah Jacobson, Ph.D. (Tulane University)  
Instructor
Merl C. Hokenstad, Jr., Ph.D. (Brandeis University)  
Ralph S. and Dorothy P. Schmitt Professor
Lenore A. Kola, Ph.D. (Boston University)  
Associate Professor
Gerald J. Mahoney, Ph.D. (Vanderbilt University)  
Verna Houck Molto Professor
Baila Miller, Ph.D. (University of Illinois at Chicago)  
Professor
Field Education

The faculty at MSASS place a high priority on the integration of theory with practice. To facilitate this integration, all field work is done concurrent with course work. Through field education, students have the opportunity to acquire new skills and apply their classroom learning in their practice setting. The school is affiliated with over 300 agencies in the Greater Cleveland area, creating a vast network of field education as well as employment opportunities. Students are required to complete over 900 clock hours of field education. The school and the affiliated agency or field setting agree on the content and conditions of field education, including the qualifications of social workers who serve as field instructors. Field placement decisions are based on educational criteria, with student interests and career objectives taken into consideration.

Direct Practice Concentrations:
- Aging
- Alcohol and Other Drug Abuse
- Children, Youth and Families
- Health
- Mental Health
  - Health; Alcohol and Other Drug Abuse; and the Aging concentrations are offered only in the Full-Time format.

Macro Practice Concentrations:
- Management
- Community Development
  - Electives in the Macro Concentrations are offered only in the Intensive Weekend format.

Plan of Instruction for the M.S.S.A. Degree

Full-time Programs

The traditional full-time program is a four-semester program. Students with a bachelor’s degree in social work who are granted advanced standing may complete the program in three semesters.

Twelve-Month Advanced Standing Program

Program Description

The Twelve-Month Advanced Standing Program enables qualified B.S.W. graduates to earn a master’s degree in one year. Students begin the program in the fall semester and complete it the following summer. Students may also elect a traditional fall, spring, fall pattern instead of attending classes in the summer.

Program Structure and Requirements

During the fall and spring semesters, students attend advanced courses in their area of concentration (Children, Youth, and Families; Aging; Adult Mental Health; Alcohol and Other Drug Abuse; Health; Management; and Community Development) and complete advanced field education requirements.

The typical spring and fall course load includes four courses (12 credit hours), the ABLE Seminar, and the field education assignment of three days per week at the field site (3 credit hours). Courses include advanced socio-behavioral theory, advanced research, advanced methods, and advanced policy. During the final summer semester, students carry 13 credit hours: three courses in addition to the final registration for field education. The total credit hours required for this program is 45.

Field Education

During the fall and spring semesters, Twelve-Month students participate in an advanced field education experience related to their area of concentration. The first two field education semesters (SASS 502 and 503) follow the standard format for full-time enrollment with students reporting to field education sites for three days per week for 15 weeks. Over the course of the final (summer) semester, students continue at the same placement site, completing field requirements while attending accelerated formatted classes.

Admission Criteria for The Twelve-Month Program is open to admitted students who have a bachelor’s degree in social work (B.S.W.) from an accredited program completed within the past
seven years. Grades of B or better must have been attained in all core social work courses. These include: policy, research, methods/practice, human behavior, and field practicum. Students granted less than the full 15 credit hours of advanced standing may enter the standard, full-time program and complete degree requirements in three to four traditional semesters.

**Additional Information**
Because of the short time frame for completing the twelve-month advanced standing program, dual degrees, individualized curricula, and the school social work emphasis are not available in this program.

**Senior Year in Professional Studies Program**
Undergraduate students of superior ability and achievement may be admitted to the Mandel School of Applied Social Sciences at the end of their junior year. A student in the Senior Year in Professional Studies Program is permitted to substitute the first year (31 semester hours) at the Mandel School of Applied Social Sciences for the last year of undergraduate work. The bachelor’s degree will be granted by the undergraduate college when the student has completed his or her first year at the Mandel School of Applied Social Sciences. Students applying for this program must be interviewed by an admissions officer as part of the application process to explore the candidate’s level of maturity, knowledge of social work, and readiness for professional education. Application for this program should be made prior to the second semester of the junior year. Requirements for admission to the Senior Year in Professional Studies Program are as follows: attainment of a cumulative grade point average of at least 3.25 in all courses in the student’s undergraduate program; completion of three-quarters of the major and minor concentration requirements in the undergraduate program. Final acceptance into the Senior Year in Professional Studies program is contingent upon receipt of a written statement from the dean of the applicant’s undergraduate college, guaranteeing that the student will receive the baccalaureate degree from that college upon satisfactory completion of 31 semester hours at the Mandel School of Applied Social Sciences of Case Western Reserve University.

**Note:** This program is available to students at Case Western Reserve University, Hiram College, the College of Wooster, Baldwin Wallace University, and John Carroll University by joint agreement with these institutions. Interested students from other institutions are encouraged to speak with the Office of Admissions.

**Intensive Weekend Program**
The school offers a format of concentrated weekend learning for social workers with career experience who are employed full-time. Classes meet one weekend per month (including one Friday per course) throughout the calendar year. Five courses are offered each year (six during the first year) and one course is taken at a time. This program allows students to complete their field education requirement at their place of employment. A student can expect to earn the degree in three years. If granted advanced standing, a student may be able to complete the program in two years.

**Extended Degree Program**
Students may opt to complete their degree work on a part-time basis during their first year. During the second and third years, the student will complete field education requirements and carry a full-time or nearly full-time load.

Extended degree program (EDP) students select classes from the full-time weekday schedule. Employed social workers may participate in this program providing they can arrange a flexible work schedule. Field education requirements may be fulfilled at the student’s place of employment. Such placements must be approved by the director of Field Education.

The EDP program may be completed in three years. Students granted advanced standing may complete the program in fewer semesters. EDP students are required to register for a minimum of six credit hours per semester. A student must complete all degree requirements in a maximum of five years.

**Dual and Interdisciplinary Degree Programs**
*(available to full-time students only)*

**Dual Social Work and Social Welfare (M.S.S.A./Ph.D.) Program**
The dual degree program has been structured for students who seek the traditional goals of the Ph.D. program - contributing to the advancement of the knowledge base of social welfare through research and theory development - and a desire to become professional social workers at the master’s level.

The dual M.S.S.A./Ph.D. degree program requires 57 credit hours of course work (normally 19 three-hour courses), 15 credit hours of field practicum, and 18 credit hours of dissertation. The M.S.S.A. degree will be awarded after successful completion of 45 credit hours of course work and 15 credit hours of field education. The Ph.D. degree will be awarded following acceptance of the student’s dissertation.

Course requirements for the dual degree may be completed in two and a half academic years plus two summers. The first academic year consists of M.S.S.A. courses and field practicum. The two summers and the second academic year include primarily Ph.D. level courses. A second field practicum is also required. With the additional time required for dissertation research, the two degrees can be earned in a minimum of four years compared to five years for completion of each degree separately. Dual degree students must meet the admissions standards of the M.S.S.A. and the Ph.D. programs and complete applications for both programs simultaneously.

**Dual Social Work and Law (M.S.S.A./J.D.) Program**
A dual-degree program established by the Mandel School of Applied Social Sciences and the university’s School of Law makes it possible for selected full-time students to pursue an integrated program of studies and receive the M.S.S.A. and J.D. degrees. This program allows completion of both degrees within four years rather than the normal five years. Applicants for the dual-degree program must apply to and meet the admission requirements of both professional schools.

**Dual Social Work and Master of Nonprofit Organizations (M.S.S.A./M.N.O.)**
The dual M.S.S.A./M.N.O. (master’s degree in nonprofit organizations) is designed for individuals without previous graduate training in social work or management who have set their sights on becoming managers of social service agencies. The program is designed to bring the student to a level of professional competence in both the management of nonprofit organizations and the practice of social work. Students may pursue a direct practice, management, or community development concentration in their M.S.S.A. degree.

The Mandel Center also offers a one-year certificate program in nonprofit management. This program consists of five courses that
meet throughout the year on evenings and/or weekends. Students interested in this degree option should contact:
Carol Willen, Ph.D., Director of Education, Mandel Center for Nonprofit Organizations

**Dual Social Work and Master’s in Business Administration**
The M.S.S.A./M.B.A. is designed for candidates who wish to prepare for advanced social work practice in a variety of clinical settings while developing the skills to assume management responsibility in those organizations.

**Non-Degree Study**
Some courses may be taken on a non-degree basis with the permission of the Associate Dean of Academic Affairs. A maximum of 12 hours earned on a non-degree basis may be counted toward requirements for the master’s degree if the student is subsequently admitted as a degree candidate.

**Admissions and Application Information**
Admission to the master’s degree program at the Mandel School of Applied Social Sciences is granted on a selective basis determined by the quality of the total application. An applicant for admission is expected to meet the following minimum requirements:

1. A bachelor’s degree from an accredited college or university.
2. Evidence of capacity to succeed in graduate level social work education based on undergraduate work and any previous graduate work. For acceptance into the program, the minimum undergraduate grade-point average is 2.7. A Miller Analogies Test or Graduate Record Exam score at or near the fiftieth percentile may compensate for a grade point average below 2.7.
3. Undergraduate course work in the social and behavioral sciences strong enough to ensure the candidate’s ability to do creditable work at the graduate level. Courses might include history, anthropology, psychology, sociology, philosophy, communications, and social welfare. In addition, applicants should have completed course work in human biology that provides a foundation for understanding human bio-psycho-social development. The latter requirements may be extended to allow completion before the end of the student’s first semester at MSASS.
4. Evidence of a combination of personal qualities and values that are considered essential for the professional practice of social work: strong moral character; strong analytical and verbal skills; caring and compassionate qualities; and a personal commitment to social justice, empowering individuals, and serving vulnerable and underrepresented groups.
5. The School may request a personal interview or additional information about an applicant if necessary.

**Admission Procedures**
The Mandel School bulletin and application materials can be secured from the Office of Student Services, Mandel School of Applied Social Sciences, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio 44106-7164 or by calling 1-800-863-6772.

Students are admitted primarily for the fall semester, although special requests for admission during the spring semester may be considered. Applications are accepted on a rolling admissions basis, though prospective students are strongly encouraged to apply early (December/January) for admission. A $50 non-refundable application fee must be submitted at the time of application.

**Advanced Standing**
Advanced standing (up to 15 credit hours) may be granted to students who have earned a bachelor’s degree in social work within the past seven years from an institution accredited by the Council on Social Work Education. Students must have earned a grade of B or better in each social work course for which advanced standing credit hours are given. Students granted advanced standing may not be required to complete selected social work foundation courses and the first semester of field education.

**Proficiency Examinations**
Students who do not hold a bachelor’s degree in social work may waive the foundation courses in policy, socio-behavioral theory, and research by passing a proficiency examination. Such waivers do not reduce the credit hour requirements for the degree, but enable students to take advanced, open elective courses in place of the foundation courses. There is no fee for examinations, or penalty, if the student does not pass the examination.

**Transfer**
Transfer credit may be given for related course work completed within the past three years. Credit hours must not have been applied toward a previous graduate degree. Up to 6 hours of credits may be transferred from a non-social work master’s level program. Students who are transferring to MSASS from another graduate school of social work may apply for transfer credit for up to one full year of academic work and field education. Transfer students from social work programs must submit field work evaluation(s) and official transcripts. Students must have received a grade of B or better in any course for which transfer credit is sought.

**International Students**
Applicants from other countries follow the regular application procedure. International students must have completed available social work training in their own countries, and have had paid experience in the social welfare field prior to entering the professional degree program. International students are required to furnish results of the Test of English as a Foreign Language (TOEFL) administered by the Educational Testing Service, Princeton, New Jersey, U.S.A. Results of this test must be forwarded to the Office of Student Services. A student from abroad whose native language is English, who has completed his or her work in a foreign university where English is the language of instruction, or who has studied at or graduated from an American institution, is exempt from this requirement. All international students must pay the health service fee and purchase the medical insurance policy. No exceptions are allowed. All international applicants must submit to the University’s Office of International Students evidence of funding sources to fully finance the cost of education, ousing, and transportation. Students holding a B.S.W. from their countries may be eligible for advanced standing. Applicants should contact the Council on Social Work Education (CSWE) directly and ask to have their program reviewed. Please write to CSWE, 1725 Duke Street, Suite 500, Alexandria, VA 22314-3457.
Financial Information

Tuition
In the 2002-2003 academic year, tuition for the Mandel School of Applied Social Sciences in the Full-Time master’s degree program is a flat rate of $21,840 and $728 per credit hour for other programs.

A non-refundable deposit of $100 is required of all master’s degree candidates at the time of acceptance. This deposit will be applied toward tuition for the degree program. Complete Academic Policies, Procedures and Financial Aid Information are available by contacting MSASS.

Doctoral Programs

Doctor of Philosophy
Students selected for study in the Ph.D. in Social Welfare program share a goal with distinguished faculty: the development of knowledge that will enhance the effectiveness of institutions and professions created to serve human need. The purpose of the program is the preparation of scholars, teachers, and practice leaders to generate new knowledge on the policies and programs of social welfare and the practice of social work. Accordingly, we emphasize the creative and evaluative skills necessary for independent inquiry. We prepare students to be knowledgeable in:

- relevant areas of the social and behavioral sciences;
- research, design, statistics, and the philosophy of science;
- theory-building and theories of social welfare; and
- methods for the application and transmission of knowledge in the human services.

In addition to this foundation knowledge, students develop specialized expertise in policy analysis and program planning or social work practice theory; and in one or more substantive areas of social welfare. Effort is made to provide an educational climate in which critical analysis and creative thinking flourish. The program core emphasizes philosophical and scientific approaches to theory development, the content and boundaries of theoretical social welfare, statistics and advanced research methodologies, and the social and behavioral science foundations underpinning social welfare programs and social work practice.

The area of specialization enables the student to apply social science theory, analytical approaches, and research tools to either social welfare policy or social work practice. Students are encouraged to focus on a substantive policy or practice area during the period of specialization. This facilitates the development of a dissertation proposal. Permeating the content of the entire program is a focus on the development and transmission of knowledge as a part of an educational process.

Students with a specific career interest in teaching, regardless of their area of specialization, are encouraged to take courses in social work education, learning theories, and teaching strategies as an integral part of the educational plan. Teaching practica can be arranged. Students can pursue special interests through individual reading and tutorial courses. In addition, regular course offerings in other departments of the University are available to students, and joint offerings have and continue to be developed. To the extent possible, practical experiences on faculty-conducted research projects are made available to doctoral students.

A total of 36 credit hours of course work is required, plus 18 hours of dissertation credit. A qualifying examination, given after completion of the program core, determines each student’s eligibility for degree candidacy. The degree is awarded following successful completion of the dissertation.

The school reserves the right to require additional courses which may not be credited toward the doctoral requirements, if the faculty believes the student has insufficient knowledge in core areas of the curriculum.

Formats of the Ph.D. Program
In response to the differential needs and interests of potential Ph.D. students, MSASS offers two formats for meeting course and degree requirements. Program requirements under both formats include taking 12 courses (36 credit hours), passing a qualifying exam, and completing a dissertation. The alternative program structures are:

The Full-Time 14-Month Program
Under this format, full-time students can complete course requirements in a minimum of 14 calendar months. This intensive study plan requires total commitment to Ph.D. study during this period of time.

Full-time Ph.D. Program
First Summer
SASS 608 Philosophy of Science and Theory Building (required)
SASS 610 Theories of Human Behavior: Macro and Micro Dimensions (required)
SASS 613 Advanced Research Design (required)
Fall Semester
SASS 615 Social Statistics and Data Analysis (required)
SASS 614 Models of Qualitative Research (required)
SASS 609 Theories of Social Welfare and Social Justice (required)
January Term
SASS 624 Models of Social Work Practice or
SASS 695 Social Welfare Policy and Planning Models (one required)  
Spring Semester
SASS 625 Social Work Practice Applications or
SASS 694 Models of Service Delivery (one required)
SASS 618 Measurement Issues in Quantitative Research (required)
SASS 617 Specialization Seminar (elective)
SASS 630 Seminar in Social Work Education (elective) & Praxis (elective)
SASS 637 Independent Study
Dissertation (SASS 701/18 credit hrs.)

The Summer Study Program
Course work and residency requirements for the Summer Program can be completed during three summers and two January interim periods. This format is designed to accommodate social work educators and professionals who must maintain their employment commitments, but wish to pursue Ph.D. study during the summer residence. Under both formats, all students will begin the program the first Monday in June with an intensive six-week period of study. During this time they will take three core courses. Students must devote full time to study during this six-week period. Summer program students will have a one-week period of study in January, a second six-week period of study following the summer, a second one-week period in January, and finally a third six-week summer period. During the fall and spring semesters of the first year, Summer Study Students take two graduate level stati

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Summer-study students will complete the qualifying examination prior to their third summer of residence. It is expected that the third summer will be devoted to preparation of the dissertation prospectus, as well as completion of course requirements.

**Admission to Doctoral Program**

Through the School of Graduate Studies of Case Western Reserve University, the Mandel School of Applied Social Sciences offers a Ph.D. in social welfare. To be admitted to the Ph.D. program, a candidate should have a master’s degree from an accredited school of social work or a master’s degree in a related field and demonstrate a superior record in undergraduate and graduate studies. Practical experience in social welfare is required. Application to the Ph.D. program will be considered from persons with master’s degrees in allied fields with the recognition that their program will include equivalency requirements related to knowledge of social welfare. Students without a master’s in social work may be interested in the dual degree M.S.S.A./Ph.D. program. The Miller Analogies Test or Graduate Record Examination is required for application to the Ph.D. program. Applicants should have a score of at least 1,100 on the combined Verbal and Quantitative section of the Graduate Record Examination or 60 on the Miller Analogies Test. A minimum grade point average of 3.0 for baccalaureate and master’s degree study is expected.

Additional materials considered in reviewing applications include the completed application form and a written statement, with the non-refundable application fee (waived for students from other countries); official transcripts of all previous undergraduate and graduate courses taken for credit; and letters of recommendation. In addition, students from other countries must submit results of the Test of English as a Foreign Language (TOEFL) or its equivalent. General inquiries about the advanced programs and requests for application forms should be directed to:

**Dissertation Requirements**

Each candidate for the Ph.D. degree must submit a written dissertation as evidence of his or her ability to conduct independent research at an advanced level. The dissertation must present a significant contribution to knowledge in the student’s field, and at least a portion of the content must be suitable for publication in a reputable professional journal or as a book or monograph.

The dissertation prospectus must be completed and accepted within two calendar years after the student has been admitted to candidacy. It is to the student’s advantage to make steady progress in his or her research and aim for early completion of the dissertation. Before a candidate leaves the school as a full-time student, he or she should have formulated the topic, been assigned a dissertation advisor, and had the dissertation prospectus approved by a faculty committee constituted for this purpose.

Once a student registers for SASS 701, Dissertation, he or she must continue to register each succeeding regular semester (fall and spring) until the dissertation is complete unless granted a leave of absence. The minimum requirement for the dissertation is 18 hours. The minimum acceptable registration is three semester hours per semester, until 18 hours are completed.

All requirements for the Ph.D. degree must be completed within a period of five consecutive calendar years after a student is admitted to candidacy, including periods of leaves of absence. For students whose leaves of absence are for duty in the armed
services, the time limitation will be extended by their period of service.

**Doctoral Program Financial Aid**

Financial aid is available to admitted students in the form of tuition assistance and research and training assistantships. Policies of the doctoral program regarding international students and registration are the same as those of the master’s degree program described in the MSASS bulletin. Grading policy is the same as that for the master’s degree program.

**Continuing Education Program**

Opportunities to increase practical knowledge and skills are offered to human services practitioners in a variety of workshops, institutes, and cosponsored events. Every effort is made to provide practitioners with information that addresses (1) current social issues and practical problems; (2) basic principles and concepts applicable to a wide range of services; and (3) innovative approaches to direct services, staff development, management, and planning.

Over 130 courses are offered throughout the year on campus and at selected off-campus sites. New offerings are developed in response to the demands of practice and to the needs of public and voluntary agencies at all levels. Social Work Licensure Examination Review Courses are offered three times per year.

MSASS is approved by the Ohio Counselor and Social Worker Board to provide continuing professional education to social workers and counselors. Courses offered in the MSASS Continuing Education Program usually meet license renewal requirements for these and other professionals: i.e., psychologists, nurses, nursing home administrators and chemical dependency counselors.

General inquiries should be sent to the Director, Continuing Education, Mandel School of Applied Social Sciences, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio 44106-7164. Brochures describing these programs are issued regularly, and individuals are placed on a mailing list on request.

**Course Descriptions**

**Applied Social Sciences (SASS)**

- **SASS 401. Field Education I (2)**
- **SASS 402. Field Education II (4)**
- **SASS 495. Field Education Seminar (1)**
   This seminar prepares students for entry into field education. The course introduces students to a number of topics that are considered basic to beginning the social work field practicum.
- **SASS 500. Special Topics in Applied Social Sciences (1-6)**
- **SASS 503. Field Education III (4)**
  Prereq: SASS 402.
- **SASS 504. Field Education IV (4)**
- **SASS 515. Family Caregiving (3)**

The purpose of this interdisciplinary graduate-level seminar is to explore the theoretical research, policy, and practice issues related to informal caregiving of the elderly. Topics will include the historical and cultural context of family caregiving, theoretical paradigms (i.e., adult development, stress and coping), characteristics of caregivers (i.e., gender, relationship, race, ethnicity, employment status, geographical setting), characteristics of the elderly care-receiver (i.e., type of cognitive and physical impairments), ethics, physical and mental health outcomes, service delivery issues, institutionalization, and bereavement. Through readings, discussions, guest lectures, and paper presentations, students will learn about the complexities of informal caregiving of the elderly from a range of disciplinary perspectives in order to improve assessment and practice skills in a variety of settings. Students are encouraged to focus on issues relevant to their discipline, specialization, or field of practice for their seminar papers.

- **SASS 574. Legal Issues in Social Work (3)**
  This course surveys the legal system as it affects social work, either direct service practice or the development of human service policies and programs. Students are exposed to the basic trial court procedures and have the opportunity to develop necessary skills to testify. A paper is required in which the student analyzes and integrates the legal and social work issues on a proposed topic of interest.

- **SASS 575. Travel and Study Seminar (3)**
  This course acquaints the student with the socio-political factors that influence the development of social welfare systems in a selected country and the impact of these systems on the development and functioning of individuals, families, groups, or communities. The role of the emerging social work profession in social change is explored via the social welfare system. Topics focus on the health care, mental health, aging, child, and/or educational systems and are oriented towards direct practice, management, or community development.

- **SASS 586. Ethical Issues in Social Work Practice (3)**
  The main focus of the seminar is to relate ethical principles to direct practice. Through lecture, discussion, group projects, and case examples, students gain a deeper understanding of ethical issues related to confidentiality, justice, client autonomy, whistle blowing, and other areas of great importance to social work practice today.

- **SASS 590. Field Practice (1-12)**
- **SASS 594. Independent Study Abroad (1-12)**
  (Credit as arranged.)
- **SASS 598. Individual Reading (1-12)**
  Prereq: Special written permission needed. See MSASS registrar.
- **SASS 608. Philosophy of Science and Theory Building (3)**
  This is a required foundation course. The nature of theory is examined. Inductive and deductive methods for knowledge building are reviewed. Course content draws from philosophy of science as well as empirical and phenomenological research.
- **SASS 609. Theories of Social Welfare and Social Justice (3)**
  This is a foundation course required for all students. Theories of social welfare and social justice are examined. Course content draws from moral philosophy, economics, political science, cultural anthropology, sociology, history, psychology, and social welfare theory and provides students with a broad orientation to the field of theoretical social welfare.

- **SASS 610. Theories of Human Behavior: Macro and Micro Dimensions (3)**
  This course deals with labeling, socialization, ecological, structural-functional, and conflict theories as macro-level theories. The course ends with a review of cultural, social reproduction, and postmodern orientations.
- **SASS 613. Advanced Research Design (3)**
  This foundation course in research methods is required of all students. It is a prerequisite to the quantitative and qualitative courses. Research designs and methods relevant to social welfare planning, policy development, practice and administration are examined.
- **SASS 614. Models of Qualitative Research (3)**
  This required course introduces the social scientific paradigms for qualitative research and then explores varying qualitative research strategies, methods of data collection and analysis, and standards of evaluation. Political and ethical issues raised by qualitative research are considered.
  Prereq: SASS 608, SASS 613, and SASS 618 (recommended).

- **SASS 615. Social Statistics and Data Analysis (3)**
  This foundation course (or its equivalent) is required of all students. Content includes univariate, bivariate and inferential statistics, and the use of electronic data processing technology to manage and analyze data.
- **SASS 616. Multiple Regression and Analysis of Variance (3)**
  This course builds on SASS 615, and either it or its equivalent is required of all students. Content focuses on using analysis of variance and multiple regression.
SASS 617. Specialization Seminar (3)
This course focuses on problem definitions and research issues related to specialized populations, fields of service and practice roles. The issues selected as the focus are based on faculty and student interests. Prereq: SASS 614 or SASS 618.

SASS 618. Measurement Issues in Quantitative Research (3)
This required course covers the operationalization of social science concepts and development of methods for their measurement. Issues covered include index and scale construction, validity, reliability, generalizability theory, multi-dimensionality, questionnaire design, interviewing, and experimental control.

SASS 624. Models of Social Work Practice (3)
This is the first of two required courses for students specializing in direct practice. It critically analyzes major models of current practice, including the traditional, unitary and radical approaches. The course is designed to examine the development of practice theory, to develop a framework for the analysis of theory and to study the content, structure applications, and implications of the three models.

SASS 625. Social Work Practice Applications (3)
This is the second of two courses aimed at the analysis and development of models of direct practice. Student works on the construction of an approach to practice related to his or her interests. Prereq: SASS 624.

SASS 630. Seminar: Social Work Education (3)
The first of two courses preparing students for careers in academe. Examination of the structure and content of American higher education. Emphasis is placed on program design and curriculum and course development.

SASS 632. Research Project (3)
This course provides students with the opportunity to work with specific faculty engaged in research studies either on an individual or group basis. Prereq: SASS 614.

SASS 635. Methodological Issues in Qualitative Research (3)
This course builds on SASS 614, Models of Qualitative Research. It focuses on the application of specific qualitative data-collection methods, data-analytic approaches, and strategies for representing findings from qualitative investigations. Prereq: SASS 614.

SASS 637. Individual Reading (1-18)
This is an individual reading course permitting students to select areas of interest and pursue these interests with specific faculty. (This also is the course number to register for dissertation credits before passing the qualifying examination.)

SASS 642. Teaching Practicum (1-6)
Students interested in experiential learning within social work education can arrange a teaching assistantship within the M.S.S.A. curriculum.

SASS 646. International Social Welfare (3)
This elective course focuses on social welfare programs and services in selected industrialized countries, with particular attention given to comparison of income maintenance and social service programs. Frameworks for cross-national analysis are examined and various national programs are evaluated in the context of these frameworks.

SASS 694. Models of Service Delivery (3)
This course is required of all planning and policy development students. Content includes specific social science content relevant to social welfare planning.

SASS 695. Welfare Policy and Planning Models (3)
This seminar focuses on the analysis of social welfare policy. Tools of policy analysis and frameworks for policy analysis are examined and criticized. Policy alternatives are considered from an analytical and comparative perspective. Attention also is given to policy development and implementation with emphasis on program planning and evaluation.

SASS 701. Dissertation Ph.D. (1-18)
This course is intended for students who have passed the qualifying examination and are actively working on their dissertation.

Problem, Policy, Program (SPPP)

SPPP 470. Social Policy (3)
This course provides basic perspectives on social policies related to poverty, health, aging, mental health, substance abuse, and discrimination. An analytical framework is used to systematically identify, define, and analyze social problems and policies. The course also introduces the student to social planning and service delivery.

SPPP 500. Special Topics in Social Work Policy (3)
This seminar course is intended for students who are interested in exploring advanced topics in social policy.

SPPP 502. Alcohol and Other Drug Abuse Policy and Service Delivery (3)
This course explores selected current alcohol and other drug abuse (AODA) problems using a problem analysis framework. Emphasis is placed on current and past AODA problem definitions as they affect policy and program development. Conceptualization of the problems resulting from AODA patterns of use and abuse, causation theories, the impact of cultural and social diversity as well as discrimination upon all client systems, and the role of local and national institutions which advocate for this population group are reviewed. Prereq: SPPP 470.

SPPP 510. Mental Health Policy and Service Delivery (3)
This course is designed for students preparing for careers as social workers in the mental health field with an understanding of mental health policy and service delivery at the federal, state, and local levels. Through readings, lectures, discussion, and written assignments, the course will aid students in developing a macro-level perspective of mental health policies and programs. Prereq: SPPP 470.

SPPP 511. Issues in Health Policy and Service Delivery (3)
This course examines health care policy issues and options, and highlights the development of health care policy in the U.S., the influence of health policy development, and the role of social work. It also examines the problems, policy, and program issues in the subsidy, financing, reorganization, and regulatory capacity of health policy. National, state, and local issues will be stressed. The course is for students in the health concentration but also welcomes students from other areas. Prereq: SPPP 470.

SPPP 512. Legislative and Political Process (3)
This course focuses on how to deal effectively with legislators, their staff, and legislative systems. The roles of money and information in legislative and political systems are examined. The process through which a bill moves to become law is explored, including critical points of intervention in that process. Lobbying legislators, including presentation of testimony and use of coalitions, is featured. Prereq: SPPP 470.

SPPP 513. Aging Policy and Service Delivery (3)
This course reviews current income, health, and social service policies for older Americans. It also investigates patterns and levels of care for the elderly. Trends and issues in policies and programs for seniors are analyzed in the context of the dimensions and differential characteristics of the aging population in the country. Some cross-national comparisons of services for the elderly are included in this analysis. Prereq: SPPP 470.

SPPP 520. Homelessness (3)
This course provides an understanding of homelessness and its incidence and prevalence, its origins, both historical and social, its consequences, and policy-based strategies for its prevention. The course investigates the impact of homelessness on single individuals, families with children, minorities, and vulnerable populations such as the mentally ill and alcoholics. Students, organized into a task force, examine a range of professional and community-based responses to the problem. The task force method enables students to assess the effects of public policy on homeless people, critique the effectiveness and adequacy of local shelter and service programs, and propose community-based strategies to prevent, stop, and better homelessness. Prereq: SPPP 470.

SPPP 525. AIDS Seminar (3)
This course is designed to provide an understanding of HIV/AIDS. The nature and prevalence of the disease, including its impact upon vulnerable populations such as children and youth, women, gay and lesbian populations, people of color, prisoners, IV drug users, and street people are examined. The course focuses on public policies, programs, and service delivery for HIV/AIDS at local, state, and national levels. Topics include the policy-making role of advocacy groups, the function of AIDS service organizations, and the design of educational and preventive programs. Prereq: SPPP 470.
SSPP 529. Child and Family Policy and Service Delivery (3)
This course focuses on major federal legislation impacting children, youth, and families, examined in the context of community based social work policy/practice. It builds upon the foundation course in social welfare policy and enables students to use an advocacy approach to provide policy-informed services and to participate in policy and implementation and change. Prereq: SSPP 470.

Research (SRCH)

SRCH 426. Introduction to Social Research (3)
This course provides an overview of the basic concepts used in the conduct of scientific inquiry and the tools of research methodology. It introduces students to the issues involved in the design, implementation, analysis and utilization of social research. Students are encouraged to focus on a practice-related research problem in their individual or group research projects, as well as to focus on research issues relevant to their specialization, field of practice, or field practicum setting. Students are alerted to the risks of cultural bias in research throughout the course through examples and scientific readings.

SRCH 530. Practice Evaluation (3)
This advanced course prepares direct practice students to examine their own practice with individuals, families, and groups. Attention is given to basic principles of measurement and selection of appropriate measurement instruments for use in direct practice settings. The course is intended to provide students with the technical skills necessary to investigate the components of social work practice and contribute to an empirically validated social work knowledge base. The student is asked to determine the efficacy of his/her practice intervention in field placement by using a suitable design and method. A hands-on project is required using clinical experience from field practice. Prereq: SRCH 426 and SASS 401.

SRCH 532. Needs Assessment and Program Evaluation (3)
This course is designed to introduce students to the design, implementation, management, analysis, and utilization of program evaluation research. The major rationales for this course are: 1) the strong need for accountability in social service delivery, 2) the need to remain current on developments in service interventions, and 3) the need to defend human service programs on the basis of effectiveness and efficiency. Students will develop their understanding and use of skills in the interpretation and conduct of different types of program evaluation, including needs assessment, monitoring/ process evaluations, and outcome/impact assessments. Students will learn to determine needs of client populations, whether program objectives are being achieved, whether programs are achieving outcomes, and whether program performance is efficient. Prereq: SRCH 426 or equivalent. Coreq: Advanced field placement, SSBT 534.

SRCH 536. Individual Research Practicum (3)
With instructor and research sequence chair approval, an individual program of supervised research experience may be undertaken. This course allows the student to tailor a program of applied research to a specific practice issue or program. Prereq: SRCH 426.

Socio-Behavioral Theory (SSBT)

SSBT 440. Human Development Over the Life Span (3)
This course offers an overview of normal individual development throughout the life cycle. Psychosocial theory, learning theories, and social role theory constitute the theoretical base for this foundation course. Developmentally determined objectives and tasks for every life stage are examined in the context of biological, genetic, psychological, familial, and sociocultural factors. Special emphasis is placed on the impact of gender, health, and minority status, and on community institutions of human development. This course supports the foundation social work methods course by introducing substantive content on human development as a framework for assessment, prevention, and intervention with psychosocial problems. Curricularly related to the advanced sociobehavioral courses on human development and developmental dysfunction, this course provides a basic understanding of normal human development, which can serve as a contextual framework for developmental deviations from the norm.

SSBT 500. Special Topics in Sociobehavioral Theory (1-3)
This seminar is intended for students who are interested in exploring advanced topics of current interest in sociobehavioral theory.

SSBT 501. Advanced Child and Adolescent Development and Dysfunction (3)
This course traces the development and dysfunction of individuals from conception through adolescence. It stresses transactions between the individual and his/her environment including schools, peers, community, and family. Special attention is given to the influences of poverty, gender, and ethnicity on development and dysfunction. A variety of etiologic perspectives are addressed in explaining the major maladaptive conditions of children and adolescents. Prereq: SSBT 440.

SSBT 508. Advanced Adult Development and Dysfunction (3)
This course examines broad perspectives on adult development and specific dysfunctions in adulthood. Several developmental theories are reviewed. The prevalent and serious emotional problems experienced by adults in our society are presented, with particular attention given to the social contexts in which these problems occur. Examples of such problems include marital dysfunction, family violence, maladaptive approaches to parenting, alcoholism and other addictions, depression, and suicide. The affects of poverty, gender, and minority status on development and dysfunction are addressed. Prereq: SSBT 440.

SSBT 520. Family System Theories (3)
This course covers development of the family over the life span, with an emphasis on normal family stages and tasks. Life cycle stages include marriage, parenting young children, families with adolescents, launching children and moving on, and families in later life. Divorce, remarriage, and forming a step-family are considered. The course covers a range of family forms based on culture and socioeconomics as well as changes in the family life cycle over time. Families coping with various life stressors, such as alcoholism or drug addiction, children with chronic illness or developmental disabilities, care of elderly family members, and living in impoverished conditions also are discussed. Prereq: SSBT 440.

SSBT 534. Organizational Theory (3)
This course enables students to understand the organizational conditions, processes and structures and the nature of human service organizations. The course covers various theoretical perspectives on organizations, including the issues of goals, power, leadership, effectiveness, efficiency, performance, clients and staffing. Special attention is given to the ways in which nonprofit human service organizations are similar to and different from other types of organizations. Prereq: SSBT 440.

SSBT 535. Human Sexuality (3)
The course addresses sexuality as an integral part of human functioning and human relationships throughout the life cycle. The formation of sexual identity is addressed, including gender identity, sexual orientation, and sexual intention. The physiological and psychological aspects of sexual behavior are covered, including the effects of aging, chronic illness, and sexually transmitted diseases. The course concludes with practical applications for social work, including an overview of assessment and treatment of sexual dysfunction. Prereq: SSBT 440.

SSBT 540. Theories of Groups, Organizations, Communities, and Social Class (3)
The course provides a foundation of knowledge about the theory, development, and behavior of groups, organizations, and communities and the influence of these meso- and macro-systems upon individuals and families. The course emphasizes the application and integration of theoretical perspectives on social behavior in relation to empowerment-oriented group work, administration, and community organizing. Prereq: SSBT 440.

SSBT 542. Child and Adolescent Psychopathology (3)
This course focuses on the dynamics, etiology, and description of diagnosable mental disorders in children and adolescents including disorders of behavior, conduct, affect, and thought. The physical, psychological, environmental, and social factors that contribute to mental disorders in children and adolescents are emphasized, along with treatment possibilities and social implications. Prereq: SSBT 440 and SSBT 501.

SSBT 546. Welfare Reform and Poverty (3)
This course identifies and critically analyzes major theories or urban poverty and their implications for social policy in contemporary American
society. Economic, sociocultural, cultural, and integrative theories of poverty are examined. Case studies of poverty theories for social policy and the elimination of poverty are addressed. Prereq: SSWM 440.

SSBT 548. Adult Psychopathology (3)
This course introduces the etiology and dynamics of anxiety disorders, mood disorders, personality disorders and psychoses of adults. The etiology of pathology will be examined in the context of theories on personality development, biological and sociocultural domains. Attention is given to treatment possibilities and the social implications of these disorders. Prereq: SSBT 440 and SSBT 508.

SSBT 555. Women's Issues (3)
This course examines theories that are relevant to the development and socialization of women and discusses issues that are relevant to women's lives within the context of oppression based on sexism, racism, ageism, homophobia, and other forms of discrimination. Emphasis is placed on assisting students in becoming more aware of the issues that are specifically relevant to their own development and socialization, and preparing for effective and sensitive professional practice by increasing knowledge about the issues facing women. Prereq: SSBT 440.

SSBT 584. Diversity, Discrimination, and Oppression (3)
This course provides students with a basis for developing their ability to value a diverse world and to understand how discrimination and oppression operate to limit the life opportunities of members of minority and disenfranchised groups. Students will have the opportunity to develop and enhance their personal and professional awareness of their own cultural identity and to use this as a basis for developing their competence to work with individuals and groups different from themselves. Selected theoretical perspectives will provide a descriptive and explanatory framework for critically analyzing the manifestation of discrimination and oppression and their impact on the affected populations. Social work's response to discrimination and oppression within the profession and in society at large will also be examined.

Social Work Practice (SSWM)

SSWM 400. Social Work Methods (3)
The foundation methods course is based on a generalist social work practice perspective incorporating a problem-solving methodology applicable to client systems including individuals, families, small groups, organizations, and communities. Emphasis is placed on developing skills with respect to relationship formation and engagement; data collection and assessment; goal setting and contracting; designing and implementing appropriate interventions; assuming appropriate practice roles; evaluation; and termination. Explicit attention is given to issues of human diversity and their impact on work with clients at all points in the social work process. The course isundergirded by relevant socio-behavioral and practice theories that emphasize the reciprocal nature of person-environment interaction and community-based practice.

SSWM 500. Special Topics in Social Work Methods (1-3)
This seminar course is intended for students who are interested in exploring advanced topics of current interest in methods. Prereq: SSWM 400.

SSWM 517. Family System Interventions (3)
This course covers the knowledge, concepts, and skills associated with working families. The practice method will reflect a family systems approach, integrating theories and approaches within a systemic perspective. It will build practice skills in assessing, interviewing, and intervening with families and emphasize a strength-based perspective on intervention with families. Considerations of family issues at different developmental stages will be presented. The issue of ethically competent and community-based social work practice with families will be stressed throughout the course for each content area. Prereq: SSWM 400 and SSBT 520.

SSWM 518. Death and Dying (3)
This course focuses on the concept of death and related topics from a social work perspective. Such topics include the role of death in American culture; the dying process and its institutions; assessment and intervention strategies; life span and family life considerations; and end-of-life decisions. The course provides both theoretical and experiential exposure to the dying process as it relates to self, the dying person, and the bereaved. Students will gain insight into serving the terminally ill, those who need assistance with mourning and grief, and clients dealing with difficult life-and-death decisions regarding loved ones. Prereq: SSWM 400.

SSWM 519. School Social Work Seminar (3)
This course prepares students to be certified school social workers. The course addresses major issues in American schools; a theoretical framework for school social work services; design, delivery, and evaluation of school social work services; legal and ethical issues; and the roles and intervention strategies of school social workers. It covers student and family problems and areas of need such as disability, truancy, divorce, teen pregnancy, youth depression and suicide, substance abuse, violence, and dropping out of school. This course is required for those participating in a planned program of study leading to state certification as a school social worker. If space permits, other students may enroll if they have or have had school social work experience. Prereq: SSWM 400.

SSWM 530. Managing Organizational Change (3)
This course provides a conceptual and practical understanding of planned change in human service organizations considering both organizational resources and achieving outcomes for clients. Skills and strategies for identifying needs for change, preparing and managing a change process, and institutionalizing change are critically examined. Prereq: SSWM 400 and SSBT 540.

SSWM 531. Strategic Alliances (3)
This course provides organizational leaders with the concepts and practices critical to the development of interorganizational alliances, from affiliations to mergers and consolidations. Various strategies are examined and existing community-based national and international linkages are explored. Prereq: SSWM 400 and SSWM 540.

SSWM 541. Attracting Government, Foundation, and Corporate Support (3)
This course reviews the trends, types of support available, sources of information, processes for accessing, criteria for decision-making, and the ‘politics’ of grant, contract, in-kind, or other support. Preparation of winning proposals constitutes a special focus. Nonprofit organizations’ accountability, stewardship, and recognition responsibilities or activities are explored. Prereq: SSWM 400, SSWM 544, and SSWM 545.

SSWM 542. Conducting Annual, Federated, and Membership Campaigns (3)
This course focuses on the planning, implementation, and evaluation of annual funds, federated campaigns, and membership campaigns. Special attention is paid to direct mail fundraising, telemarketing, phonathons, and special events fundraising. Computer software options and the selection and use of consultants are highlighted. Prereq: SSWM 400, SSWM 544, and SSWM 545.

SSWM 544. Budgeting and Financial Management in Social Service Organizations (3)
Social service managers must be both responsible and accountable for the management of resources that enhance the provision of effective and efficient services to clients. In this course, students obtain an understanding of the skills, tools, and strategies needed to plan for the financial stability of their organizations. Students use a critical thinking perspective to examine budgetary and financial choices. They are able to understand the impact of power and politics in budget and financial processes. In addition, they are able to recognize ethical dilemmas that are often inherent in financial decision-making. Students demonstrate their understanding of program budgeting, financial reporting, and monitoring as well as other resource management concerns that affect human service managers and organizations. Prereq: SSWM 400.

SSWM 545. Social Program Design (3)
Students develop skills and techniques for forming social agencies and designing social service programs. The course addresses the demands of multiple constituencies (clients, other agencies, legislators, the legal system, etc.) and competing values (the ability to be flexible versus the need for control and to work both inside the organization and outside its boundaries). It presents an approach that focuses on establishing outcome-based goals and interventions. Prereq: SSWM 400.

SSWM 546. International Social Work (3)
This is an advanced seminar designed for students interested in the international dimensions of the social work profession and social work prac-
tice. The seminar focuses on commonalities and differences in the roles and functions of social workers in different nations. It also gives attention to social work as a global profession and social work practice on an international level. Prereq: SSWM 400.

SSWM 564. Interventions in Alcohol and Other Drug Abuse (3)
The course provides a bio-psychosocial approach to prevention, assessment, and treatment of alcohol and other drug abuse problems. This course introduces the student to the etiology and treatment of alcohol and other drug abuse in the context of social work practice. The historical background of alcohol and other drug treatment interventions, self-help groups, and conceptual models of addiction are presented. Students explore their own attitudes and values toward AODA problems and how these affect treatment outcomes as well as the development of programs. Emphasis is placed on current screening and assessment techniques and prevention and treatment issues in social work practice with alcohol and other drug abuse. Prereq: SSWM 400.

SSWM 565. Community-Based Practice with Children and Families (3)
This course covers knowledge, concepts, and tools associated with contemporary child welfare practice. The practice method reflects a family-centered or family-based approach, meaning that the welfare of children cannot be considered separately from the families of which they are a part. For each topic area, major social work roles, activities, tasks, and skills are explored along with problems and issues in implementation. Program exemplars and case studies are presented for illustration purposes and practical application of the skills and techniques presented. Child welfare services that promote safety, permanency, and child well-being are presented. Consideration of family needs at different developmental stages of the child and family life cycle are also presented. The issue of culturally competent community based social work practice is stressed throughout the course for each content area. While this is primarily a methods course, program delivery and policy issues are discussed as they relate to the socio-political and organizational contexts of practice. Prereq: SSWM 400.

SSWM 567. Community Organization and Development Strategies (3)
This course demonstrates the application of social science theory to the issues of economic and neighborhood development. It illustrates how social workers can refine their role, skills, and understanding of techniques in community organization, and presents strategies for economic and housing development. Prereq: SSWM 400 and SSBT 540. Cross-listed as MAND 467.

SSWM 569. Management of Community Based Development (3)
This course examines the fundamentals of building and managing an effective community development organization. Students will develop an understanding of community development with a focus on housing, economic development, and community building. Community building integrates family development, education and health, housing, and economic development. The use of technology as a tool in community development is covered. Prereq: SSWM 400, SSWM 544, SSWM 545, and SSWM 567. Cross-listed as MAND 469.

SSWM 571. Case Management (3)
This course addresses case management as an interdisciplinary human service intervention and examines the social, policy, programmatic, and practice factors that shape the delivery of case management services. A variety of models of case management are covered, along with their respective implications for social work practice. Multiple perspectives of consumers of case management services are addressed. Prereq: SSWM 400.

SSWM 573. Home-Based Family Interventions (3)
This course provides students with an in-depth, comprehensive understanding of family preservation services and practice. Home-Based Family Interventions encompasses the values, attitudes, beliefs, knowledge base, and skills necessary for the beginning home-based worker. The course reviews the theories that guide family-centered services, examines models of family preservation services across various service systems, reviews current research on home-based services, and teaches skills or competencies necessary for home-based family work. A variety of teaching methods is used to learn, observe, and practice new skills. Prereq: SSWM 400.

SSWM 574. Integrative Seminar in Alcohol and Other Abuse (3)
This course builds upon the material presented in the methods course (SSWM 564) in alcohol and other drug abuse. It is intended as an elective course for students who are interested in developing their clinical skills in AODA and in enhancing their abilities to conduct an empirically-based practice with AODA clients. Course objectives include integrating clinical and research knowledge about AODA; strengthening the student’s clinical skills in AODA practice; focusing on the complexity of comorbidity issues of AODA practice including, but not limited to, mental health problems, sexual victimization, and domestic and family violence; and recognizing policies and practices relevant to cultural diversity, gender differences and discrimination in social work practice with AODA problems. Prereqs: SSWM 400 and SSWM 564.

SSWM 575. Social Work With People Who Have Chronic Mental Illnesses (3)
This course focuses on people who have severe mental illnesses. Students learn primary and tertiary community-based treatment and rehabilitative approaches, services, and programs. In helping people achieve recovery, students learn the theory and practice skills that underscore the four major approaches to community-based service delivery: the assertive case management model; strengths case management model, psychosocial rehabilitation model, and the recovery model. Within each model, specific attention is placed on practice similarities and differences, especially in interviewing assessment, and intervention. Within these practice skills, students learn how to identify social justice and empowerment values that are supported or undermined. Advocacy is highlighted as a central social work value and practice skill that cuts across community-based practice models. Finally, lectures, readings, and discussions examine how gender, ethnicity, and social class produce various experiences of mental illness and various social work interventions. Prereq: SSWM 400.

SSWM 579. Cognitive Behavioral Interventions (3)
This course acquaints students with the theoretical, conceptual, and skill bases of several cognitive-behavioral approaches to practice. Topics include assessment, use of tasks and homework, coping skills, cognitive restructuring, and problem solving approaches to practice. The course draws upon students’ field and work experiences to illustrate the application of the concepts and skills under discussion. Prereq: SSWM 400.

SSWM 580. Mental Health Practice with Children and Adolescents (3)
This course will focus on developing specialized knowledge and social work techniques related to professional social work in such settings as hospitals, child guidance agencies, family service agencies, mental health centers, and residential treatment centers. Concentration will be on assessment of normal and pathological social functioning as related to age-appropriate development, adaptations of psychotherapeutic principles to social work interventions, maximizing individual, family and environmental strengths in each situation as guidelines for offering help. Prereq: SSWM 400 and SSBT 501.

SSWM 581. Social Work with Older Populations (3)
This course in gerontological social work provides advanced content in working with elderly people and their families in the community and in residential settings. Using a biopsychosocial approach, the course explores various issues of later life including, but not limited to, retirement, social roles, depression, social networks, and grief. Specific attention is paid to assessment and diagnosis, goal setting, and rationale for selection of treatment approach. Prereq: SSWM 400.

SSWM 582. Social Work in Child Abuse and Family Violence (3)
This course addresses the etiology, investigation, and treatment of child abuse including sexual abuse and the roles of child welfare, health, and mental health agencies. Particular attention is given to direct work with children and adults who have experienced abuse, and to interventions in instances of family violence. Prereq: SSWM 400 and SSBT 501.

SSWM 583. Mental Health Practice with Adults (3)
This course builds on the content from required foundation social work methods, policy, and advanced sociobehavioral theory courses. It complements the content of advanced methods courses, including Social Work with People who Have Chronic Mental Illness (SSWM 575), Social Work in Child Abuse and Family Violence (SSWM 582), and Interventions in Alcohol and Other Drug Abuse (SSWM 564). This course explores currently prevailing theoretical perspectives to mental health practice with
adults, including cognitive theory, behavior theory, crisis theory, and structural theory informing ego psychology. Specific focus of attention is on the newly evolving object relations theoretical frameworks to practice. Risk status—including the effects of poverty, gender, culture, discrimination, and oppression—is considered in the treatment process and in the utilization of mental health services to adults. The empirical and value base of interventions is examined. Prereq: SSWM 400 and SSBT 508.

SSWM 584. Social Work with Couples (3)
This course provides an overview of assessment and intervention methods for working with couples around issues of marriage, divorce, and remarriage. Alternate couple forms are discussed. The course emphasizes systems and social learning approaches, communication and negotiation in problem solving and its relevance to assessment, treatment structure, and techniques. Special attention will be given to problem areas such as commitment, sexual dysfunction, chemical dependency, and destructive communication patterns. Prereq: SSWM 400.

SSWM 585. Social Work with Groups (3)
A theoretical formulation of the social group work method as a problem solving process is addressed. Exercises are presented in the use of diagnostic skills to determine individual needs and problems for which groups may be helpful, the worker’s role in facilitating group functioning through his/her use of various program media. Attention is given to the significance of goals, agency environment, and policy for direct work with groups. Prereq: SSWM 400.

SSWM 586. Race and Class: Implications for Social Work Practice (3)
This course provides students with the opportunity to integrate concentration content within a perspective focusing on social work practice within the context of race and class. Specific attention will be focused on the development of a practice model that takes into account the impact of race and class on social functioning. Students will explore the effects of race and class on critical life areas such as education, housing, access to health care services, and the involvement with the justice system. Prereq: SSWM 400.

SSWM 589. Social Work Interventions in Chronic Illness (3)
This course is an interest-focused seminar, which consists of the instructor’s didactic presentations and students’ individual presentations. The instructor addresses the unique features of practice in healthcare settings within a community-based context perspective. Various social work interventions appropriate for use in healthcare are explored. Additional content focuses on developmentally determined issues for chronically ill children, adolescents, young adults, middle-aged adults, and older adults, including sensitivity to issues of diversity in practice populations. Students select one chronic illness for intensive study. The chronic illness must be an organically-based disease process, not a mental illness or an addiction. Prereq: SSWM 400.
School of Dentistry
School of Dentistry

10900 Euclid Avenue
Phone 216-368-3200; Fax 216-368-3204
Jerold S. Goldberg, Dean

The School of Dentistry is a professional school offering a curriculum leading to the Doctor of Dental Surgery degree (D.D.S.). Advanced Education Programs in the dental specialties are also available. The School of Dentistry also offers a program of continuing education courses for dental practitioners and auxiliaries including dental laboratory technicians.

The School of Dentistry was organized June 21, 1892, as the Dental Department of Western Reserve University. For the first 25 years of its existence, the school was located in downtown Cleveland. In 1917, the School of Dentistry became an integral part of the University and now occupies a building adjacent to the schools of medicine and nursing and University Hospitals of Cleveland.

The School of Dentistry is a member of the American Association of Dental Schools and all of the programs of the School of Dentistry are accredited by the Commission of Dental Accreditation. Since its organization, it has conferred degrees on approximately 4,500 graduates.

Administration

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Dean of the School of Dentistry; Professor of Oral and Maxillofacial Surgery

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Associate Dean for Clinical Affairs; Professor of General Practice Dentistry and Chair of the Department

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Assistant Dean and Director of Development and Alumni Affairs

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Director of Student Services

David A. Dalsky, B.A., M.Ed. (Kent State University)
Director of Admissions

John W. Smolik, M.B.A. (Baldwin Wallace College)
Director, Finance and Operations

Faculty

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Associate Professor of Pediatric Dentistry and Chair of the Department

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Associate Professor of Oral Diagnosis and Radiology; Associate Dean for Academic Affairs
The Cleveland Health Sciences Library (CHSL) was formed in 1966 by an agreement between the Cleveland Medical Library Association (CMLA) and Western Reserve University. CHSL operates in two locations: the Allen Memorial Medical Library and the Health Center Library (HCL). The total collection currently numbers 380,000 volumes. More than 1,177 journals are received.

The Allen collection, strongly clinical, serves private and institutional members of the Cleveland Medical Library Association as well as faculty and students of Case Western Reserve University.

The Health Center Library collection of basic science materials is primarily for faculty and students of the schools of dentistry, medicine, and nursing and the department of biology.

The Dittrick Museum of Medical History, located on the third floor of the Allen Library, contains nearly 20,000 objects related to the history of medicine, dentistry, and pharmacy, with special emphasis on Cleveland and the Western Reserve. The museum also contains a medical archives collection and a rare book room.

Reference staff in both libraries help and instruct patrons in the use of the library and its bibliographic resources. Items not available on campus may be obtained through interlibrary loan. Other services provided are quick telephone reference, citation verification, computerized or manual bibliographic searches, and access to the internet. The library staff can provide on-line searching of more than 100 data bases.

### Hospital Affiliations

The School of Dentistry has working relationships with many hospitals and health clinics in the Greater Cleveland community. Students have the opportunity to function as dentists and observe hospital routine and operating room techniques in these hospitals. Many members of the faculty hold staff appointments in these extramural health facilities.

University Hospitals is a 974-bed tertiary care facility located across the street from the School of Dentistry. Graduate departments in Oral & Maxillofacial Surgery and Pediatric Dentistry are based at this facility. A variety of educational and research opportunities exist in relation to this affiliation.

The Veterans Administration Hospital is a modern 780-bed hospital in the University Circle area. The hospital provides dental services for both outpatient and inpatient veterans.

### The Free Clinic

The Free Medical Clinic of Greater Cleveland, at 12201 Euclid Avenue, is a nonprofit community service organization that presently offers medical, dental, pediatric, and legal services, as well as family planning and psychological counseling programs for adults and children; provides a patient advocacy program and speakers for community education and training at other health agencies; and operates a hotline seven evenings a week.

Dental students may volunteer their services to any of the programs at the clinic. However, most participate in delivering dental care to the indigent; this also increases students' skills in emergency and comprehensive patient care.

### The Profession of Dentistry

The mission of dentistry is the protection and improvement of the health of individuals and society with a concentration on oral health. Professional activities encompass a wide variety of endeavors including the clinical care of individuals, the prevention of disease, the discovery of new knowledge, and the development of procedures and policies that protect and improve health, especially for those populations at risk for disease.

Because oral health is an important concern of society, the role of the dentist continues to be essential and rewarding. Men and women who are interested in scientific studies directly related to the welfare of people should find a strong appeal in dentistry as a life work. It offers an unusual opportunity for public service, community respect, and the use of originality, compassion, and substantial skill and independent judgment on a daily basis.

### Mission Statement

The mission of the Case Western Reserve University School of Dentistry is to efficiently provide contemporary programs in oral health education, patient care, research and scholarship, and service that are attractive to our constituents. We will accomplish this in an environment which fosters collegiality and professionalism, and that enables a diverse group of students to become competent practitioners of dentistry.

### Dental Education Program

The students who enter the School of Dentistry are very carefully selected and already have had many opportunities for intellectual and social development. The years in dental school
should permit the continued maturation of the individual and should emphasize the basic knowledge and skills which are common to all dentists. Graduates should continue their dental education during their professional careers and add to the basic concepts taught in dental school by studying the literature and by attending continuing education courses. While in dental school, the student develops an attitude of professionalism and a sense of responsibility toward the patient’s welfare, which will provide optimal dental care.

The Committee on Dental Education studies, reviews, and evaluates the school’s educational goals and objectives, subject matter, grading systems, and clinical and laboratory experiences.

Continuing Education

The School of Dentistry, in conjunction with the Greater Cleveland Dental Society, offers an expanding program of continuing dental education to practicing dentists and auxiliary personnel.

Guest lecturers, including faculty, who have distinguished themselves in one of the many specialty areas of dentistry present courses on an annual basis.

The continuing education courses encompass the expanding horizons of dentistry, covering such subjects as endosseous implants, periodontics, oral medicine, endodontics, dental materials, aesthetic dentistry, restorative and prosthetic dentistry, occlusion, practice management, and orthodontics, as well as expanded functions for dental auxiliaries.

These courses are designed to keep the practitioner abreast of current procedures and enrich the participant’s knowledge of the newest and most accepted advances in all subjects of dentistry. Courses may include subject matter of an experimental and/or controversial nature. This material is offered to the profession for educational and informational purposes in a spirit of academic freedom. Participants are given the opportunity to weigh the validity and usefulness of this material according to their own professional experience and judgment.

Case Western Reserve Dental School continuing education courses are eligible for fellowship credit through the Academy of General Dentistry (AGD). The Case Western Reserve University Dental School continuing education program is a ADA-recognized provider (Continuing Education Recognition Program.)

License to Practice Dentistry in Ohio

Currently the license to practice dentistry is granted by the Ohio State Dental Board after successful completion of appropriate examinations.

The candidate must be 21 years of age, show evidence of good moral character, and affirm that he or she understands the Ohio Dental Law.

Specific information about licensure in Ohio and other states should be obtained from the individual state boards of dentistry.

Admission

Admission to the D.D.S. Program

The Case Western Reserve University School of Dentistry is a participant in the American Association of Dental Schools Application Service (AADSAS). An application request card may be secured from either AADSAS, 1625 Massachusetts Avenue, N.W., Suite 101, Washington, D.C. 20036, or from the School of Dentistry. It is advantageous to initiate the application procedure as early as possible. You may choose to submit your application electronically or download and print the application via the application service home page www.ADEA.org.

Application may be initiated as early as June of the year before intended registration. Applications may be forwarded before the completion of prerequisite course work and the Dental Admission Test. At the time the application is forwarded to AADSAS, the application fee of $45 (see financial information) should be forwarded to the School of Dentistry. The applicant should request the Council on Dental Education of the American Dental Association, to forward a Dental Admissions Test transcript to the School of Dentistry. When the application is complete, it will be reviewed by the Admissions Committee. If additional material is required, it will be requested after review of the application. The committee reviews applications continuously throughout the year.

Dental Admissions Test

All applicants are required to take the Dental Admissions Test, which is conducted by the Council on Dental Education of the American Dental Association, in electronic format at Sylvan Learning Centers. The School of Dentistry recommends that the test be taken no later than April of the year before the expected date of application. The scoring of the Dental Admissions Test is on a range of 1 to 30, with the mean score being 16; each integer represents one half of one standard deviation.

Personal Interviews

All accepted applicants to the School of Dentistry are interviewed by the Admissions Committee before acceptance. Since it is physically impossible for the committee to interview every applicant, interviews are held only at the invitation of the committee. The Admissions Committee begins conducting formal interviews in August for entrance the following August. Early applications are encouraged and given priority, but the deadline is February 1st.

Academic Requirements

Matriculation at the School of Dentistry requires a minimum of 60 semester hours or its equivalent of collegiate courses exclusive of physical education and military training. Most applicants have completed three or more years of work toward a bachelor’s degree by the time they enter dental school.

Primary consideration is given to applicants with a superior grade point average in both overall course work and prerequisite pre-dental courses. All applicants are expected to have demonstrated competence in the basic prerequisite courses. Students likely to be given first priority are those who have achieved superior grades in the basic sciences and who have taken an adequate sampling of courses in the social sciences and humanities to give them a broad background. Candidates with major areas of concentration in fields other than the basic sciences are given equal consideration with those who have majored in the basic sciences.

In order to permit maximum flexibility in the selection of candidates, the school has established a limited number of specific prerequisite courses. These include a minimum of 12 semester hours of chemistry (of which 6 semester hours should be in organic chemistry), 6 semester hours in biology, 6 semester hours in physics, and 6 semester hours in English. All prerequisite science courses must include laboratory instruction. These minimal requirements permit superior applicants to pursue a variety of subjects in their areas of academic interest. Students who have difficulty in the prerequisite science courses are encouraged to pursue additional work in the sciences.

Pre-dental electives suggested by the Admissions Committee include comparative anatomy, cell biology, genetics, biochemistry, microbiology, and physiology. These courses are helpful in providing a foundation for the basic science courses to be taken in
dental school. However, advanced science courses should not be taken to the exclusion of courses in the humanities and social sciences, which are likely to enhance the applicant’s social and verbal skills and facilitate effective dealings with patients.

Advanced science courses most commonly taken during the undergraduate years by dental students include anatomy, biochemistry, calculus, cell biology, genetics, microbiology, and physiology.

Letters of Recommendation

The applicant should arrange to have letters of recommendation sent to AADSAS at the time the completed application is forwarded to AADSAS. These should be from the Pre-Dental Advisory Committee at the applicant’s college. If no Pre-Dental Advisory Committee exists, letters from two instructors in the basic sciences are acceptable. Additional letters may be requested by the Admissions Committee.

Deposit of Acceptance

In accordance with the guidelines of the American Association of Dental Schools, applicants will not be advised of acceptance before December 1 of the year preceding their enrollment. Acceptances on or after that date are provisional and are contingent on the applicant’s maintenance of an acceptable level of achievement throughout the remainder of the college program. Upon notification of acceptance, the applicant is required to make a deposit of $1,000, due 45 days from the date of acceptance. All deposits apply toward tuition and are non-refundable and non-transferable.

After January 1, the payment of the deposit is required no later than 30 days after notification of acceptance. By July 15, the balance of tuition for the first semester of the first year must be paid.

Advanced Standing

A student in good standing at another dental school or a graduate of a foreign dental school may be considered for advanced standing at this school. Acceptance is based on the review of credentials, personal interview, bench testing, and English language testing as applicable. Transfers for students attending other dental schools can be arranged only if schedules and course content at the other school are similar to those of the Case Western Reserve University School of Dentistry.

The transferring student or foreign-trained dentist must submit a written request to the Committee on Admissions of the School of Dentistry indicating a desire for transfer or be considered for advanced standing. Upon receipt, an application will be sent. In addition to the completed application form, the applicant must submit all undergraduate and dental school transcripts, Dental Admissions Test scores, Dental National Board scores, a letter from the dean of the school of current attendance stating that the applicant is in good standing, or in the case of a foreign graduate, a letter from the dean of the school attended stating that the student was graduated and at what rank, and other information deemed appropriate by the committee. The fee for application to advanced standing is $55 and must accompany the submitted application.

If the committee decides that a transfer or advanced placement is feasible, the applicant will be required to pass a laboratory “bench test” examination in the clinical sciences. All travel and lodging costs are borne by the applicant. An additional fee is charged for those who are required to take a “bench test” and is due at the time of the test.

Academic Regulations

D.D.S. Program

Registration

The act of registration includes the payment of the first semester tuition and the completion of the simplified registration form provided by the School of Dentistry. First-year students who do not register on the opening day of school and who have failed to provide satisfactory reasons in advance for the delay forfeit their right to admission. Vacancies which arise from such circumstances are filled from the list of alternate candidates at the discretion of the Committee on Admissions.

Registration must be completed by all upper level students within 10 days after the opening day of school. Under unusual circumstances, special arrangements may be made with permission of the dean. The Social Security numbers of students are used for all records and documents and must be provided at the time of registration. Foreign students will be issued a number for this purpose if they have not obtained a Social Security number prior to registration.

Grading Policy

The responsibility for assigning grades rests exclusively with the course director, who must announce the general method of grading at the beginning of the course. Course grades are reported to the registrar of the school at the end of the course or when a final grade has been determined if prior to the scheduled completion time for the course. Incomplete or conditional grades can be changed only by the course director in accordance with university policy.

The following grading system is used at the School of Dentistry for students entering the Doctor of Dental Surgery program:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Quality Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>4.33</td>
</tr>
<tr>
<td>A</td>
<td>4.00</td>
</tr>
<tr>
<td>A-</td>
<td>3.71</td>
</tr>
<tr>
<td>B+</td>
<td>3.33</td>
</tr>
<tr>
<td>B</td>
<td>3.00</td>
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<tr>
<td>B-</td>
<td>2.66</td>
</tr>
<tr>
<td>C+</td>
<td>2.33</td>
</tr>
<tr>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>C-</td>
<td>1.66</td>
</tr>
<tr>
<td>D+</td>
<td>1.33</td>
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<tr>
<td>D</td>
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<tr>
<td>D-</td>
<td>0.66</td>
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<tr>
<td>F</td>
<td>0.00</td>
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</tbody>
</table>

Grades not Averaged

IN .................. Incomplete and not averaged when received.
P .................... Passed and not averaged for pass/fail course.
NP .................. Failed and not averaged for pass/fail courses; Must be removed through remediation.

Grade point averages are calculated by multiplying the number equivalent of the letter grade by the number of credit hours for the course. The semester grade point average is computed by dividing the total number of grade points earned during a given semester by the sum of the credit hours for all courses in which the student received letter grades of A, A-, B+, ... or F taken during that same semester. The cumulative grade point average is computed by dividing the total grade points earned by the sum of the credit hours for all courses included in the grade point calculation. Grade points earned when an IN grade is replaced by the appropriate course grade are credited to the semester in
which the incomplete or course in progress grade was received, but action taken regarding student standing or promotion at the time of the incomplete is not affected.

Promotion
The general guidelines used by the Committee on Student Standing and Promotion are that each student must attain a grade point average of at least 2.0 for didactic courses and for pre-clinical technique/clinical courses by the end of the first semester, and each semester thereafter. Students may not be promoted with one or more failing or incomplete grades unless they have entered a remedial program to remove those grades by a deadline set by the course director or committee. In the usual case, the remediation must be completed no later than the end of the next regular semester or summer clinic session, whichever is sooner. Students cannot be graduated with any failing or incomplete grades and must have a minimum overall cumulative 2.0 grade point average. Each student’s academic performance is reviewed by the Committee on Student Standing and Promotion as soon as possible after the conclusion of each semester and summer clinic session. Additional review may occur after each eight week period or when grade reports are submitted. The committee sets standards of academic performance for promotion and standing, probationary requirements and remedial actions, and recommends candidates for graduation. The committee, at its option, may place a student on academic review, academic probation, clinical warning, clinical review, clinical probation, require repeat of an academic period, or require a student to withdraw.

The committee will notify each student in writing of their status at least twice each academic year; following the end of each semester and more frequently if necessary. The committee takes reasonable care to accurately evaluate each student and inform them of their status by letter in a timely manner. If a letter cannot be hand delivered, it will be mailed to the student’s official address. The committee reserves the right to reissue letters of standing or promotion at any time it deems necessary. It is the responsibility of the student to fulfill all academic, pre-clinical, and clinical requirements, and to abide by all official policies and protocols outlined in the student services and clinical policy manuals of the Dental School. For each semester of enrollment, the student is expected to achieve a grade point average of at least 2.0 for didactic courses and 2.0 for pre-clinical technique and/or clinical courses. Students who fail to meet these general guidelines may be placed on:

1. Academic review: The student has failed to achieve an acceptable level of performance in a limited number of courses and/or has not achieved a grade point average of at least 2.0. Academic review serves to warn the student that some improvement is required and future promotion may be withheld in the absence of demonstrated improvement. Academic review may, but not necessarily, precede academic probation or dismissal.

2. Academic probation: The student has failed to achieve an acceptable level of performance in a number of courses and/or has earned a grade point average deemed unacceptable by the committee. In being placed on academic probation, the student may continue in the program for the next semester, during which time the student must demonstrate an acceptable level of performance or be required to withdraw or repeat an academic period or year. In unusual circumstances, students may be continued on academic probation for one or more succeeding semesters. A student with two or more semesters of probation may become ineligible for federally-sponsored financial aid.

3. Clinical review: The student falls short of the minimum expectations for clinical performance, including demonstration of clinical skills and knowledge, patient management, conformity with infection control policies and procedures, attendance and clinical productivity. Clinical review serves to warn the student that some improvement is required and future promotion may be withheld in the absence of demonstrated improvement. Clinical review may, but not necessarily, precede clinical probation or dismissal.

4. Clinical probation: The student has failed notably to achieve an acceptable level of clinical performance in one or more of the following areas: clinical skills, clinical knowledge and appropriate application of that knowledge, patient management, conformity with infection control policies and procedures, attendance and clinical productivity. In being placed on clinical probation, the student may continue in the program for the next semester, during which time the student must demonstrate an acceptable level of clinical performance or be required to withdraw or repeat an academic period or year. In unusual circumstances, students may be continued on clinical probation for one succeeding semester.

A student may appeal an action of the Committee on Student Standing and Promotion. The appeal must be in writing, state the basis of the appeal, and be filed within 14 days of the issuance of the notification letter sent to the student informing them of committee action. The written appeal should be directed to the chairperson of the committee. The student may request or be invited to appear before the committee at the hearing of the appeal. The committee will inform the student in writing of the results of the hearing of the appeal. The student is advised to consult with the chairperson, the director of student services, or the associate dean for academic affairs for further information prior to filing the appeal so that the process can be fully explained and the student’s rights protected. The school reserves the right to require a student to withdraw from the school for any reason it deems sufficient. Academic or clinical failure, moral delinquency, gross misconduct, or failure to meet the specific conditions of probation or review is sufficient reason for requiring withdrawal from the school.

Terms and Course Length
The school year consists of 34 weeks of five days each, exclusive of vacations, and is divided into two semesters of two terms each. The final week of each semester is reserved for examinations. There are mandatory summer clinic and class sessions for all students at the end of the second and third years. A fee is charged for these summer sessions.

Attendance
Students enrolled at the School of Dentistry are expected to pursue their course of study according to a systematic plan as determined by the Faculty. It is the policy of the School that student attendance for clinic and clinic duty assignments is mandatory. Attendance requirements for lectures, laboratories and seminars are at the discretion of the course director. The course director is free to determine the extent to which absences affect the final grade. The student should realize that lack of regular attendance is extremely disruptive of academic progress and every attempt to attend all classes is strongly encouraged. The student should also be aware that the Committee on Student Standing and Promotion will consider faculty notation of poor attendance in its deliberations.

The Office of Student Services serves as a clearinghouse to notify faculty and staff of a student’s absence. Students who are not able to attend classes, laboratories or clinic are to call 216-368-6136 and advise the office of the period and expected duration of an absence and the reason that you will not be able to attend classes. The office will notify appropriate faculty and staff.
Note that the above action does not represent an approved absence. The clearinghouse function provided by the Student Service Office is a notification service. Individual faculty may express their own policy concerning absence as stated in the course outline.

There are situations where an approved absence that excuses the individual from classes et al. are appropriate. An approved absence requires the approval and signature of the Director of Student Services.

Absence from Examinations

The student is expected to be present at all examinations or provide, when possible, advance notice to the Office of Student Services when absence from an examination is anticipated. If a student fails to provide advanced notice, the student must provide an appropriate excuse. Failing to provide an acceptable excuse, the student will meet with the Director of Student Services and the course director to discuss the absence. Following such consultation, the student will be informed of the consequences. The course director may permit the student to be re-tested (with or without penalty), be assigned a grade of zero for the examination, or receive a failing grade for the course.

Leave of Absence

A student may request a Leave of Absence for personal reasons or reasons of health when anticipated or actual absence is in excess of three weeks. Such request must be submitted in writing to the Director of Student Services who will forward the request to the Committee on Student Standing and Promotion. The request must be submitted by letter and state the reason for the request, the length of leave requested and the date of return. The Committee will ordinarily grant such requests if the student is currently enrolled and has been in regular attendance prior to the time or circumstances that necessitated the request. The request may be submitted by a parent, spouse or authorized agent of the student if the student is unable to file the request. The maximum length of leave is one year. Students must resume registration at the expiration of the leave unless formally granted an extension. Re-entry into the dental program is determined by the Committee on Student Standing and Promotion and may not necessarily be at the same level attained at the time the leave was granted. The Committee also reserves the right to place a student on Leave of Absence when it has determined that the circumstances warrant that action, even in the absence of a formal request.

Degrees Conferred

The degree Doctor of Dental Surgery (D.D.S.) is awarded to students successfully completing the four-year professional program offered by the school. The Master of Science in Dentistry (M.S.D.) degree is awarded to graduate students who successfully complete a graduate program of advanced study. Degrees are granted by the university on the recommendation of the faculty subject to the satisfactory completion of all curricular requirements and the discharge of all financial obligations to the university. The recommendation for a degree is discretionary with the faculty, and there is no contract stated or implied, between the university and the student that a degree will be conferred at any stated time, or at all.

Withdrawals and Refunds

To officially withdraw from the School of Dentistry, a written notice must be submitted to the dean for approval. Failure to attend class or merely giving notice to an instructor will not be regarded as an official notice of withdrawal. A student who withdraws after the start of a semester must pay a portion of the usual tuition. The student is charged in accordance with the University policy on withdrawals. If the withdrawal occurs during the time that the student is enrolled in summer clinic, the student is charged at a rate of 12.5% per week of usual fee for summer clinic.

The university will refund any tuition paid for a semester by any student in good standing who is inducted, or called to active duty, by the Armed Forces of the United States prior to completing that semester, and who does not receive credit for the work completed during that semester.

Appropriate Attire

All students are expected to dress appropriately. The dental student is obliged to follow the dress code developed by the Dental Student Council and approved by the faculty. Graduate students and residents are expected to dress in a manner acceptable to their department.

Personal Property Insurance

Students are responsible for their personal property while on campus. The University assumes no responsibility for loss of or damage to a student’s personal property, and the University insurance program does not cover such losses. Many “homeowner policies” purchased by a student’s family provide coverage for such perils as fire, water and theft. If this coverage does not exist, the student may wish to consider a separate policy.

Student Services

The dental school’s Office of Student Services acts as a resource for individual dental students, and for classes as a whole, providing services and administering programs that supplement the regular curriculum and enrich the quality of student life. Programs under the direction of this office include:

Student Activities

The School of Dentistry encourages its students to avail themselves of cultural opportunities within the university and the community.

Each class has its own student organization which is governed by the students, with advice from the dental school’s Office of Student Services and other teaching staff when such advice is requested.

The Student Council is an organization representing the entire student body whose purpose is to advance the interests of the students of the School of Dentistry and the university. Students of the School of Dentistry share in university athletics, participating in interclass, interdepartmental, and intercollegiate contests in various activities.

The School of Dentistry has chapters of three of the national dental student fraternities: Alpha Omega, Delta Sigma Delta, and Psi Omega. Students of all classes are eligible for student membership in the American Dental Association.

American Student Dental Association

The American Student Dental Association (ASDA) is a student organization of approximately 20,000 individual predoctoral and postdoctoral members organized into chapters, one at each of the U.S. dental schools. The ASDA is committed to the following:
1. Developing and training future leaders of the dental profession
2. Improving the quality of dental education
3. Disseminating information of value to dental students
4. Promoting the social, moral, and ethical obligations of the profession
5. Ensuring due process for all dental students
6. Representing dental students before legislative bodies and organizations
7. Providing opportunities for students and recent graduates to deliver health care to people in areas of need
   The local chapter at Case Western Reserve University, representing more than 90 percent of the dental students, provides benefits that include:
   1. Five professional publications
   2. Reprints of national dental board examinations
   3. Insurance at low group rates (disability/major medical, equipment, professional liability, term life insurance)
   4. Reduced ADA dues upon graduation.

Freshman Orientation
   Incoming students are introduced to the school, the university, and the Cleveland area in a three-day program presented by the Office of Student Services, faculty members, and upper-class students.

Faculty Advisors
   All students are assigned to faculty advisors during freshman orientation. The advisors are volunteers from the faculty who offer the students guidance and fellowship during their educational program.

Student Monitoring
   The Director of Student Services monitors student grades on a regular basis and works individually with students. Students are assisted in defining problems, identifying available resources, and choosing specific steps to be taken toward improvement.

Tutoring
   The Office of Student Services provides tutoring for students who need to improve their academic performance. The tutors are usually upperclassmen or graduate students. Students may seek tutoring on their own or be recommended for tutoring by course instructors. Tutors emphasize study techniques, time allotment, problem solving, and communication in addition to comprehension of content.

Honors, Prizes, and Awards
   Recognition, both honorary and monetary, is given to students who achieve excellence in different facets of their dental education. A complete description of each award is available in the Office of the Dean.

Scholastic Achievement
   Alpha Omega Fraternity Award for Scholarship
   Omicron Kappa Upsilon
   Callahan Prize
   American Academy of Oral Medicine
   American Association of Women Dentists Award

General Dentistry
   American College of Dentists, Ohio Section
   International College of Dentists
   Pierre Fauchard Academy Award

Community Dentistry
   Robert Dean Feder Award
   Comprehensive Dental Care
   Ohio Academy of General Dentistry

Endodontics
   American Association of Endodontists
   Doctor Paul P. Sherwood/Hrutkay Award

Operative Dentistry
   Academy of Operative Dentistry

Oral Diagnosis, Radiology, and Treatment Planning
   American Academy of Radiology
   American Academy of Oral Medicine

Oral Pathology
   American Academy of Oral Pathology

Oral and Maxillofacial Surgery
   American Association of Oral and Maxillofacial Surgeons
   American Dental Society of Anesthesiology, Incorporated

Orthodontics
   American Society of Orthodontists

Pediatric Dentistry
   American Society of Dentistry for Children
   Academy of Dentistry for the Handicapped

Periodontics
   American Academy of Periodontology

Prosthodontics
   Dentsply International Merit Award in Prosthodontics

Practice Management
   Richard A. Collier Prize

Research and Scientific Papers
   Alpha Omega Prize
   Block Drug Award

Student Affairs
   The University Office of Student Affairs serves as an ombudsman focusing attention on the rights and responsibilities of students within the university community. In addition, it serves as a central source of information about university policies and procedures that affect student life and extracurricular programs and services. Students may contact the University Office of Student Affairs for resolution of specific problems and for referral to other university offices or campus agencies.

Academic Programs

Doctor of Dental Surgery Degree Curriculum
   The Doctor of Dental Surgery curriculum is a sequence of learning experiences designed to prepare the student to serve as an effective general dental practitioner. The present curriculum is a “diagonal” structure designed to give the student a broad foundation through initial instruction in the basic sciences and an introduction of limited clinical experiences during the early period of education. As the student progresses through the educational program, clinical experience increases to facilitate integration of basic science information with clinical science training.

Methods of Instruction
   The traditional methodology of lecture, seminars, laboratory, and clinical teaching is augmented by the use of teaching aids developed at the School of Dentistry and elsewhere. Among these aids are:
   1. Television monitors for live and taped presentations
   2. Slides with accompanying text (audio and visual)
Combined Degree Programs

By arrangement with the College of Arts and Sciences of Case Western Reserve University and other cooperating institutions of higher education, an in absentia privilege is accorded undergraduates in their senior year whereby the first year of professional study may be substituted for the last year of liberal arts education. The student may be granted a baccalaureate degree by the liberal arts college upon completion of the first year in the School of Dentistry. Arrangements for this in absentia privilege must be made by the student with the liberal arts college before entering the School of Dentistry. This option must be exercised at completion of the first year of study in the School of Dentistry unless permission is granted by the undergraduate college and dental school by prior arrangement.

Joint Degree Programs

Students enrolled full time in the School of Dentistry desiring to enter a joint degree program must apply and be admitted to a non-dental degree program of another school of the university through the usual process followed for admission at that school. If accepted, the student must notify the associate dean for academic affairs in writing at least four weeks prior to the start of the semester they wish to initiate non-dental course work in the joint degree program. A dental student must be in the top one-half of the class to be eligible to enter a joint degree program and may not begin earlier than the second semester of the first year.

If the student appears eligible for the initiation of a joint degree program, a dental faculty member will be assigned as an Advisor to the student. The faculty Advisor will be responsible for routine matters such as assisting in registration (e.g. add slips) in addition to the advisory function. Students should be assigned, or request, an Advisor on the faculty of the second school in which non-dental course work is taken.

Eligible students must meet with the advisors and program coordinators of both schools. Following this meeting, the student will be provided with a written agreement and guidelines specifying the program which will have priority in all future considerations, a curriculum plan and projected timetable for the completion of course work, and other conditions or stipulations in effect that will govern the student’s tenure in both programs. The student will acknowledge the agreement with their signature.

First year students are limited to one course (3 credit hours) in the first semester (spring) of a joint program. Upper level students (years two through four) in good standing (defined as top one-half for this purpose) may enroll for up to two courses (six credit hours) in each of the fall or spring semesters. Course work undertaken in the non-dental program must not ordinarily be scheduled during the regular school hours at the School of Dentistry unless approval is granted by the associate dean for academic affairs. Course work taken as a part of the non-dental program cannot be used to meet the requirements of the dental program.

Tuition charges for course work taken in the non-dental program are the responsibility of the School of Dentistry to the extent outlined in the agreement and to a maximum of six credit hours per semester (fall and spring semesters only) if the student fulfills all eligibility requirements, is enrolled full time and in good standing at the School of Dentistry, and is current in the payment of tuition to the School of Dentistry. Tuition charges for non-dental courses taken during the summer semester are the responsibility of the student. Enrollment in a joint degree program does not constitute a guarantee that a degree will be granted for either program at any given time or at all.

Permission to continue in the joint program may be withdrawn by either school for a variety of reasons including, but not limited to, poor or failing grades or grade point averages, incompleteness or tardiness in completing program requirements, delinquency in payment of tuition, nonacademic or academic probation, suspension or dismissal.

Problems that might arise will be resolved on a case-by-case basis by the associate dean for academic affairs and the faculty advisors in consultation with the student. The student may appeal any unfavorable decision to the Committee on Student Standing and Promotion for final resolution.

Special Programs for Undergraduates

The College of Arts and Sciences and the School of Dentistry jointly offer two programs for exceptionally able and well qualified high school seniors who plan to pursue careers in dentistry. Students admitted to these programs will be provided with advisors from both the College of Arts and Sciences and the School of Dentistry. Prior to enrollment in the School of Dentistry, all students are required to achieve an acceptable performance on the Dental Admission Test given by the American Dental Association. Students in the Six-Year Dental Program should take the test no later than April of the second year and must achieve an average of 15 or higher on both “Academic” and “PAT” portions of the test.

Six-Year Dental Program

The Six-Year Dental Program is designed to enable the especially mature student who is determined to pursue a career in dentistry to accelerate his or her undergraduate and professional education.

The first two years of the program are spent in the College of Arts and Sciences. Students are required to follow a specific curriculum. In order to secure the place reserved for them in the first class year at the School of Dentistry, students must earn a cumulative average of 3.0 or higher for all course work attempted and must achieve grades of “B” or higher in the required courses in biology, chemistry, and physics.

After successful performance in the pre-dental part of the program and on the Dental Admission Test, students in the Six-Year program move into the first year of dental school. The D.D.S. is awarded upon completion of the six-year program.

Up to 10 students can be admitted to the Six-Year Dental Program each year.

Pre-Professional Scholars Program in Dentistry

The Pre-Professional Scholars Program in Dentistry is designed for those who desire careers in dentistry but wish to broaden and enrich themselves with a full undergraduate program before embarking on study in a professional school. Such students matriculate in the College of Arts and Sciences with a conditional commitment for admission to the School of Dentistry to be honored upon completion of the bachelor’s degree.

Students are free to develop and follow a course of study that reflects their educational interests and needs rather than concentrating solely on activities that enhance their chances for admis-
sion to professional study. Participants will be expected to take the courses required of pre-dental students and to maintain a grade point average of 3.0 or higher both for their work in the sciences and overall.

**Expanded Function Dental Auxiliary Program**

The School of Dentistry offers a non-degree certificate course in expanded dental functions to dental auxiliaries with requisite training and experience. This continuing education program prepares the student to take an examination administered by the Ohio Commission on Dental Testing for Advanced Qualified Personnel.

The Expanded Function Dental Auxiliary course is a part-time program and includes didactic, pre-clinical laboratory, and clinical training. It is affiliated with several hospitals and health agencies in the Cleveland metropolitan area, where a portion of the clinical training takes place. Students are selected for admission on the basis of their performance on an entrance examination administered by the program faculty.

**Basic Science Programs**

The most direct route toward a career in research is through the Doctor of Philosophy degree programs offered by the departments that are basic to health education: anatomy, biochemistry, microbiology, pathology, pharmacology, and physiology. Inquiries about these non-dental school programs should be addressed to the Dean of Graduate Studies, whose catalogue provides specific information about these programs. Fellowships may be available to qualified students to assist them during their period of study and research leading to an advanced degree. The curricula of the School of Dentistry are designed to provide general education in dentistry or in areas of clinical specialization. However, recognizing the need within dentistry for individuals qualified for teaching and research, the School of Dentistry may provide the use of its facilities and faculty as part of a cooperative program in the training of such individuals.

**Admission to Advanced Education Programs**

**Programs Offered**

The School of Dentistry, in cooperation with other institutions, offers programs of study in advanced education in general dentistry, endodontics, pediatric dentistry, periodontics, orthodontics, and oral and maxillofacial surgery. Entry requirements vary and are determined by the program director and faculty of each program who select applicants for admission. Program length, stipends offered and program requirements vary by program. Requests for application materials should be directed to the Office of Graduate Studies of the School of Dentistry or printed from the internet at http://www.cwru.edu/dental/casewebsite/

All advanced education programs are accredited by the Commission on Dental Accreditation of the American Dental Association and are board-eligible programs for the respective specialty boards. The programs in endodontics, orthodontics, and periodontics are master's degree programs with a certificate granted upon completion of the degree requirements. The programs in advanced education in general dentistry and pediatric dentistry are certificate-only programs. The program in oral and maxillofacial surgery is a joint program with the School of Medicine leading to the M.D. degree and certificate in oral and maxillofacial surgery. A certificate-only program in oral and maxillofacial surgery may be available at the discretion of the department.

**Entry Requirements**

The School admits qualified students without regard to race, religion, age, sex, color, sexual orientation, national or ethnic origin. All programs are highly structured and require a commitment to full-time study. Time for employment is limited; enrolled students are not permitted to engage in outside dental practice without the approval of their program director.

In order to be considered for admission, the applicant must submit several items; a completed application form (PASS or MATCH applications are accepted for some programs), all requested supporting documents such as transcripts, letters of recommendation, etc., and an application fee by the deadline published for each program. Incomplete or late applications will not be considered unless all other qualified applicants have been offered admission and a vacancy remains.

The selection of individuals for entry into a program of study is made by the program director (faculty) from the pool of applicants. The general criteria of the most qualified applicants for admission are as follows:

The applicant must be a graduate of dental school accredited by the American or Canadian Dental Association or have been graduated from an institution considered by the School of Dentistry as one of acceptable academic caliber. (Applicants who are currently enrolled as dental students must submit a final transcript and verification of graduation from a dental school prior to entry if selected.)

The applicant should have earned a 3.0 (B) average or its equivalent and/or been graduated in the highest one-third of their graduating dental class.

The applicant must have passed Part I of the National Dental Board and should have an average score of at least 85 and have taken or applied for Part II (to be completed with a score of 85 or higher prior to entry if selected). If the applicant is a graduate of a foreign dental school and has not taken the National Dental Board, recent GRE examination results may be substituted (general test and one subject test in biochemistry, biology or chemistry). GRE scores should be at the fiftieth percentile or higher.

The applicant should have a documented interest in their field of study and must meet additional criteria set by the department to which they are applying. Applicants graduated from a non-English speaking dental school, and for whom English is not their first language, must take the TOEFL test with a minimum score of 550 (paper-based score) or 213 (computer-based score).

These criteria are considered minimums and a higher level of performance (where applicable) enhances the likelihood of acceptance. Applicants who paid an application fee but were not accepted, can be considered, at no additional fee, for entry the following year. In order for the application to be considered for the following year, a request for reactivation of the application must be made in writing and received by the deadline for applications for the following year. Those not selected for the second year must submit a new application and pay the applicable fee for further consideration.

Applicants selected for programs in advanced education in general dentistry, oral and maxillofacial surgery, or pediatric dentistry must be eligible for licensure or intern certificate issued by the State of Ohio, and must be a graduate of a dental school accredited by the Commission on Dental Accreditation. International applicants are accepted into the programs offered by the Departments of Endodontics, Orthodontics, and Periodontics.
Admission of Students from Other Countries

See “Students from Other Countries” in the Student Affairs section of this Bulletin.

M.S.D. Degree and Residency Programs

Registration

Advanced education programs operate on a 12 month basis, from July 1st of one year to June 30th of the next. The year is divided into two six-month semesters (Fall, July 1 to December 31; Spring, January 1 to June 30). The act of registration includes submission of a course schedule approved by the department, the payment of semester tuition and the completion of the simplified registration form. Each semester, registration must be completed as scheduled. Registration for each semester is handled through the Dental School Registrar. Students enrolled in fall and spring semesters may arrange to pay bills for tuition and fees in two installments. At least half of the total bill must be paid at registration, the remainder must be paid in accordance with university policy. Fees may be charged for late registration or late payment. Students who fail to register within 30 days after the published dates will be considered to have withdrawn from the program. In the School of Dentistry, students who are not registered are not considered students of record, lose the protections of the university in matters of liability and therefore, may not treat patients. They can no longer attend class or receive grades and will have to formally reestablish their matriculation. In any circumstance, all lost course and/or clinical time will be added to the end of the program’s original completion date.

Under unusual circumstances, special arrangements for registration may be made with permission of the department chairperson and the Associate Dean for Graduate Studies. Social Security numbers are used for all records and documents and must be provided at the time of registration. Foreign students will be issued a number for this purpose if they have not obtained a Social Security number prior to registration. New students and new residents who do not register as specified and who have failed to provide satisfactory reasons for the delay in advance, forfeit their right to admission. Vacancies which arise from such circumstances are filled from a list of alternate candidates at the discretion of the department.

Grading

The responsibility for assigning grades rests exclusively with the course director, who must announce the general method of grading at the beginning of the course. Course grades are reported to the Registrar of the School at the end of the course or when a final grade has been determined if prior to the scheduled completion time for the course. Incomplete or conditional grades can be changed only by the course director (see grading policies of the university). The following grading system is used at the School of Dentistry for advanced education courses:

- A ................................................... 4.00
- A- ..................................................... 3.66
- B+ ...................................................... 3.33
- B ...................................................... 3.00
- B- ...................................................... 2.66
- C+ ...................................................... 2.33
- C ...................................................... 2.00
- F ...................................................... 0.00
- IN ...................................................... Incomplete
- S ...................................................... Satisfactory (Thesis or Research)

Extra Courses

Individual students enrolled in an advanced education program, whether or not a master’s degree is involved, may be required to take courses beyond the general requirements set forth by the department in order to complete the program. In such instances, the student must be notified in writing by the department.

Transfer Credit

Transfer of credit from another university is limited to six semester hours of graduate-level courses. Such transfer requires approval from the student’s advisor, the departmental chairperson, and the Office of Graduate Studies. Courses must have been taken within five years prior or subsequent to matriculation in the graduate program at Case Western Reserve University, and only those with grades of “B” or better are transferable. No credit for thesis may be transferred from another university.

Graduate credit is not awarded for 100 or 200 level courses or their equivalents.

Thesis Advisory Committee

Each master’s degree candidate is advised with their program director as to when, and how, to form a thesis committee. The department chair, in consultation with the program director, chooses a faculty member to serve as the primary thesis advisor. This advisor also serves as the chair of the thesis committee. The primary thesis advisor will help identify other members of the faculty (at least two) to serve as secondary advisors and as members of the thesis committee. At least two members of the thesis committee must be from the department in which the student is enrolled, and one must be from another department. Additional membership is not restricted and may include persons from outside the University who have qualifications acceptable to the department chair. Members of the thesis committee continue in their capacity until the student graduates or leaves the program of study. The thesis committee will be responsible for guiding the student in the development of a thesis protocol. Once a protocol is acceptable, the thesis committee members advise the student on the conduct of the research and writing of the thesis document. Ultimately, the committee members will evaluate the student’s oral defense and final thesis document.

Research Project

For master’s degree programs, each student must carry out an original and meaningful research project acceptable to the department chairperson and the advisory committee. A written thesis, similarly acceptable, is to be prepared and must conform to the standard format determined by the Office of Graduate Studies of the School of Dentistry. The thesis must be submitted before the prescribed deadline. An oral examination (defense) of the thesis is required. This examination is administered by the student’s advisory committee before a standard date set by the Office of Graduate Studies of the School of Dentistry. Unanimous agreement of the committee is required to pass the thesis examination. A student must be registered for thesis credit or continuing graduate work during the semester in which the thesis examination is conducted. The thesis defense is ordinarily open to all members of the university faculty, student body, and guests.

WD .................................................. Withdrew all classes
np ..................................................... Not Passing (Pass/Fail Course)
np ..................................................... Not Passing (Pass/Fail Course)
np ..................................................... Not Passing (Pass/Fail Course)
np ..................................................... Not Passing (Pass/Fail Course)
np ..................................................... Not Passing (Pass/Fail Course)
np ..................................................... Not Passing (Pass/Fail Course)
chairperson, with a copy filed in the Office of Graduate Studies of the School of Dentistry.

Time Limits
Each student is expected to maintain continuous registration and all requirements must be completed within five consecutive calendar years immediately following matriculation as an advanced education student, including approved periods of leave of absence. A student who fails to complete the requirements within five years must be formally readmitted with full standing in order to continue study, subject to terms of readmission, future time limits, and revised requirements for the award of the degree. Prior status in the program is no guarantee of readmission and should not be assumed.

Leave of Absence
A student may request a leave of absence for personal reasons or reasons of health when anticipated or actual absence is in excess of three weeks. A written request for a leave of absence must include the reason for the request and the length of time requested. A leave of absence cannot exceed one calendar year. It must be submitted to the program director and to the Associate Dean for Graduate Studies of the School of Dentistry. The program director will forward the request with his/her response to the Committee on Graduate Studies. In order to be eligible for such requests, the student must be currently enrolled and in regular attendance prior to the time or circumstances that necessitated the request. At the expiration of the leave, the student must resume registration unless formally granted an extension. A leave of absence does not extend the maximum time permitted for the completion of degree requirements. A student who fails to obtain an approved leave, or who fails to resume registration at the time expected, may be separated from the program. During the period of leave, it is expected that the student will not avail himself or herself of the teaching and research resources of the School of Dentistry or the University. At the end of an approved leave, reentry into the program is reviewed by the program director in concert with the Committee on Graduate Studies, and may not be at the same level attained at the time the leave was granted. Programs with a high patient case component may require that the clinical portion of the program be repeated in its entirety. Finally, the committee also reserves the right to place a student on leave of absence where it has been determined that the circumstances warrant, even in the absence of a formal request.

Maintenance of Good Standing
A minimum cumulative grade point average of 2.75 is required for good standing in a graduate program for all courses taken for graduate credit (excluding those graded Satisfactory/Unsatisfactory or Pass/No Pass).

The Associate Dean for Graduate Studies reviews student performance and may recommend a course of action to the Committee on Graduate Studies. The committee may require remedial work, place a student on academic review or probation, set conditions for continuation in the student’s course of study or program, and may require withdrawal for failure to meet the academic standards set by the department or school. A student who receives a grade deemed unsatisfactory in any course is placed on probation and must remove himself or herself from probation within a time period specified by the committee. It is expected that removal from probation will ordinarily require repetition of the course with an acceptable grade or the successful completion of work deemed equivalent by the student’s advisory committee and the departmental chairperson.

In this regard, a student may be separated from the university for any one of the following reasons:
1. Failure to correct probationary status within the specified time period.
2. Failure to achieve a minimum grade point average of 2.50 or above upon completion of 12 semester hours or a grade point average of 2.75 or higher upon completion of 21 semester hours of graduate study.
3. Failure to complete all requirements for the master’s degree within five consecutive calendar years from the term of matriculation, unless granted an extension of a maximum of one year upon recommendation of the advisor and chairperson and approved by the Associate Dean for Graduate Studies.

In calculating the grade point average, all courses for which quality points are given are counted, including courses which may be required to be repeated. In addition, on the recommendation of the student’s department, and with due process, the School of Dentistry may suspend or separate a student from the university for failure to maintain appropriate standards of conduct and integrity in discharging their responsibilities. Academic failure, moral delinquency, gross misconduct, or failure to meet the specific conditions of probation or academic review is sufficient reason for requiring withdrawal from the school.

Graduation
The minimum requirements for the master’s degree in the School of Dentistry are 54 semester hours of course work, including six or more semester hours of thesis/equivalent registration, and the submission of an accepted thesis. Individual departments may require additional semester hours of specific course work and/or thesis. Not less than 48 semester hours may be at the 500 level or higher.

A candidate for a Master of Science in Dentistry degree must make application for the degree to the Office of Graduate Studies of the School of Dentistry no later than two months before the commencement at which the degree is expected.

Candidates must meet all deadlines for completion of degree requirements set forth in the calendar issued by the Office of Graduate Studies for the School of Dentistry. All thesis students must be registered during the semester in which the degree is awarded (also see “Delayed Graduation”).

The awarding of the degree is dependent upon the satisfactory completion of all requirements, and the recommendations of department chairperson, Committee on Graduate Studies, and Faculty of the School of Dentistry. The student must complete all requirements for both the master’s degree and certificate in order to receive either.

Degrees will not be awarded to candidates with delinquent financial accounts that include, but are not limited to, tuition payments, fees, and library fines.

Delayed Graduation
A candidate who has successfully defended his or her thesis, but who fails to meet the deadline for thesis submission for graduation in one semester, will be permitted to receive his or her degree at the next scheduled graduation, without further registration or payment of tuition if the completed thesis is submitted within fourteen days of the date originally scheduled for graduation. If all requirements are not met within this grace period, the candidate must register for the subsequent semester.
Course Descriptions
Dentistry (DENC, DEND, DENF, DENT)

Professional Courses (D.D.S.)

DENC 122. Preventive Periodontics (1)
Companion clinical component to DEND 121. Clinical application of methods for the prevention and maintenance of periodontal health in patients. The importance of patient education, motivation, and cooperation in present methods of prevention and plaque control.

DENC 124. Outreach Preventive Dentistry (2.5)
Clinical component of DEND 123.

DENC 162. Dental Anatomy (1)
Companion preclinical component to DEND 162. Laboratory exercises and assignments include drawings, waxups, tooth identification, and use of semi-adjustable articulator.

DENC 163. Masticatory Dynamics (1.5)
(See DENC 162.)

DENC 172. Basic Procedures in Fixed Prosthodontics (1)
Laboratory component of DEND 172.

DENC 222. Periodontics (1)
Companion clinical component for DEND 222. Students observe and assist at periodontal surgical procedures on moderately advanced periodontal diseases. Treatment includes root planing, curettage, occlusal adjustment, minor tooth movement and case maintenance.

DENC 227. Oral Diagnosis (.5)
Companion clinical component for DEND 229. Clinical experiences consisting of assignments in the admitting and radiology service; radiology seminars where the technique and interpretation of the radiographs taken by the students are discussed; and clinical conferences with a staff member.

DENC 248. Endodontics (.5)
Companion laboratory component to DEND 248. Complete endodontic treatment performed by each student on extracted teeth using gutta percha.

DENC 267. Partial Denture Design Lab (1.5)
Theories of removable partial denture construction which enable the student to perform exercises that are associated with the techniques used to achieve a successful result. Students will be evaluated by various testing methods.

DENC 269. Prosthodontic Technology (1.5)
Companion preclinical component to DEND 269. Each student constructs a complete set of dentures using laboratory manikin as patient. Although DENC 269 was conceived as a technique course, one of its principal objectives is to prepare the student for the clinical aspect of dental education.

DENC 271. Basic Procedures of Restorative Dentistry (2)
Companion laboratory component to DEND 272. Exercises in restorative dentistry in the preclinical laboratory including tooth preparation and restoration, related techniques, biomechanics, and clinical application. Single-tooth and fixed partial prostheses on a typodont according to modern principles of design, occlusion and esthetics.

DENC 272. Basic Procedures of Restorative Dentistry (2)
(See DENC 271.)

DENC 282. Orthodontics (1)
Companion laboratory component to DEND 282. Application and fabrication of various orthodontic appliances.

DENC 322. Surgical Periodontics (1.5)
Companion clinical component to DEND 321. Clinical treatment in conjunction with residents and faculty.

DENC 328. Oral Diagnosis and Treatment Planning (1)
Treatment planning based on the correlation of fundamentals taught in diagnosis, preventive dentistry and restorative dentistry. Clinical experience in the application of didactic training consists of four components; assignments in the admitting and radiology service where students carry out examinations of the newly admitted patients and evaluate their problems and needs; radiology seminars where the technique and interpretation of the radiographs taken by the students are discussed; assignments to the emergency service; and clinical conferences with a staff member.

DENC 348. Endodontics Clinic (1.5)
Companion clinical component to DEND 348. Clinical application of endodontic techniques.

DENC 364. Operative Dentistry Clinic (1.5)
Companion clinical component to DEND 364. Clinical application of the basic principles of operative and cosmetic dentistry.

DENC 368. Removable Prosthodontics Clinic (1.5)
Companion clinical component to DEND 368. Clinical experiences in removable prosthodontics.

DENC 374. Fixed Prosthodontics Clinic (1.5)
Companion clinical component of DEND 374. Clinical experiences in fixed prosthodontics.

DENC 378. Pediatric Dentistry and Applied Nutrition (1.5)
Companion clinical component of DEND 378.

DENC 389. General Practice Dentistry (3)
Comprehensive dental care. Each student is assigned for clinical training to a preceptor group led by a practicing general dentist. The preceptor guides the students in diagnosis, treatment planning, and actual patient treatment with consultation in various specialties as required. Experiences in the provision of emergency dental care. The preceptor directs the total dental health care of the patients of each of his students. Biweekly seminars are provided for each preceptor group. Special topics, student cases, techniques, and journal articles are discussed.

DENC 390. General Practice Dentistry (3)
Clinical application of the principles of general practice dentistry.

DENC 422. Periodontics (.5)
Clinical application of surgical and nonsurgical techniques used in the treatment of moderate periodontal disease. Students exposed to more advanced cases through clinical demonstrations by instructors. Students encouraged to gain additional experience and become more confident in the management of periodontal patients.

DENC 428. Oral Diagnosis and Radiology (.5)
Clinical experience in the admitting and radiology service.

DENC 448. Endodontics (1)
Clinical application of the principles of endodontics therapy. Diagnosis and treatment planning. Management of endodontic emergencies and prognosis of endodontic treatment.

DENC 458. Clinical Oral Surgery (.5)
Clinical application of the principles of oral surgery.

DENC 464. Operative Dentistry (1.5)
Clinical application of the principles of operative dentistry.

DENC 468. Prosthodontics (1.5)
Clinical application of the principles of prosthodontic dentistry.

DENC 474. Fixed Prosthodontics (1.5)
Treatment of patients requiring simple and advanced fixed prostheses as an integrated part of total patient care.

DENC 478. Pediatric Dentistry (1)
Emphasizes comprehensive oral health care of the well child to provide experience in examining, diagnosing, treatment planning, and completing treatment of a selected number of children. Preventive aspects of pediatric dentistry emphasized. Additional voluntary experiences in clinical practice of pediatric dentistry available.

DENC 482. Clinical Orthodontics (1)
Clinical application of the principles of orthodontics.

DENC 489. General Practice Dentistry (5)
Comprehensive dental care. Each student is assigned for clinical training to a preceptor group led by a practicing general dentist. The preceptor guides students in diagnosis, treatment planning, and actual patient treatment with consultation in various specialties as required. Experiences in the provision of emergency dental care. The preceptor directs the total dental health care of the patients of each of his students. Biweekly seminars are provided for each preceptor group. Special topics, student cases, techniques, and journal articles are discussed.
DENC 490. General Practice Dentistry (5)
(See DEND 489.)

DEND Courses

DEND 101. Gross Anatomy (5)
Anatomy of the human body in three parts: musculoskeletal, visceral, and head and neck. Special emphasis on the developmental origins and biomechanics of the components of the face and masticatory apparatus.

DEND 102. Dental Histology (3)
Ultrastructure cytology, general histology, and organology. Histophysiological correlations.

DEND 104. Neurobiology (3)
An integrated approach to the anatomy and physiology of the human nervous system. Analyzes neuronal phenomena at both cellular and systems levels. Focus on the principles of organization of those components related to the neurology of the jaws.

DEND 106. Oral Histology (3)
Development of teeth and supporting tissues. Histology and ultrastructure cytology of the oral region with emphasis on the calcified tissues.

DEND 107. Biochemistry (4)
Structure and metabolism of carbohydrates, lipids, proteins, and nucleic acids and their functions in the life processes of the cell.

DEND 108. Physiology (4.5)
This course investigates the functions of human organ systems in the healthy state and leads to an understanding of the workings of the human body. Muscle, bone, gastrointestinal, cardiovascular, renal, respiratory and endocrine systems are covered.

DEND 110. Special Topics in Dentistry (.5-4)
Directed study under faculty supervision and with special permission of the Associate Dean for Academic Affairs.

DEND 114. Professional Development (1)
This didactic course focuses on the professional development of the student dentist. Basic principles of professionalism and ethics are introduced. A model of patient-centered communication is presented, and students begin to develop effective dentist-patient communication skills. Students acquire a basic understanding of theories of human behavior. Students consider and understand the variety of factors that can influence patients’ oral health choices. A model of behavior change and principles of patient education are presented. Specific behavior management issues are considered.

DEND 116. Introduction to Microbiology and Infection Control (3)
Introduction to the basic concepts, characteristics and techniques used in the study of the clinically and orally significant microbial groups: viruses, bacteria and fungi. The structure, metabolism, genetics, and control of each microbial group will be described. Also, the introduction of the molecular, cellular, and organismal mechanisms responsible for the human immune response system. Basic concepts of infection control in the clinical setting will be reviewed.

DEND 119. Critical Thinking in Research (1)
Students initiate evaluation of experimental design and apply analytical statistics to the critical reading of dental literature.

DEND 121. Preventive Periodontics (1)

DEND 123. Outreach Preventive Dentistry (3)
This course covers the basic didactic and clinical curriculum necessary for first-year dental students to be able to place dental sealants on elementary/middle school children as part of a school-based sealant program. Etiology of dental caries, preventing dental disease, behavioral management theories, and sealant techniques will be explored.

DEND 162. Dental Anatomy (3)
Descriptive anatomy of masticatory structures with emphasis on deciduous and permanent teeth and the temporomandibular-mandibular movements, and the fundamental concepts of the functional relationships between the dentition and the temporomandibular joint. Lectures on comparative anatomy and variations in tooth morphology.

DEND 163. Masticatory Dynamics (2)
(See DEND 162.)

DEND 172. Basic Procedures in Fixed Prosthodontics (3.5)
To introduce and familiarize the dental student to basic principles related to fixed prosthodontics. The introduction will emphasize principles of engineering and preparation designs, full coverage retainers for abutments for both metal and ceramic restorations, as well as partial coverage retainers for abutments.

DEND 182. Facial Growth and Development (1)
Introduction to the normal and abnormal growth and development of the human face.

DEND 211. General Pathology (5)
General principles of pathology: etiology; retrograde changes; inflammation and repair; bacterial, viral, and mycotic infections, and disturbances of growth presented as an introduction to a more detailed consideration of oral pathology. The pathology of the organ systems.

DEND 214. Oral Pathology (4)
Diseases and abnormalities of the teeth and adjacent hard and soft tissues. Includes periodontal, pulpal, and periapical diseases as well as cysts, tumors, developmental anomalies, and oral aspects of systemic disease.

DEND 215. Immunology and Medical Microbiology (5)
Fundamental concepts of bacteriology, virology, and immunology, and their interrelationships in systemic and oral disease processes.

DEND 222. Periodontics (1)
A comprehensive course in periodontology including etiology, diagnosis, radiographic, interpretations and prognosis.

DEND 225. Physical Evaluation (1)
Involves the exploration of patient database building. The scope and methods for data collection, physical examination appropriate to dental care, data recording and data interpretation are discussed in order to be able to assess the patient’s ability to receive dental care safely. The recognition of signs and symptoms of medical and dental disease and the implications for patient well-being are discussed. Systematic evaluation of the patient’s physical examination, medical history, and dental history are integrated so that differential diagnoses may be developed.

DEND 227. Oral Diagnosis (2)
This course presents a comprehensive and systematic approach to oral diagnosis and treatment. To accomplish this the student is presented with: 1) the pertinent steps and modalities to follow in the examination of the patient; 2) a diagnostic sequence which can be followed in a dental practice; 3) a method of differential diagnosis of oral lesions based on a classification of lesions as grouped according to their similar clinical and/or radiographic appearances; and 4) a working knowledge of the common oral lesions that are thus classified.

DEND 228. Treatment Planning I (1)
This course provides lecture presentations to help prepare the student to develop skills in patient diagnosis and treatment planning. The lectures will guide the students through the thought processes necessary in the development of treatable work plans. The emphasis will be on exposing the students to the approach used in our clinic of providing the patients with options of optimal, alternative and emergency diagnostic or recall treatment plans using decisional analysis.

DEND 229. Principles of Radiography (1)
Initial course teaching the second-year dental student the basic principles of taking an intraoral radiographic series. Also discussed are the physics involved in x-ray generation, and the parts and function of the x-ray unit. Head and neck anatomy and pathology in regards to radiographic interpretation.

DEND 230. Advanced Principles of Radiography (1)
This is a continuation of DEND 229. This course will explore alternative intraoral radiographic techniques, extraoral radiography techniques, their uses and limitations. Also, discussion of radiation safety in the dental office and film processing. An opportunity to gain ‘hands-on’ experience in learning to align a patient for a panoramic radiograph, expand diagnostic skills and a thorough review of radiographic anatomy and pathology.
DEND 243. Pharmacology (4)
This course introduces students to the principles of pharmacology and to the mechanisms of drug action in the context of common disease states.

DEND 248. Endodontics (1)
Introduction to methods and materials necessary for successful root canal therapy.

DEND 251. Applied Anatomy of the Head and Neck (.5)
Review of head and neck anatomy with clinical correlations.

DEND 252. Oral Surgery - Pain Control (1)
Anatomy pertaining to local anesthesia. Drugs used in local anesthesia and technique of administration. Management of complications. Slides and clinical demonstrations.

DEND 264. Partial Denture Design (4)
Recognition of clinical situations that require partial denture therapy are developed. Introduction to the terms used in removable partial prosthodontics. Partially edentulous casts diagnosed, designed, surveyed, contoured for path of insertion, prepared for rest seat areas, and finally tripoded for further orientation by each student on his or her own casts. Thus the design, surveying, and clinical applications for removable partial service are presented in order to maintain optimal oral health conditions and to provide a sound basis for the prosthesis.

DEND 269. Prosthodontic Technology (4)
A lecture-demonstration-laboratory approach to complete denture prosthesis construction. Emphasis on certain fundamental biological considerations of the edentulous patient, such as the oral membranes, muscles, bones, and phonetics and how they relate to the technical aspects of denture constructions.

DEND 271. Basic Procedures of Restorative Dentistry (2)
Lectures, demonstrations and instruction in restorative dentistry related to techniques, biomechanics, and clinical application. Single-tooth and fixed partial prosthesis according to modern principles of design, occlusion and aesthetics.

DEND 272. Basic Procedures of Restorative Dentistry (2)
(See DEND 271.)

DEND 282. Orthodontics (1)
Presents principles of orthodontics including relevant areas of applied growth and development, diagnosis methods, biomechanics, and techniques. Histological and physiological changes due to orthodontic tooth movement and biomechanics and laboratory techniques related to the fabrication and use of suitable orthodontic appliances. Biomechanical principles, and the materials science and biologic background necessary for proper clinical management of these appliances.

DEND 284. Dentofacial Morphology (1)
Study of the direct association between the static dentition and the dynamics of facial growth and development studied from the onset of calcification of the deciduous teeth through the mixed-dentition stages to the final eruption of the third molars in functional occlusion.

DEND 291. Dental Auxiliary Management (.5)
Lectures in the principles of auxiliary management. Overview of organization, management, communication skills, duty delegation, and organization of work. Information is provided about the dental allied health fields, duties, responsibilities, training, and testing.

DEND 307. Biochemistry (4)
(See DEND 107.)

DEND 312. Oral Cancer Diagnosis (1)

DEND 315. Practice Management I (4)
Basic concepts of accounting and business management are presented in order to allow students to interpret financial reports, with particular emphasis on dental-related documents.

DEND 320. Issues and Trends (1)
Major issues and trends that affect oral health and the mission of dentistry in the United States. Critical analysis and discussion of journal articles in the dental literature.

DEND 321. Surgical Periodontics (1)
Case analysis and treatment planning for various conditions of periodontal disease. Case presentation to patients. Basic surgical technique and advanced types of periodontal surgery demonstrated. Occlusal analysis and occlusal adjustment considered.

DEND 326. Complete Dentistry I (1)
The didactic curriculum provides a series of lectures that emphasize the importance of evaluation of the entire stomatognathic system for treatment planning. Causal relationships influenced by misdirected forces and hyperfunction are discussed.

DEND 327. Complete Dentistry II (1)
Complete Dentistry II is a continuation of Complete Dentistry 326 and deals with topics such as rehabilitation of the anterior dentition and the posterior dentition. The etiology of temporomandibular dysfunction, patient examination, and treatment. Prereq: Pass all second-year courses.

DEND 328. Treatment Planning II (1)
This course will initially deal with the predoctoral clinic process of collecting data and information following the protocols which are utilized in our clinic. The process of educating the patient from a medical and patient management viewpoint will be discussed and practiced by the students with written assignments. A "flow chart" approach will be utilized to deal with clinical departmental patient issues to aid the student in developing treatment plans.

DEND 332. Geriatric Dentistry (1)
The didactic curriculum provides a general background on the changing demographics of our population as well as knowledge about the medical, social, psychological, and dental problems many older Americans face today. Dental problems common to the elderly, approaches to treatment planning and the provision of care for this unique group in traditional and non-traditional settings are explored.

DEND 333. Management of Medical Emergencies (1)
Patient evaluation, diagnosis and treatment of life-threatening emergencies that may arise in the course of dental treatment. Includes instruction in basic life support and cardiopulmonary resuscitation.

DEND 340. Physiopharmacological Basis of Oral Medicine (2)
Lectures and case studies designed to review the normal physiology of the organ systems, and to discuss the pathophysiology of disease states of special interest, the principles of current and accepted medical and/or pharmacological management of these conditions, and the basis for modification of dental therapy. The student will (1) acquire essential knowledge to assess the functional state of various organ systems based on the recorded medical and drug history and the correlation of significant clinical, laboratory, and radiographic findings; (2) be prepared to prescribe for maximum benefit and recognize the clinical ramifications of concomitant drug therapy; and (3) will initiate appropriate medical consultations or referrals for suspected problems and modify dental therapy as dictated by the presence of a particular disease.

DEND 348. Endodontics (1)
Recognition of endodontic pulpal health and the changes that occur in the transition from health to disease. The didactic component focuses on scientific basis for recognition of degenerative states of the dental pulp and the philosophy of endodontic therapy. The clinical component focuses on the treatment of diseased, pulpally-involved teeth of actual patients. It provides practical instruction on how to render endodontic therapy under the direct supervision of qualified endodontic personnel.

DEND 351. Oral Surgery II (1)

DEND 352. Dental Management of Medical Disease (1)
Hospital procedures and protocol and the management of surgical complications and emergencies. General principles of surgery as applied to selected topics.
DEND 354. Oral Surgery IV (1)

DEND 355. Introduction to Conscious Sedation (.5)
Physiopharmacology of nitrous oxide use. Indications, contraindications, and complications.

DEND 360. Implant Dentistry (1)
Didactic and laboratory instruction that introduces the concepts used in implantology. These include the scientific basis of implant tissue reactions, and the surgical and restorative protocols. Emphasis is placed on slide presentation of actual cases. An opportunity is given to students to place an implant in an artificial mandible and to manipulate implant components on a typodont.

DEND 363. Operative Dentistry (1)
Expands beyond the basic concepts learned in BPRD to include new advances in materials and in techniques, plus the indications and contraindications for their use, as supported by recent research and literature. Problem solving in clinical practice will be emphasized.

DEND 364. Esthetic Dentistry (1)
Lectures and demonstrations. The indications, contraindications, limitations, and use of modern techniques and materials in operative and cosmetic surgery.

DEND 368. Prosthodontics (2)
Develops basic principles previously taught for clinical application. Instruction to immediate denture, partial denture, and over denture prostheses. Lectures and audio-visual demonstrations relating to cleft palate, TMJ disturbances, and cosmetic prostheses of the face.

DEND 371. Occlusion Seminar (2)
An introduction to gnathological principles: terminology, procedures and instrumentation. Correlation of history and clinical symptoms with treatment modalities emphasized. Use of bite planes, centric relation registration, and diagnostic waxup on mounted casts.

DEND 374. Fixed Prosthodontics (1)
Diagnosis and treatment planning in fixed prosthodontics and construction of simple crowns and bridges. Lecture series discussing the discussions and demonstration of elementary and advanced methods of restoring occlusion, esthetics, and speech using fixed prosthesis.

DEND 378. Pediatric Dentistry (2)

DEND 379. Nutrition for Dentistry (1)
General nutrition concepts are presented in addition to aspects pertinent to the practice of dentistry.

DEND 394. Dental Patient Management/Risk Management (1)
Principles of patient management and risk management are reviewed. The primary focus is directed toward the skills associated with communication. A variety of examples of malpractice are reviewed and discussed. Other areas of risk are discussed such as infection and occupational hazards related to EPA and OSHA standards.

DEND 411. Clinical Oral Pathology (1)
Clinical features of oral lesions as a basis for differential diagnosis. Clinical slides representing a variety of diseases. Students are encouraged to participate in classroom discussions.

DEND 415. Practice Management II (2)
Students deal with entrepreneurship applications and experiences specific to dentistry and are introduced to the process of formulating a business plan. Personal finance and investment strategies are covered in this course, particularly as they pertain to developing a business plan for the students' careers. Each student constructs a business plan specific to the goals and situation of that student.

DEND 416. Practice Management III (1.5)
This course develops skills in advanced financial, accounting, investment, and management concepts including both commercial and personal. It develops managerial methods including negotiation techniques and employee management/development, recruiting, and performance evaluation. Information regarding financial and logistical models of dental practice is presented drawing comparisons from the unique attributes of each model.

DEND 420. Jurisprudence and Professional Ethical Responsibility (.5)
Ethical and legal issues, civil and criminal law, contracts, malpractice and current ethical and legal dilemmas encountered in practice.

DEND 421. Periodontal Medicine and Case Presentation (1)
Further application of the knowledge and skills learned in prior periodontal courses. Focus is on how selective periodontal treatment can be integrated into a treatment plan considering the parameters presented by a special situation. Some examples are treatment related to endodontics, prosthodontics, geriatrics, esthetics, orthodontics, and implantology.

Prereq: DEND 121, DENC 122, DEND 222, DEND 222, DEND 321, and DENC 322.

DEND 426. Oral Diagnosis Seminar (1)
Case-based review of oral diagnosis, radiology, and medicine.

DEND 427. National Boards Part II Preparation (1)
Multidisciplinary approach designed to prepare students for the National Dental Board Examination, Part II.

DEND 428. Regional Board Preparation (1.5)
Procedures, standards, and expectations of regional board examinations are reviewed in order to better prepare students.

DEND 430. Treatment Planning III (1)
This course prepares the fourth-year dental student to develop treatment plans for clinical patients in a systematic manner weighing the risks, benefits, and prognosis after accurately diagnosing the disease processes of the oral cavity and its contiguous structures. The lectures will emphasize the phase approach to treatment planning and will utilize a patient-based learning format. Students will develop their own treatment plans utilizing the patient information given in class and information on an accessible web page. This course will utilize more complex patient cases.

DEND 445. Clinical Pharmacology (1)
Drugs useful in dentistry with special emphasis on their clinical application.

DEND 455. Oral Surgery IV-A (.5)

DEND 482. Orthodontics (1)
Instruction through lectures and audio-visual programs enabling the student to gain judgment, knowledge, and skills to select and treat uncomplicated tooth irregularities in children and adults. Advanced topics in comprehensive orthodontics, such as surgical orthodontics and cleft-palate treatment.

DEND 488. Case Presentations (2.5)
Selected cases presented by students and instructors emphasizing diagnosis, treatment planning, and complete patient care. Topics of special interest covering the concepts of total patient care and recent advances in dental treatment presented by guest lecturers and faculty.

DENF Courses

DENF 422. Comprehensive Periodontics (3)
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dentistry in order to assure competency in the periodontic procedures associated with general dentistry.
DENT 428. Comprehensive Oral Medicine (3)
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dentistry in order to assure competency in the oral medicine procedures associated with general dentistry.

DENT 448. Comprehensive Endodontics (3)
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dentistry in order to assure competency in the endodontic procedures associated with general dentistry.

DENT 455. Comprehensive Oral Surgery (3)
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dentistry in order to assure competency in the oral surgery procedures associated with general dentistry.

DENT 464. Comprehensive Operative Dentistry (3)
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dentistry in order to assure competency in the operative procedures associated with general dentistry.

DENT 468. Comprehensive Removable Prosthodontics (3)
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dentistry in order to assure competency in the removable prosthodontics procedures associated with general dentistry.

DENT 474. Comprehensive Fixed Prosthodontics (3)
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dentistry in order to assure competency in the fixed prosthodontic procedures associated with general dentistry.

DENT 478. Comprehensive Pedodontics and Orthodontics (3)
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dentistry in order to assure competency in the pediatric and orthodontic procedures associated with general dentistry.

DENT Courses

DENT 310. Summer Clinic (0-5)
Attendance is mandatory in the dental clinic between the spring semester of the second year and the fall semester of the third year. Students begin performing restorative preparations on patients and become acquainted with all aspects of clinical practice and operation.
mechanisms of resistance are reviewed. Microbial diagnostic methodologies are discussed. Integration of periodontics, endodontics, and pediatric dentistry are stressed as it relates to the inflammatory process in the human host.

**DENT 523. Clinical Specialty Seminar I - Orthodontics (2)**
This course is a companion to clinical training in orthodontics and involves faculty and student evaluation of past and present literature. Sessions are used to evaluate current timely literature, and lectures and seminars complement the clinical experiences with topics including patient management, treatment of various aged populations and malocclusions, orthopedic appliances, treatment of patients with special needs, and various aspects of fixed and removable mecanotherapy. First in a series of four courses.

**DENT 524. Clinical Specialty Seminar II - Orthodontics (2)**
Second in a series of four courses. (See DENT 523.)

**DENT 527. Clinical Specialty Seminar III - Orthodontics (2)**
Third in a series of four courses. (See DENT 523.)

**DENT 528. Clinical Specialty Seminar IV - Orthodontics (2)**
Fourth in a series of four courses. (See DENT 523.)

**DENT 529. Endodontology I (3)**
Scientific rationale for endodontic practice. Endodontic anatomy, physiology, pathology, and microbiology. All treatments and techniques studied and substantiated by current and classical research. First in a series of four courses.

**DENT 530. Endodontology II (3)**
Second in a series of four courses. (See DENT 529.)

**DENT 531. Endodontology III (3)**
Third in a series of four courses. (See DENT 529.)

**DENT 532. Endodontology IV (3)**
Fourth in a series of four courses. (See DENT 529.)

**DENT 539. Endodontic Literature Review I (3)**
Provides scientific basis for present and future treatment. Instructs students in critically evaluating literature. Provides format for lifelong self-education. Specific journal assignments summarized, evaluated, and presented for group discussion weekly. First in a series of four courses.

**DENT 540. Endodontic Literature Review II (3)**
Second in a series of four courses. (See DENT 539.)

**DENT 541. Endodontic Literature Review III (3)**
Third in a series of four courses. (See DENT 539.)

**DENT 542. Endodontic Literature Review IV (3)**
Fourth in a series of four courses. (See DENT 539.)

**DENT 549. Clinical Pharmacology I (1)**
This course is designed to enable residents to obtain an understanding of the pharmacology of the most commonly prescribed medications; pharmacotherapeutic concepts in relationship to disease pathophysiology; rational drug therapy in the treatment of disease; drug-drug interactions and drug-disease interactions; adverse drug events. Residents will be expected to apply information on disease pathophysiology and pharmacotherapy to clinical cases. The ultimate goal is to provide relevant information to assist clinicians in practice.

**DENT 550. Clinical Pharmacology II (1)**
(See DENT 549.)

**DENT 551. Clinical Endodontic Specialty I (3)**
Students present case histories as they encounter them in clinic. Cases discussed in detail and critically evaluated by colleagues and graduate endodontic faculty. Past endodontic literature discussed in detail as each student presents a topic assigned by faculty. Problems in clinic discussed. Several guest endodontists present various techniques and perform them. First in a series of four courses.

**DENT 552. Clinical Endodontic Specialty II (3)**
Second in a series of four courses. (See DENT 551.)

**DENT 553. Clinical Endodontic Specialty III (3)**
Third in a series of four courses. (See DENT 551.)

**DENT 554. Clinical Endodontic Specialty IV (3)**
Fourth in a series of four courses. (See DENT 551.)

**DENT 555. Management of Medical Emergencies (1)**
This course covers the diagnosis and management of common medical emergencies, with special emphasis on patient evaluation and history taking to prevent such emergencies in the dental office. Venipuncture technique and the use of emergency equipment are demonstrated. Also included is a basic course in cardiopulmonary resuscitation, with practical demonstrations and examinations that lead to certifications in basic CPR.

**DENT 557. Periodontal Conference I (1)**
Presentation of treated patients with advanced periodontal disease. Discussion of the clinical findings, etiology, diagnosis, and treatment plan. Critical review of the different surgical procedures used in therapy and evaluation of postoperative results. First in a series of four courses.

**DENT 558. Periodontal Conference II (1)**
Second in a series of four courses. (See DENT 557.)

**DENT 559. Periodontal Conference III (1)**
Third in a series of four courses. (See DENT 557.)

**DENT 560. Periodontal Conference IV (1)**
Fourth in a series of four courses. (See DENT 557.)

**DENT 564. Advanced Principles of Occlusion (1)**
Structure and function of all anatomic components involved in occlusion, mechanics of articulation and mastication, recording of mastication patterns, diagnosis of occlusal dysfunction, relationship to neuromuscular and temporomandibular joint anatomy and pathology, and treatment techniques used in gnathology.

**DENT 565. Practice Management I (Ortho) (1)**
Seminar and demonstration course designed to prepare the student for all phases of the “business” of orthodontics as well as the responsibility of being a “professional.” Management of the department clinic, private practice management, office visitations, and the business community, and ethics through the use of guest speakers on jurisprudence, personal and professional insurance, accounting, estate planning, risk management, informed consent, banking, office design, organized dentistry and investments. First in a series of four courses.

**DENT 566. Practice Management II (Ortho) (1)**
Second in a series of four courses. (See DENT 565.)

**DENT 567. Practice Management III (Ortho) (1)**
Third in a series of four courses. (See DENT 565.)

**DENT 568. Practice Management IV (Ortho) (1)**
Fourth in a series of four courses. (See DENT 565.)

**DENT 569. Orthodontic Literature Review I (1)**
Seminar course. Familiarizes students with classical and contemporary orthodontic literature. Provides students with broad knowledge of orthodontics. Students develop a more scientific attitude which enables them to think and to question, rather than to blindly accept words in print. Students introduced to contemporaneous areas of interest. Possibilities for further research discussed. First in a series of two courses.

**DENT 570. Orthodontic Literature Review II (1)**
Second in a series of two courses. (See DENT 569.)

**DENT 572. Advanced Specialty Principles: Preclinical I (1)**
Initial topics provide instruction and laboratory exercises including band formation, impressions, study model construction, wire bending, and soldering. Tweed tip-edge straight-wire techniques performed on typodonts. Topics dealing with materials and mechanics used in orthodontics. Laboratory projects designed to prepare the student for clinical procedures. Later topics place emphasis on record gathering, diagnosis, case planning, treatment, retention, and periodic review of case progress. A comprehensive clinical examination in preparation for board examination is given in the third course.

**DENT 573. Advanced Specialty Principles: Clinical I (2)**
Full fixed orthodontic appliance treatment of patients in an educational setting. First in a series of four courses.

**DENT 574. Advanced Specialty Principles: Clinical II (2)**
Second in a series of four courses. (See DENT 573.)

**DENT 575. Advanced Specialty Principles: Clinical III (2)**
Third in a series of four courses. (See DENT 573.)

**DENT 576. Advanced Specialty Principles: Clinical IV (1)**
Fourth in a series of four courses. (See DENT 573.)
DENT 577. Clinical Periodontics I (3)
Clinical practice of periodontics supplemented by case evaluation and treatment planning. A comprehensive study of normal and diseased periodontal tissues including etiology and diagnosis. Current modes of therapy-rationale technique, and prognosis. First in a series of four courses.

DENT 578. Clinical Periodontics II (3)
Second in a series of four courses. (See DENT 577.)

DENT 580. Orthodontics-Oral Surgery Conference (1)
A seminar series involving a multidisciplinary approach to the treatment of patients with severe craniofacial deformities. Begins in the fall of each year (continuing for four semesters) with a series of lectures, followed by assignment of patients supervised jointly by the departments of orthodontics and oral surgery. Meetings held bimonthly to review patient progress, plan treatment, and present cases for discussion. Each student involved in all phases of treatment: presurgical orthodontics, the surgical procedure, finishing orthodontics, and retention.

DENT 581. Clinical Periodontics III (3)
Third in a series of four courses. (See DENT 577.)

DENT 582. Clinical Periodontics IV (3)
Fourth in a series of four courses. (See DENT 577.)

DENT 583. Orthodontic Diagnostic Seminar I (1)
Series of lectures and seminars covering the science of orthodontic diagnosis. Course consists of lectures on techniques of diagnosis, treatment planning, and critique of cases from the department or from faculty private practices. Content also includes long-term follow-up of post retention cases. First in a series of three courses.

DENT 584. Orthodontic Diagnostic Seminar II (1)
Second in a series of three courses. (See DENT 583.)

DENT 585. Orthodontic Diagnostic Seminar III (1)
Third in a series of three courses. (See DENT 583.)

DENT 586. Limited Tooth Movement for the Dental Specialist (1)
A review of the rationale for orthodontic treatment in periodontally diseased patients and in pre-restorative dentitions. Lectures, audio-visual programs, and technique sessions. Diagnosis, treatment planning, and various methods of tooth movement.

DENT 587. Periodontal Prosthesis (1)
This course examines and defines the periodontal prosthetic interrelationships beginning with treatment planning and continuing with discussing the utilization of the combined treatment modalities. It focuses on provisionalization, furcation treatment, occlusion, aesthetics, removable appliances, and special advanced treatment problems.

DENT 588. Hospital Rotation (2)
Students are assigned full time to anesthesia service and perform such duties as directed by anesthesia staff: preoperative evaluation of patients, indications and contraindications for specific methods of anesthesia, relationship of medical problems to anesthesia risks, assisting in preparation of patients for anesthesia, intubation and anesthesia management, assisting in the management of complications, and post-anesthetic recovery management including monitoring of vital signs, blood gases, EKG, etc., and participation in post-anesthesia rounds and conferences.

DENT 595. Advanced Periodontal Seminar I (1.5)
Series of seminars covering clinical, histological, and physiological aspects of the periodontium in health and disease, etiology, diagnosis, prognosis, prevention, and treatment of periodontal disease, as well as the relationship of periodontics to other phases of dentistry. First in a series of four courses.

DENT 596. Advanced Periodontal Seminar II (1.5)
Second in a series of four courses. (See DENT 595.)

DENT 597. Advanced Periodontal Seminar III (1.5)
Third in a series of four courses. (See DENT 595.)

DENT 598. Advanced Periodontal Seminar IV (1.5)
Fourth in a series of four courses. (See DENT 595.)

DENT 651. Thesis M.S.D. (1-9)
Subsections for each program area of study: endodontics, orthodontics, or periodontics.

DENT 661. Conscious IV Sedation I (2)
Didactic portion covers physical evaluation, physiology, pharmacology, emergencies, and techniques. Cardiac monitoring, basic life support, and advanced cardiac life support.

DENT 662. Conscious IV Sedation II (1)
(See DENT 661.) Supervised clinical experience in conscious IV sedation.

DENT 663. Implant Dentistry I Periodontics (1)
Designed to enhance the understanding of current concepts and their role in the multidisciplinary treatment of the patient.

DENT 664. Implant Dentistry II Periodontics (1)
(See DENT 663.) Clinical demonstration, participation, and case presentation in implant dentistry.

DENT 682. Cephalometrics (1)
A lecture and laboratory course in cephalometric roentgenography leading to a thorough understanding of craniofacial radiographic techniques. Use of x-rays and radiation hygiene, and technical and interpretive proficiency.

DENT 683. Advanced Cephalometrics and Imaging (1)
This course is designed to extend study of the cephalometric technique and includes its use in the assessment and prediction of growth, the effects of treatment, the limitations of the technique and its value as a research tool. Prereq: DENT 682.

DENT 684. Radiology and Cephalometrics (1)
Fundamentally related to cephalometric radiography, skeletal morphology, and cephalogram interpretations of historic analyses via the Krogman-Sassouni Syllabus. Also, clinical evaluations of hard and soft tissue relationships of the airway and skeletal maturation are presented. The use of Bolton Standards in craniofacial analysis is stressed.

DENT 685. Literature Review in Periodontics I (1)
Comprehensive discussion of selected articles related to clinical periodontology and basic sciences of significance to periodontal research and therapy.

DENT 686. Literature Review in Periodontics II (1)
(See DENT 685.)

DENT 690. Pediatric Dental Residency (1-10)
Allows registration for non-degree-seeking students in graduate level courses at the direction of the department.

DENT 695. Oral Surgery Residency (1-10)
Allows registration for non-degree-seeking students in graduate level courses at the direction of the department.
School of Law
The school has a student body of about 700 and a faculty of about 49. In the school’s early years, most students came from Ohio and remained in Ohio after graduation. Today, students come from all parts of the country (though Ohio still has a large representation), and more of them leave Ohio than stay. There are Case Western Reserve law graduates in virtually every state (and in several foreign countries), and certainly in every major U.S. city. An active and aggressive Career Services Office works with students, graduates, and prospective employers from all over the nation to maximize job opportunities.

**Administration**

Gerald Korngold, J.D. (University of Pennsylvania)

Andrew P. Morriss, J.D., M.Pub.Aff. (University of Texas), Ph.D. (Massachusetts Institute of Technology)

Associate Dean for Academic Affairs

Sonia M. Winner, J.D. (University of Dayton)

Associate Dean for Development and Public Affairs

Barbara F. Andelman, J.D. (Ohio State University)

Associate Dean for Student Services, Enrollment Planning, and Special Projects

Susan Renee Seliga, J.D. (Cleveland State University)

Hiram E. Chodosh, J.D. (Yale University)

Director of the Frederick K. Cox International Law Center

Kathleen M. Carrick, M.L.S. (University of Pittsburgh), J.D. (Cleveland State University)

Director of the Law Library

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Director of Research, Analysis and Writing Program

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Executive Director of the Graduate Tax Program

Thomas I. Hausman, J.D. (Ohio State University), L.L.M. (New York University)

Administrative Director of the Graduate Tax Program

Lewis R. Katz, J.D. (Indiana University)

Director of the Graduate Program for Foreign Students in U.S. Legal Studies

Henry T. King, Jr., LL.B. (Yale University)

U.S. Director of the Canada-United States Law Institute

Wilbur C. Leatherbury, J.D. (Case Western Reserve University)

Director of Skills Courses and Advocacy Programs

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Co-Director of the Milton A. Kramer Law Clinic Center

Kenneth R. Margolis, J.D. (Case Western Reserve University)

Co-Director of the Milton A. Kramer Law Clinic Center

Maxwell J. Mehman, J.D. (Yale University)

Director of the Law-Medicine Center

Craig Allen Nard, J.D. (Capital University), J.S.D., L.L.M. (Columbia University)

Director of the Center for Law, Technology and the Arts

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Cheryl Smith Cheatham, M.S.L.S. (Case Western Reserve University)

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Anne-Marie E. Connors, M.A. (Saint Louis University)

Director of Alumni Relations and Development

Deborah S. Dennis, M.L.S. (Kent State University)

Head of Bibliographic Access

Andrew Dorchak, M.L.S. (Kent State University)

Head of Reference

Michelle C. Frygier, M.A. (Case Western Reserve University)

Director of Publications and Communications

Betty J. Harris

Registrar

Alice Hunt

Assistant Director of Finance and Administration

D.R. Jones, J.D. (Mercer University), M.L.S. (University of Washington)

Deputy Director of the Law Library

Judith A. Kaul, M.S.L.S. (Case Western Reserve University)

Technology and Reference Librarian

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Director of Finance and Administration

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Director of Admissions

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Assistant Director of Support Services

Serials/Collection Access Librarian

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Assistant Director of Academic Support for the Graduate Program for Foreign Students in U.S. Legal Studies

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Access Services Librarian

Sarah McFarlane Polly, J.D. (Ohio State University)

Associate Director for Career Services

Jay A. Ruffner, B.S. (Case Western Reserve University)

Student Finances Administrator

Adria J. Sankovic, M.A. (Case Western Reserve University)

Assistant Director for the Graduate Program for Foreign Students in U.S. Legal Studies

Melissa A. Santee, B.A. (University of Toledo)

Director of the Annual Fund

Alice Simon, M.A. (University of Baltimore)

Manager of Academic Centers and Law Journals

Melody Stewart, J.D. (Cleveland State University)

Director of Student Services

Carole Zalokar, A.A. (Lakeland Community College)

Assistant Registrar

Piper Hollis, M.A. (Ohio State University)

Director of Development

**Faculty**

Gerald Korngold, J.D. (University of Pennsylvania)

Dean and Everett D. and Eugenia S. McCurdy Professor of Law

Jonathan H. Adler, J.D. (George Mason University)

Assistant Professor of Law

Arthur D. Austin II, J.D. (Tulane University)

Edgar A. Hahn Professor of Law

Jessica W. Berg, J.D. (Cornell University)

Assistant Professor of Law and Biomedical Ethics

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Assistant Professor of Law

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Piper Hollis, M.A. (Ohio State University)

Director of Development
Identification of applicants for the J.D. program is based on three primary factors: academic record, personal qualities, and an interest in legal methodology. Applicants must be graduates of an accredited college or university. The admissions committee uses a variety of metrics to evaluate applicants, such as undergraduate grade point average and Law School Admission Test scores. The committee also considers personal qualities and an interest in legal methodology.

The admissions committee looks carefully at such indicators as class rank, standardized test scores, and the applicant’s academic record. The committee also considers the applicant’s personal qualities, such as leadership potential, maturity, and a commitment to public service.

The objective is to enroll a class that 1) is diverse and reflects the range of backgrounds and experiences of the applicant pool, and 2) will more than likely do very well in a rigorous law program.

This section relates to the J.D. programs; see below for information regarding admission to LL.M. programs.

Admission

This section relates to the J.D. programs; see below for information regarding admission to LL.M. programs. For complete information about admission policies and procedures, and about the law program generally, see the law school’s current admissions bulletin, which the school’s Office of Admissions will mail on request.

Admission Policy

Since the School of Law receives many more applications than there are places in the first-year class, the admissions process must be selective. The objective is to enroll a class that 1) is diverse and 2) will more than likely do very well in a rigorous law program. The admissions committee looks carefully at such indicators as undergraduate grade point average and Law School Admission Test (LSAT) score, but it weighs other, non-quantitative factors into the decision. The school particularly encourages applications from people of color and others underrepresented in the legal profession, as well as from older students. The admissions committee
will consider with sensitivity any information about a candidate’s special circumstances. The school receives applications as early as September for admission in the following fall. The earlier the application, the greater the chance of a scholarship. Beginning in January, the admissions office takes action on the applications that clearly meet or clearly fail to meet the selection criteria. As decisions are made, applicants are notified. Most decisions are made between January 1 and May 1. At that point the class is filled, and the office starts a waiting list of candidates with acceptable credentials. As vacancies occur up to the date of registration, the best-qualified candidates are drawn from the list.

**Admission Requirements**

**Admission to Regular Standing**

In order to enroll as a candidate for the Juris Doctor (J.D.) degree, a student must have a bachelor’s degree from an accredited institution. Every applicant must have taken the Law School Admission Test (LSAT) and must have registered with the Law School Data Assembly Service (LSDAS) before the application deadline.

Admission to Advanced Standing Students currently enrolled in accredited law schools may apply for admission with advanced standing. They must complete four semesters in residence at Case Western Reserve to receive the J.D. degree.

**Admission as a Visitor**

We accept students enrolled at other law schools who wish to take courses at Case Western Reserve for credit toward their own school’s degree requirements. Such students must submit a letter from their dean indicating that they are in good standing and that the other law school will accept the academic credits from Case Western Reserve.

**Financial Information**

See “Financial Information” section of this bulletin.

**Academic Programs**

**Juris Doctor (J.D.) Degree**

The School of Law offers the Juris Doctor (J.D.) degree as well as dual degree programs (see below). The J.D. degree requires successful completion of 88 credit hours. The first-year program for the J.D. degree consists mainly of the required basic courses. In addition, in the spring semester students select a 3-credit elective course; the menu of first-year “perspectives” courses varies from year to year.

**Fall Semester Required Courses**

- LAWS 132, Torts (4)
- LAWS 123, Contracts (4)
- LAWS 131, Criminal Law (4)
- LAWS 151, Research, Analysis, and Writing I*

**Spring Semester Required Courses**

- LAWS 104, Civil Procedure (4)
- LAWS 103, Constitutional Law I (4)
- LAWS 144, Property (4)
- LAWS 152, Research, Analysis, and Writing II*

In the second year, every student must take LAWS 375, Professional Responsibility (3). Otherwise, the curriculum is elective after the first year. As a requirement for graduation, every student must complete a substantial research paper.

**Concentrations**

For complete information about the Voluntary Concentration program, consult the law school’s Student Handbook (available from the Registrar).

**Voluntary Concentrations:**

- Business Organizations
- Criminal Law
- Litigation
- Health law
- International Law
- Law, Technology and the Arts
- Public Law - Public and Regulatory Institutions track or Individual Rights and Social Reform track

**Interdisciplinary Programs**

For complete information about dual degree programs, consult the law school’s Student Handbook (available from the Registrar).

**J.D./M.B.A.**

A dual degree program between the School of Law and the Weatherhead School of Management allows students to earn two degrees in four years. Students spend the first year in one school and the second year in the other. Once the required courses are behind them, they spend the third and fourth years taking electives at both schools. Five areas of law-management specialization have been approved by the two schools: international business, health systems management, corporate finance, banking and investment, and labor and industrial relations.

**J.D./M.S.S.A.**

Together, the School of Law and the Mandel School of Applied Social Sciences offer a four-year program in law and social work. Students take the basic required courses in both schools and then have considerable flexibility in pursuing their particular interests and preparing themselves for different careers. Besides their time in the classroom, students gain practical experience in internships.

**J.D./M.N.O.**

A 4-year program combining the J.D. with a master’s degree in nonprofit organizations is offered in cooperation with the university’s Mandel Center for Nonprofit Organizations. Housed in the Mandel School of Applied Social Sciences, which has long been noted as a training ground for administrators of nonprofits, the center is co-sponsored by MSASS, the School of Law, and the Weatherhead School of Management.

**J.D./M.D.**

The School of Law and the School of Medicine offer a dual degree program that allows a student to complete both degrees in six years. A student who begins at the law school spends two years studying law, then four years studying medicine. Alternatively, a student may spend the first two years and the last two years at the medical school, and the two middle years at the law school.

**J.D./M.A. (Bioethics)**

The School of Law and the Center for Biomedical Ethics make it possible for a student to earn two degrees in seven semesters, or in six semesters plus two summer sessions. Typically a student begins with a year of law study.
J.D./M.A. (Legal History)
Enrolling in both the law school and the School of Graduate Studies, a student can study law and legal history and earn the two degrees in seven regular semesters or six semesters plus two summers.

J.D./CNM (Certificate in Nonprofit Management)
The CNM is a non-degree professional certification that provides knowledge in critical areas of management methodology and the operational environment of the nonprofit sector. For additional information on this program, contact the Registrar’s Office at the School of Law.

J.D./M.P.H. (Public Health)
The M.P.H. degree will generally add a year of additional course work to the J.D. degree, creating a four year program. Law students enrolled in the dual J.D./M.P.H. degree program may earn up to 12 credits toward the J.D. in graduate level M.P.H. courses. The law school offers several health law courses that meet the M.P.H. elective requirements.

Graduate School Option
Students in the School of Law may take up to nine hours of courses in the other graduate and professional schools of Case Western Reserve University and have such courses counted for credit toward the J.D. degree.

LL.M. in United States Legal Studies
The LL.M. in U.S. Legal Studies is designed for graduates of foreign law schools who wish to spend an intensive year immersed in American legal education. LL.M. candidates take most courses with American J.D. candidates and have seminars with American lawyers. Degree requirements include 24 course credits (including LAWS 570, Foreign Graduate Seminar). Students from civil law countries must take LAWS 595, American Contract Law, and students whose command of English is deficient will be required to take an English language course. LAWS 263, Doing Business in the U.S., is an elective available only to LL.M. students.

Each student’s courses will be determined by the program director in consultation with the student and will be based on the student’s prior legal education and interests. After completion of the degree requirements, students may elect to spend a summer internship with a law firm or corporate legal department in the United States. Further information and admission materials may be requested from Professor Lewis R. Katz, Director of the LL.M. in U.S. Legal Studies Program or Ms. Adria J. Sankovic, Assistant Director of the LL.M. in U.S. Legal Studies Program.

LL.M. in Taxation
The School of Law offers the LL.M. degree in Taxation to qualified candidates who hold a J.D. degree. Candidates for the LL.M. must complete 24 credit hours at the 600 level; the selection of courses will depend on the candidate’s prior legal education and experience. Students may complete the LL.M. in one academic year or may enroll part-time; the schedule of courses accommodates persons regularly employed. Students enrolled on a part-time basis need to fulfill their credit requirement for the degree within five years. Classes are also open to qualified persons (such as accountants) who do not hold a J.D. degree and thus cannot be candidates for the LL.M. Further information and admission materials may be requested from Professor Thomas I. Hausman, Administrative Director of the LL.M. in Taxation Program.

The Law Library
The law library’s holdings include more than 365,000 books and volume-equivalents, complete collections of federal and state law, law reviews, current law services, an extensive British and Commonwealth collection, and special collections in taxation, labor law, foreign investments, international law, and environmental law. The law library is building strong collections in law and medicine, intellectual property, and law of the European Union. It is a selective depository for both U.S. and Canadian government documents. The law library is a member of OhioLINK, which is a consortium of Ohio’s college and university libraries and the State Library of Ohio. OhioLINK offers access to more than 51 million library items from 79 institutions. These materials include items from law, medical, and special collections.

The law library offers its users access to an ever-expanding list of electronic research databases as well as e-books. E-books are accessible through the library catalog. Databases offered include Lexis/Nexis and Westlaw as well as over 100 OhioLINK databases (including Index to Legal Periodicals, Medline, and Ohio Capitol Connection). Many of these OhioLINK databases contain the full text of journal articles. The law library also offers access to certain web-based subscription databases such as Hein-On-Line. Housed within the law library are two computer laboratories and a computer training classroom. In addition, the Richey Reading Room contains network connections for laptop computers.

Special Programs
Professional Skills Programs
Milton A. Kramer Law Clinic Center
The Supreme Court of Ohio authorizes student practice under attorney supervision in the final year of law school. Through the clinic, students provide legal representation to indigent clients and community groups and receive academic credit. The supervising attorneys are full-time members of the law faculty. The clinical program is the capstone of the skills curriculum and offers specialized practice experiences in Criminal Justice, Community Development, Civil Litigation Practice, focused on consumer matters, predatory lending, social security disability and other public benefit issues, Health Law, and Family Law.

Litigation Program
Since the mid-1970s, the School of Law has invested heavily in its litigation program. Students practice the basic skills of trial advocacy in such courses as LAWS 397, Trial Tactics (4), and in the co-curricular moot court and mock trial programs.

Frederick K. Cox International Law Center
The International Law Center serves as the stimulus for enhancing programs in international, comparative, and transnational law at the law school. It supports visiting scholars and visiting faculty at the law school to enrich the curriculum and research capacity of the resident faculty. It also supports the development of international information resources. Through a series of sister law school relationships, it seeks to attract foreign students to the law school and provide opportunities for Case Western Reserve law students to study abroad; it also provides opportunities for faculty to study and teach abroad.

Canada-United States Law Institute
The Canada-U.S. Law Institute, established in 1976, is jointly sponsored by the law schools of Case Western Reserve University
and the University of Western Ontario. Its primary educational purpose is to give students of both schools a comparative perspective on their own country’s legal system. Each semester, up to six students from each school spend the term in residence at the other school. The school in which the student is a degree candidate gives full credit for the semester’s work. The two schools also exchange faculty, usually for periods of one or a few days, but occasionally to teach one or more courses for a full semester.

A second purpose of the institute is to provide a framework for the exploration of transnational and international legal issues affecting the relationship between Canada and the United States. In addition to the regularly scheduled courses on Canadian-U.S. topics, the institute sponsors workshops and conferences, including annual conferences in Cleveland, which, in recent years, have dealt with Canadian-U.S. economic ties.

The institute also sponsors a regular publication, the Canada-U.S. Law Journal; the annual Niagara Moot Court Competition, in which students from U.S. and Canadian law schools participate; and special research projects, often with funding support.

Law-Medicine Center

The Law-Medicine Center at Case Western Reserve University has been in operation for 50 years. It began with a focus on forensic medicine, but has broadened to include the whole range of legal, social, economic, scientific, and ethical issues in which law and medicine are interrelated. Besides the regular course offerings, the center frequently presents lectures, symposia, and workshops, and sponsors major conferences. It publishes a student-edited journal, Health Matrix: Journal of Law-Medicine. Participants in the center’s activities include not only university personnel, but also professionals from such institutions as University Hospitals of Cleveland and the Cleveland Clinic.

Student Activities

Publications

The School of Law publishes three scholarly journals, all student-edited. The oldest is the Case Western Reserve Law Review, published quarterly. The Journal of International Law is published two to three times a year; the JIL editorial board also has responsibility for the Canada-U.S. Law Journal (sponsored by the Canada-U.S. Law Institute), published once a year. Health Matrix: Journal of Law-Medicine began as a joint undertaking of all six of the University’s professional schools but since 1990 has been sponsored solely by the law school and its Law-Medicine Center.

Competitions

Moot Court

A student board administers the Dean Dunmore Competition, a year-long program in which second-year (and a very few third-year) students participate. It culminates in a round-robin tournament involving 16 finalists. From those finalists, the board selects teams who will compete the following year in the National Moot Court Competition, the Craven Competition in constitutional law, and the Niagara Competition (sponsored by the Canada-U.S. Law Institute). Case Western Reserve also enters the Jessup International Competition; that team is selected by another student group, the Society of International Law Students.

Mock Trial

The Jonathan M. Ault Mock Trial Board sponsors an intramural competition from which emerge the members of interscholastic teams. Currently, the law school sends student representatives to the National Trial Competition, the National Student Trial Competition of the Association of Trial Lawyers of America, and a competition sponsored by the Academy of Trial Lawyers of Allegheny County, Pennsylvania.

Regulations and Rules of Conduct

The Academic Regulations of the School of Law are published annually in a Student Handbook that is distributed to every student. Copies are available on request from the school’s Registrar.

In addition to the University’s rules of conduct, law students are expected to comply with the American Bar Association’s Model Code of Professional Responsibility and Model Rules of Professional Conduct, to the extent that these are applicable, and with the law school’s own Code of Conduct. The Model Code and Model Rules are available in the law library. The school’s Code of Conduct, like the Academic Regulations, is published in the Student Handbook.

Course Descriptions

Law (LAWS)

LAWS 001. Comparative Law and Religion Seminar (3)
This seminar will focus on issues in law and religion in comparative perspectives.

LAWS 002. Education Law Seminar (3)
This seminar will build upon the foundation established by the first-year curriculum and focus on selected legal topics relating to education law and policy with a particular emphasis on constitutional (federal and state) issues. Such legal topics will include (but are not limited to) the regulation of educational institutions, student, teacher, and parental rights, equal educational opportunity, school finance, and the federal role in education. Enrollment is limited to 12. Grade is based on a presentation and a paper.

LAWS 003. Reproductive Law and Ethics Seminar (3)
This seminar will introduce students to philosophical and legal materials related to reproductive ethics and law.

LAWS 004. Settlement Law Seminar (2-3)
This seminar will examine the theory and practice of settlement of disputes. Matters to be considered include: the practical issues of how one negotiates the settlement and drafts settlement documents; the theoretical issues of why some cases settle and why some do not; the appropriate role of judges and mediators in facilitating settlements, and the procedural and substantive law affecting the settlement of law suits. Grade is based on a presentation and a paper. Enrollment is limited to 12.

LAWS 005. Federalism Seminar (3)
The seminar will explore the constitutional relationships between the federal government and the states. Through additional exposure to pertinent case law and concentrated study of early historical materials in addition to scholarly writings, the seminar builds on the basic Constitutional Law course and is designed to give students a deeper understanding of the dimension and complexity of our federal system. Topics will include the reason for a federal rather than a unitary or centralized governmental system, and how a system of divided political authority imposes restraints on federal and state legislative and judicial authorities. By way of contrast, the seminar may also explore how other countries administer federal systems and, in this country, the difference between federal/state federalism and state/local federalism.

LAWS 006. Legal History of European Union Seminar (3)
The seminar introduces students to the history, development, and present structure of the legal system of the European Union from the ECSC in 1951, through the Treaty of Rome in 1957, to the Treaty of Amsterdam in 1997. The seminar will examine the “constitutional” structures and institutions of the European Union, including the emergence of a binding jurisprudence from the European Court of Justice; will look at
general interpretive principles emanating from the European civil law tradition, such as the doctrines of subsidiarity and proportionality; will explore the public law of the European Union, the "four freedoms," human rights, and equal treatment of women and men; and will briefly treat private law rights emergent not only from treaty and parliamentary enactment but from Union jurisprudence. The seminar will concentrate on the historical and economic context, but legal doctrine and practice will also be considered.

LAWS 007. Regulation of the Political Process Seminar (3)
The seminar will cover laws that regulate elections, campaigns, and other aspects of the democratic process. Specific topics include campaign finance reform, political parties, the right to vote, and direct democracy. Prereq: LAWS 103 and LAWS 202.

LAWS 009. Business Organizations Research Seminar (2)
An opportunity to undertake significant research and writing on the law of business organizations. Each student will be expected to complete a major paper in satisfaction of the upper level writing requirement. A satisfactory paper will meet the writing requirement for the concentration in Business Organizations. Limited to 12. Prereq: LAWS 261 or LAWS 204.

LAWS 010. African-American Lawyers Seminar (3)
This seminar takes an interdisciplinary approach to the study of African-American lawyers. It examines aspects of the history of black lawyers in America, as well as topics relating to black lawyers in contemporary America. The course will situate these experiences in the context of both the history of the legal profession and the history of race relations and the struggle for civil rights in the United States. Students will prepare a substantial research paper and make an oral presentation of their research to the class. Limited to 12.

LAWS 011. Firearms Regulation (3)
This class examines the constitutional and policy questions surrounding firearms regulation. The course will cover historical issues, modern statutory controls, and legal and policy questions surrounding firearms regulation. Prereq or Coreq: LAWS 202.

LAWS 012. Constitutional Law Research Seminar (2)
This seminar permits students to write an in-depth paper, exploring an area of Constitutional Law most interesting to them. There are no explicit rules governing subject matter except that the paper must have, as its central focus, constitutional doctrine, policy, and/or analysis. Several classes will be held during the semester. The focus of these classes will be the process of writing a paper and the research tools available. A thesis statement, an outline, and at least one draft before the final paper are required. The grade will be based solely on the quality of the paper. The paper may be used to satisfy the writing requirement.

LAWS 013. Current Controversies in Environmental Law (3)
This seminar will explore current legal and policy controversies in environmental law. Special attention will be paid to recent Supreme Court decisions and forthcoming environmental protection, federal courts, including current constitutional challenges to environmental programs and regulations. Issues likely to be discussed include the impact of recent federalism decisions on environmental protection, federal preemption of state regulation, environmental standing, the non-delegation doctrine, and cost-benefit analysis, among other topics. Students will read recent Supreme Court and Circuit court opinions, appellate briefs, academic commentary and supporting materials. Grade is based on class participation, final presentation, and a paper. Limited to 12.

LAWS 014. Insurance Advanced Research (2)
This seminar will allow students concurrently enrolled in Insurance (LAWS 346) to satisfy the upper-level writing requirement. Students will receive advanced instruction in legal research in insurance law and will complete a series of research and writing exercises, including drafting a statute or administrative rule and preparing and presenting a report supporting adoptions of the statute or rule. At least one oral presentation will be required. Depending on the topic area chosen in a particular year, students may be required to write a brief in a case involving interpretation of an existing or proposed statute or rule. Limited to 12. Coreq: LAWS 346.

LAWS 015. Research Law and Ethics Seminar (3)
This seminar will introduce students to philosophical, legal, and policy materials related to research ethics and law. We will consider the regulation of research involving animals, humans, fetuses, and embryos. Attendance at classes is mandatory. Grade is based on class participation, final presentation, and paper. Limited to 12.

LAWS 016 International Environmental Law Seminar (3)
This seminar will explore current legal and policy controversies in the rapidly evolving field of international environmental law. The class will begin with consideration of current international environmental concerns and the nature of international law. The seminar will then proceed to consider several international environmental issues in some detail, analyzing current and proposed policy measures. The class will consider existing and proposed legal measures to address international environmental concerns and their alternatives. Special attention will be paid to high-profile international environmental treaties and the interface between domestic U.S. and international environmental law. Special topics likely to be covered include remedies for transboundary pollution, sustainable development, climate change, and conservation of biodiversity. Weekly readings will include primary materials (treaties, court decisions, etc.) and academic commentary. Students will be expected to read and consider the assigned material, prepare questions for class discussion, and arrive prepared to talk about the relevant legal and policy issues in some detail. Class participation will be graded. Each student will be expected to complete a substantial paper on a current issue or controversy in international environmental law. This paper may be used to satisfy the writing requirement. In addition, each student will be required to give a short presentation of his or her paper. There are no prerequisites for this seminar, however, some background in environmental and/or international law may be helpful.

LAWS 017. Scientific Evidence and Advanced Research (2)
Students must be concurrently enrolled in LAWS 214 (no exceptions). Enrollment limited to six students.

LAWS 018. Professional Responsibility Advanced Research (2)
This seminar will allow students co-currently enrolled in Professional Responsibility (LAWS 375) to satisfy the upper-level writing requirement. Students will receive advanced instruction in legal research in Professional Responsibility and will be required to complete a series of written exercises, including drafting a rule and writing a brief and a judicial opinion. The exercise will include a series of planning questions to help students structure their work. Each exercise will require the students to develop expertise in an area of Professional Responsibility through performance in simulated professional roles. At least one oral presentation will be required.

LAWS 019. Commercial Information and the Law (3)
This seminar encourages students to focus on the legal nature of valuable commercial information in the ‘global information age.’ In this context, information per se is often one of the key assets of a business. In examining the role of valuable information in law and commerce (particularly e-commerce), students will consider legal and practical questions arising from attempts to protect valuable commercial information against unauthorized access, use and/or interference, with particular focus on information stored in computer systems. Students will also examine issues arising in relation to transactions involving commercial information, such as licensing arrangements. The increase in cross-border activities involving access to valuable information will also be examined with a view to analyzing the implications of this trend for the development of private international law principles and dispute resolution mechanisms. Grade is based on class participation, final presentation, and a paper. Limited to 12.

LAWS 020. Issues and Trends in Civil Rights Law (3)
This seminar will cover the Civil War era civil rights statutes (e.g., Section 1983); provisions of the Civil Rights Acts governing discrimination in programs receiving federal funds; prohibitions against discrimination in places of public accommodation; and the Voting Rights Act of 1965, among other topics. Students will achieve an understanding of the statutory framework of civil rights law as well as specific issues that are unresolved or of particular importance in each area. The seminar will also contextualize these legal issues within the larger historical and contemporary framework of racism and discrimination. Grade is based on class participation, final presentation, and a paper. Limited to 12.
LAWS 021. Animal Law (3)
This seminar will review selected federal and state laws that pertain to animals, focusing on the Animal Welfare Act, wildlife statutes, and criminal anti-cruelty laws. Students will review recent cases and laws which address the larger questions posed by the animal rights movement, distinguishing between regulations designed for animals and those designed for humans involved with animals. After gaining familiarity with the landscape of animal law, students will examine the animal rights movement as an example of a social justice/ref orm movement. Topics will include: the conflicts and intersections between law and science; methods and tactics used in legal reform advocacy; the validity and efficacy of using philosophical justifications for legal arguments or change; definitions of property; the historical and geographic context of this movement within the spectrum of other reform movements. Students can choose to write one paper to satisfy the upper-level writing requirement or write two smaller papers which will not satisfy the writing requirement.

LAWS 022. Intellectual Property Advanced Research (2)
This advanced research seminar is designed to provide students with an opportunity to engage in in-depth and systematic research on a topic related to intellectual property law. The topic will be chosen in consultation with the instructor. Each student will be required (1) to write a substantial research paper on his or her chosen topic; and (2) to make a presentation on his or her research to the entire class. We will meet as a class at least four times during the semester, and each student will be required to meet individually with the instructor several times during the semester.

LAWS 023. Religion, Ethics, and the Law (3)
This is a paper seminar, limited to 12 students. The course will explore the interrelationship between religion, ethics, and the law in the American legal system. We will begin with a series of general questions. To what extent do we have true separation of church and state in American jurisprudence? Why should religious beliefs be given more deference than political opinions or other personal expressions? Does the law set the standard for public morality or reflect it? In order to establish a successful legal system, does society need to reach a consensus as to its moral and ethical values? When is the government ethically justified in punishing individuals for their misconduct, and what theories justify punishment within the criminal justice systems? In the second part of the course we will focus on a variety of issues that raise legal, ethical, and religious questions. Topics may include capital punishment euthanasia, genetic testing war crimes, and others. Prereq: Students must have taken and passed their RAW and Constitutional Law classes.

LAWS 024. ePayment Systems Seminar (1)
This seminar builds on the foundation established during the first-year curriculum and focuses on the law and technology of payment systems. Such topics will include the contractual relationship amongst and between the various organizations transacting to enable a b2c payment; the various elements of such agreements; the various impacts of a payment system (criminal, civil, and administrative); the implications for legal structure and policy; and the ethical considerations of a lawyer advising clients within this domain. Grade is based on a paper, a presentation, and class attendance and participation.

LAWS 025. Bioethics Research and Writing Seminar (2)
This seminar is for students interested in doing their upper-level writing requirement and/or concentration paper on a topic in the area of bioethics and law. It is a research and writing seminar, so the focus of class meetings will be on developing the papers. Students will be required to read and edit each other's drafts. Grade is based on class participation, final presentation, and paper. All students interested must pre-register for the course. Permission of instructor required. Students will need to schedule meetings with the professor during the Spring. All topics must be approved no later than July 1.

LAWS 041. Comparative Judicial Systems (2)
Students will study and work on contemporary problems confronting national judicial systems. The academic component will cover the different ways in which judicial systems and their adjudication and dispute resolution processes are organized, with a focus on critical failures in judicial performance (political interference, corruption, delay, torture, and illegal detention). Students will also study different approaches at the bina
tional, transnational, and international levels designed to accelerate justice reform. Uniquely, students will work in small teams of no more than four to conduct research and provide advice on active civil and criminal justice reform initiatives in up to five foreign countries, chosen from Africa (e.g., Tanzania, Morocco), Asia (e.g., India, Indonesia), the Middle or Near East (e.g., Israel, Turkey), Latin America (Brazil, Mexico), or Europe (e.g., Italy, France). (Countries and projects will be determined in the summer based on the intensity of the national reform activity and student interest.) The grade will be based on class and team participation, a paper and bibliography. Students may satisfy the writing requirement.

LAWS 042. Comparative Judicial Systems (2)
(See LAWS 041.)

LAWS 051. Empirical Methods for Lawyers (3)
This course will introduce students to some of the most basic and important quantitative tools of the social sciences that usefully bear on many legal issues and help students develop a rough idea of how to make use of these tools. The material will be presented in a manner that is fully accessible to those with no prior quantitative training or background in the subjects covered. The course will pay particular attention to the application of empirical methods in an array of public and private law areas. Grade is based on a short paper (pp. 8-10) and a final examination.

LAWS 060. Cyberlaw (3)
This subject deals with how the law regulates and otherwise applies to activities taking place in 'cyberspace.' It considers how existing legal principles are being modified and extended in the digital information age to meet the needs of society, particularly in relation to electronic commerce. As the nature of dealings in cyberspace develops and new legal problems emerge over time, the focus of the subject may change to reflect current legal issues. However, topics for discussion will be drawn from the following: the nature of the Internet, legal regulation of cyberspace vs. self-regulation, the relevance of international law/ international regulation, e-commerce contracting, 'property' in cyberspace with particular reference to intellectual property, trade marks and domain names, defamation on the Internet, online crime (e.g., fraud, pornography, etc.), information privacy and security, online dispute resolution and associated conflicts of law issues.

LAWS 070. Real Estate Mortgages (2)
Real estate mortgages are widely used. In fact, just about every land purchase or land improvement (whether involving a family residence or a complicated commercial development, like a shopping center) involves the use of a mortgage. Yet, even though the rights of the parties to the mortgage, (i.e. the mortgagor (debtor) and the mortgagee (creditor or secured party)), as well as the rights of third parties claiming an interest in the land (like another purchaser or lien creditor) depend upon them, the unique equitable principles and legal rules which govern the mortgage are not well known or understood. These are studied in depth in this course. Actual problems are frequently presented and solved to assure that students obtain a strong practical capacity in as well as a theoretical understanding of mortgage law. The understandings of fundamental mortgage law gained in this course will also markedly assist the student in the study of other advanced courses. These include Secured Transactions in personal property under Article 9 of the UCC. (Article 9 actually is based on the same basic principles that govern real estate mortgages), Bankruptcy, Real Estate Transactions and Development, Banking, etc. It will also give the student some badly needed understanding of equitable principles which still pervade our current legal system. Specific topics studied include the law governing the creation of the mortgage, the limitations imposed on the mortgage contract by the fundamental anti-clogging rules developed by the courts of equity, the priority accorded a mortgage when in competition with competing interests in the same land, the legal rules governing the transfer of a mortgage, the redemption rights of the mortgagor and the foreclosure of the mortgage.

LAWS 075. Business Associations for LL.M. Students (3)
This course is an introduction to the law of business associations including general and limited partnerships, limited liability companies, and corporations tailored to their specific needs.

LAWS 080. I.T. Principles for Lawyers (2)
This course is designed to allow students to achieve an overview of information technology terms and concepts.
LAWS 083. Advanced Civil Procedure (2)  
This class focuses exclusively on civil claim settlements occurring both in and outside of traditional trial courts and involving both federal and state law matters. The course will cover topics addressed not only by civil procedure laws, but also by laws in such diverse areas as contract, tort, professional responsibility, and evidence. It will include consideration of settlements of civil claims which have not yet arisen; have arisen but have not yet been pursued in litigation; and have prompted litigation.  

LAWS 084. Capital Markets, Venture Capital, and Mgmt., Principles for Lawyers (1)  
This course is designed as an introductory course for second- and third-year law students who want to understand the way in which businesses are managed and financed, the various roles that capital markets play in their development, and the methods for measuring business success. Intensive case studies will be used as a framework for looking at real world situations. The course will integrate guest lectures from visiting business leaders. CFOs will explain how they measure the success of their business and what financial information is required to do their job. Finally, a part of each class will evaluate real time business issues, applying the lessons learned from the case studies and modeling the expected outcomes. James Bildner, Case Western Reserve alumnus and CEO of Tier Technologies, will teach the course. Students will write a paper based on a case study. This course will count toward the nine-credit limit on non-law school courses. Prereq: LAWS 203, LAWS 204, or LAWS 261.  

LAWS 085. Intellectual Property Transactions (3)  
Students will explore how companies develop business and legal strategies to protect their intellectual property assets through agreements with strategic business partners, content providers, vendors, and licensees. As part of the course, students will select a company name and protect it, draft and negotiate agreements, and hold a mock negotiation at the end of the semester. One prior course in patent, trademark, or copyright is required. Grade is based on a final examination.  

LAWS 087. Public Law and Politics (3)  
This course will explore the relationship between practical politics, the law, and government by examining the social and political context of contemporary issues of major significance, with emphasis on Ohio. Classes will include guest lecturers drawn from those professionally engaged in an aspect of the political process. Grades will be based largely on independent research and writing and class participation. The course is designed to complement, but not significantly overlap, existing courses in the public law concentration, most notably, State and Local Government and Legislation.  

LAWS 103. Constitutional Law I (4)  
The constitutional system of the United States; judicial function in constitutional cases; the division of powers between the nation and the states and within the national government; the powers of the president; national and state citizenship; and constitutional limitations on the powers of the states and nation for the protection of individual liberties. Required.  

LAWS 104. Civil Procedure (4)  
A broad survey of the procedural development of a lawsuit is undertaken, tracing the various steps from pleading and discovery to trials and judgments. Modern procedural issues involved in jurisdiction of the courts, venue, choice of law, and former adjudications are discussed. Throughout the course principal attention is given to the Federal Rules of Civil Procedure. Required.  

LAWS 123. Contracts (4)  
The formation of a contract; problems of offer and acceptance; consideration; the question of contract breach; damages and remedies for a breach. Required.  

LAWS 131. Criminal Law (4)  
A basic course in substantive criminal law, dealing with the standards to be used in defining and punishing criminal behavior. The course includes discussion of crimes and criminality; culpable mental states; causation; insanity; attempt and complicity; homicide; and rape. Required.  

LAWS 132. Torts (4)  
This course covers compensation of an injured party for harm resulting from intentional or unintentional acts and omissions of others. Consideration is given to the rules, rationale, and policy underlying tort liability. The course includes analysis of assault and battery, false imprisonment, negligence, standard of care, duty, risk, causation, liabilities and rights of landowners and land users, liability relating to dangerous activities and defective products, liabilities arising from special relationships or specially recognized legal interests, and defenses. Required.  

LAWS 144. Property (4)  
The nature of property interests; estates in land and future interests; concurrent ownership; landlord-tenant; transfer of property interests; easements, covenants, and equitable servitudes; nuisance; and zoning. Required.  

LAWS 151. Research, Analysis, and Writing (2)  
Both semesters must be completed before credit is given. Students are introduced to the methods and formats of written legal analysis and to both manual and computerized legal research. Writing assignments include objective memoranda of law, pleadings, motions, and persuasive briefs. Required.  

LAWS 152. Research, Analysis, and Writing (1)  
Continuation of LAWS 151. Both semesters must be completed before credit is given. Required.  

LAWS 160. Dispute Resolution (3)  
This course will examine the characteristic methods by which American courts resolve disputes, and will then compare those methods with those used by alternative institutions of dispute resolution such as administrative agencies, arbitration, and mediation negotiation. In resolving disputed issues of law, American courts are constrained by doctrines of precedent, stare decisis, and the principles of statutory interpretation, all of which will be treated in some depth in the course. Disputed issues of fact in American courts are commonly decided by juries consisting of ordinary citizens, and the course will explore a number of features of the jury as it impacts litigation in courts. The portion of the course devoted to alternative dispute resolution will involve some simulations and role-playing exercises. There will be a single examination at the end of the term which will be the primary basis for grading.  

LAWS 200. Patent Litigation (3)  
This course will simulate a patent infringement case. Students will be asked to represent a client, and in that capacity will identify issues, provide legal advice, and prepare papers and pleadings as necessary. In particular, students will be asked to conduct a limited number of the following simulations: draft a complaint and an answer to the complaint, including counterclaims; draft discovery documents; perform a mock Markman hearing; prepare witnesses, including expert witnesses; take and defend a deposition; or prepare pre-trial.  

LAWS 202. Constitutional Law II (3)  
This course explores the individual freedoms protected by the First Amendment. Primary attention is devoted to the freedoms of speech, assembly, and association. The course analyzes what is protected, why it is protected, and to what degree it is protected. Topics covered include prior restraint, advocacy of unlawful conduct, the hostile audience, defamation, commercial speech, obscenity, offensive speech, expression on public property, and symbolic speech.  

LAWS 203. Business Associations I (3)  
This course first deals at some length with the policies and dimensions of the doctrines of vicarious liability (liability for the wrongs of another) and authority (being bound by the assent or representation of another). The discussion then moves to questions of an intermediary’s or employee’s duties of obedience, due care, and loyalty. Against this background, the statutory approaches of the Uniform Partnership Act and the Uniform Limited Partnership Act are developed and analyzed.  

LAWS 204. Business Associations II (4)  
This course is an elaboration of “corporateness” as a mode of business asset ownership and management. The functions and relationships of corporate enterprise participants, primarily promoters, shareholders, creditors, and managers, are fully investigated. The course first covers precorporational problems and fundamental concepts of corporate financing. It then canvasses the roles of ownership and management, with emphasis on the special duties (fiduciary and other) imposed on certain participants. Careful attention is paid to the allocation of prerogatives among those most intimately involved in corporate life. The discussion examines and tests the traditional view of directors as the repositories of
everyday management power and shareholders as the possessors of a theoretical franchise to select management, veto fundamental changes, and enforce management responsibilities. Maintenance of the capital structure for the protection of creditors and shareholders is treated in connection with problems of recapitalization and distribution. State statutory themes are taken in the context of the ALL-A Model Business Corporation Act. Threads of the federal corporate regimen being developed under the aegis of the securities laws are woven throughout the course fabric. Throughout the discussion, distinctions are drawn between the requirements and policies applicable to close and to publicly held corporations.

LAW 206. Corporate Tax Problems (3)
This is an advanced income tax course limited primarily to study and analysis of Subchapter C of the Internal Revenue Code. The course is intended to provide the student with a comprehensive background in taxation of corporations and shareholders, including the tax treatment of dividends, reorganizations, and liquidations. Prereq: LAW 211.

LAW 207. Evidence (3)
This is a comprehensive course in the law of evidence as applied in civil and criminal cases. Subjects include relevance, direct and cross-examination, impeachment, character, expert and lay opinion testimony, and hearsay. A problem-oriented approach is used to highlight both the practical applications and theoretical underpinnings of rules of evidence. Students may not take both LAWS 207 and LAWS 212.

LAW 210. Family Law (3)
This survey course covers law relating to the creation, functioning, and dissolution of the family as a legal unit. Topics include legitimacy, adoption, property rights, custody, marriage, family obligations, division of marital property, divorce and annulment, and child custody. Particular attention is given to the social forces that affect the development of rules and policies.

LAW 211. Federal Income Tax (4)
An introductory course in federal income taxation of the individual taxpayer, including consideration of the nature of income, specific statutory exclusions, business and nonbusiness deductions, the treatment of capital gains and losses, and elementary tax accounting.

LAW 212. Evidence (4)
A comprehensive course in the law of evidence as applied in civil and criminal cases. Subjects include relevance, hearsay, judicial notice, privileges, examination of witnesses, expert and lay opinion testimony, and real, demonstrative, and scientific evidence. This course deals with both the practical applications and theoretical underpinnings of the Federal Rules of Evidence and common law precedents. Students may not take both LAWS 207 and LAWS 212.

LAW 214. Scientific Evidence Seminar (2-3)
The legal issues associated with the use of scientific evidence at trial. It examines the admissibility of scientific evidence, expert testimony, and related issues. In addition, it considers specific techniques such as forensic pathology, fingerprint comparison, firearms identification, bite mark comparisons, questioned document examinations, and polygraph and DNA evidence testing. Outside experts are used to present many of the topics. May satisfy the writing requirement.

LAW 215. International Law (3)
Examines the basic international legal processes (including the fundamental principles, international dispute resolution processes, the sources of international law, the subjects of the international legal system, nationality and jurisdiction) as well as the role and status of international law within the United States legal system. Throughout the course, use is made of contemporary international problems.

LAW 217. Juvenile Law (2)
The role of the juvenile court in society: its jurisdiction, procedures, and dispositional alternatives. Students study both the quasi-criminal aspects of the juvenile court (jurisdiction over juvenile delinquents and status offenders) and the civil-protective aspects of the court (termination of parental rights and the handling of neglected, dependent, and abused children). In addition, the rights afforded juveniles are compared with the rights afforded adults in comparable circumstances. Many related juvenile justice issues, such as the right of a minor female to have an abortion without parental notice and the constitutionality of capital punishment for juvenile offenders, are also examined.

LAW 219. Workers’ Compensation (2)
Workers’ compensation law has a statutory basis which continues to evolve through judicial decisions. The statutes deal with benefits for work-connected injury and disability. Course material is national in scope with an emphasis on recent Ohio cases. The course also touches on related areas of law, such as torts.

LAW 220. Civil Law and Psychiatry (2)
The interaction between law and psychiatry and its effects on patient rights, institutional care, guardianship, psychiatric malpractice, suicide, psychogenic delays, and child abuse and custody. Students will test the analysis of legal issues against actual experience (videotaped interviews, visit to a state mental hospital). The course is jointly taught by a psychiatrist and an attorney specializing in mental health law.

LAW 222. The Health Care Professions (2)
Offered pass/no credit. Recommended for students interested in health law who do not have a medical background. The history of medicine, the scientific method, techniques for researching medical and scientific questions, basic human anatomy and physiology, and an overview of medical training and practice. Prereq or Coreq: LAWS 227.

LAW 224. Global Perspectives (3)
An introduction to basic comparative, transnational, and international law disciplines. Using areas of substantive and procedural law familiar to first-year students, the course examines issues arising from cross-national activity. Students are exposed to choice of law, comparative law, international law, and international institutions.

LAW 225. Criminal Law and Psychiatry (2)
The interaction between criminal law and psychiatry: psychiatric diagnosis and treatment, competence to stand trial, the insanity defense, malingered mental illness, infanticide, sexual psychopath laws, and direct and cross-examination of mental health experts. Videotaped examples serve as a basis for discussion. A visit to the Justice Center Court Psychiatric Clinic is included. The course is taught jointly by a psychiatrist and an attorney specializing in mental health law.

LAW 227. Health Law (3)
The course examines the nature and structure of the health care system; the relationship between patient, provider, and payer; private legal controls on health care delivery such as malpractice and informed consent law; and public controls in the form of government regulatory and payment programs. Cross-listed as HSMC 427.

LAW 229. Patent Law (2-3)
Basic concepts of patent law as property considered primarily in its substantive aspects, including the relationship to other forms of protection and intellectual property, infringement, and statutory requirements for patents.

LAW 232. Wills, Trusts, and Future Interests (4)
A survey of the law of intestate and testamentary succession, will substitutes, private and charitable trusts, fiduciary administration, and future interests (including the Rule Against Perpetuities).

LAW 234. Nonprofit Organizations (3)
Explores the rationales for the existence of the nonprofit sector and the allocation of certain functions to it. The focus is on the legal framework for the structure and operation of nonprofit organizations under state nonprofit corporation statutes and the policy and practice of preferred tax treatment for selected organizations and gifts to them under the Internal Revenue Code.

LAW 235. Copyright Law (3)
Copyright law is the in-depth study of the legal doctrine and policy relating to the protection of one’s artistic, literary, musical, and computer-related expression. We will focus primarily on the 1976 Copyright Act and amendments thereto, such as the Digital Millennium Copyright Act of 1998.

LAW 236. Natural Resources (3)
An introduction to the law of natural resources with emphasis on private rights rather than resources in the public domain. Major themes will include: how the common law deals with rights in another’s land; problems of common pool resources, their ownership and regulation; differ-
ent legal treatment of renewable and nonrenewable resources; legal structures available for the exploitation of natural resources. Primary focus will be on water, oil, and gas, but the legal issues of other extractive industries will also be considered.

**LAWS 238. Mergers and Acquisitions (3)**

Topics include the corporate and securities law governing various forms of mergers and acquisitions; business motivations for mergers; concerns of acquiring and acquired companies in friendly mergers; bidders’ techniques and targets' defenses in hostile tender offers and proxy contests; valuation of businesses and investments, portfolio theory, and capital markets; concerns of companies and investors in negotiating corporate financing. Prereq: LAWS 204.

**LAWS 240. Computing and the Law (3)**

Deals primarily with intellectual property issues: the patentability and copyrightability of software and the protection of interests in software by contract or by treating it as a trade secret. Issues relating to the risks of distributing computer software (i.e., the risks of products' liability for computer software) will also receive considerable attention. Some time will be spent on the legal issues that arise when computers are interconnected by networks. Since many of the legal issues relating to computers arise because courts and lawyers do not understand how computers work and what they can and cannot do, the course begins with basic instruction in such matters as registers, central processing units, logic gates, and computer languages; this portion of the course includes ungraded homework assignments.

**LAWS 244. Poverty, Social Inequality, and the Law (3)**

An overview of the way the law impacts on disadvantaged people, and the law that supports advocacy on their behalf. Students will learn about legal problems that are common to poor people and identify potential solutions. The course will analyze the effectiveness of various legal interventions such as administrative advocacy, and litigation (including individual and class representation) in various contexts. Past and current means of using and changing the law on behalf of low-income people will be studied. Students will analyze the responsibilities of lawyers to represent low-income clients. Many of the concepts will be taught through the use of case studies; a client interview will be conducted, and court observation is required. Grade is based on oral case study presentation, written assignments, and class participation.

**LAWS 245. Complex Litigation (2)**

Analysis of key issues typically encountered in complex civil litigation including substantive implications of seemingly procedural choices. Class actions, multidistrict litigation, joinder and consolidation, exploration of practical and ethical issues encountered in complex civil litigation.

**LAWS 246. Advanced Contracts (3)**

We will examine the methodology of law and economics and of deontological approaches to contracts, legal realism, the methodology of default rules, gap filling and incomplete contracts, adjustment of long-term contracts, employment contracts and the employment at will doctrine, promissory estoppel, relational contracts, incorporation strategies in the U.C.C. and the new formalism in Contracts.

**LAWS 247. International Human Rights (3)**

The course considers the role of human rights in a period of transition to a democratic system. This issue has been absolutely critical in newly democratic nations throughout the world. We will look at such subjects as access to secret police files, the role of criminal punishment, the eligibility of candidates for public office, and the role of “truth commissions.” Countries under examination will include Argentina, the Czech Republic, Germany, Poland, and South Africa.

**LAWS 248. Criminal Procedure II (2)**

The adjudicatory stage of the criminal process. Pretrial release, preliminary hearings, grand jury practice, speedy and public trial, discovery, right to jury trial, guilty pleas, right to counsel, and double jeopardy are examined. Prereq: LAWS 327.

**LAWS 249. Comparative Constitutional Law Seminar (3)**

The seminar deals with constitutional law and adjudication in a comparative context. It offers an analysis of judicial review and its position in the modern world. It explores certain structural and functional differences among national systems of judicial review and discusses the relatively recent phenomenon of judicial review at the supranational level, particularly as it has emerged in Europe. May satisfy the writing requirement.

**LAWS 250. Trends and Tensions in Legal Education (3)**

Focuses on critical legal studies; analyzes CLS impact or influence on critical race theory and feminist jurisprudence; covers deconstruction and its use as a method of criticism. May satisfy the writing requirement.

**LAWS 251. Employment Law (3)**

This course examines employer-employee relations in non-union settings. Topics include wrongful discharge, occupational safety and health regulation, minimum wage, and workplace privacy issues. The course emphasizes written work, including advanced legal research training. Minimal overlap with Labor Law (LAWS 359) and Discrimination in Employment (LAWS 328).

**LAWS 253. European Union Law (2-3)**

After a brief introduction to the institutions and organs of the European Community, the legal aspects of the internal operations of the Community will be discussed. Special emphasis will be placed on the external impact of Community law, for example, its trading rules, company law, and business competition law, as well as its rules governing the free movement of goods, services, capital, and persons. The concept of European citizenship will also be dealt with.

**LAWS 257. English for Foreign Graduate Law Students (3)**

This course is designed to teach English compositional skills and grammar for legal studies. With an English-as-a-second-language focus, this course will seek to teach students the various steps of the writing process, English grammar, and certain aspects of legal composition. The main goal of this course is to enable students to write clearly and correctly within U.S. legal studies and the U.S. legal work place. The course will meet twice a week for one hour. Students will be required to take this course based on a written exam administered at the beginning of the semester. Students must receive a grade of at least a C to pass out of the course.

**LAWS 258. Business Torts (3)**

This course builds on the foundation provided by Torts and focuses on the application of tort doctrines in the business context. Emphasis is placed on such topics as interference with economic relations, market-place falsehoods, intangible assets, appropriation, and false light. Grade is based on a final examination.

**LAWS 259. Business Associations, Advanced: Representing the Internet Start-Up (1)**

The course will provide students with an in-depth understanding of many aspects of representing the start-up internet or E-commerce company. The focus will be on corporate law and other law related to representation of such business organizations. Class will meet five times during the term for three hours each time. Students will prepare and present in-class exercises. Limited to 20. Prereq: LAWS 261 or LAWS 203 and LAWS 204.

**LAWS 261. Business Associations (5)**

This course is an introduction to the law of business associations, including general and limited partnerships, limited liability companies, and corporations. The functions and relationships of enterprise participants, primarily promoters, equity owners, creditors, and managers are investigated. The course covers pre-organizational problems and then canvases the roles of ownership and management, with emphasis on the special duties (fiduciary and other) imposed on certain participants in publicly and closely-held entities. The regulation of securities fraud, proxy voting and solicitations, and the issuance of securities under the federal securities laws is explored. Fundamental concepts of business financing, including valuation of the concern and claim structure, are investigated. Organic changes, including dissolutions, mergers, and tender offers, are discussed.

**LAWS 262. Appellate Advocacy (2)**

The goal of the course is to teach students how to handle an appellate case. It examines appellate practice and procedure through reading materials, lectures, discussions, and simulations. Students are assigned to small groups to develop their advocacy skills through simulation exercises and critique. Credit will be awarded only to students who also participate in the Dunmore Moot Court Competition in the spring semester.

**LAWS 263. Patent Prosecution (2)**

This course will expose students to the issues and concepts of drafting a patent application. Topics include defining an invention, drafting a patent application, responding to Office Actions issued by the USPTO.
Patent law is a prerequisite. Grade is based on three short papers and a multiple choice final.

**LAWS 264. International Organizations (3)**

Deals with legal issues surrounding some common characteristics of intergovernmental organizations having wide membership, with an emphasis on the United Nations systems. Many of the issues are constitutional or procedural; that is, they have to do with the powers of, and restrictions upon, the organizations or their members as set forth in the constituent instruments of the organizations or as developed in practice. Issues such as eligibility for membership and termination thereof, rights and obligations of members, dispute resolution, and legislative procedures will be addressed comparatively. The growth of international law through intergovernmental organizations is also addressed.

**LAWS 265. Health Care and the Courts (5)**

The seminar will examine a variety of health care issues that raise constitutional law questions. The course will focus on the following questions: (1) whether a constitutional right to health care exists, (2) what constitutional principles justify the state’s involvement in health care, and (3) how conflicts between individual liberty and state interests should be resolved. In analyzing these questions the class will address several contemporary issues including the right to parents to refuse medical treatment for a child on religious grounds, mandatory HIV and drug or alcohol testing, reproductive rights, maternal-fetal conflicts, assisted suicide, national DNA databanking, and others. Grade is based on a presentation and paper. Enrollment is limited to 12.

**LAWS 266. Sales and Secured Financing (4)**

A concentrated survey of the law relating to the sale and lease of goods and secured financing. (1) Sales. The primary focus will be on the law relating to the sale of goods in commercial setting, i.e., Article 2 of the Uniform Commercial Code. Some attention will be given to the United Nations Convention on the International Sale of Goods. Considerable attention will also be given to consumer sales issues, e.g., the Uniform Consumer Sales Practices Act and similar legislation. There will be some coverage of leasing of goods under Article 2A of the UCC. (2) Secured Financing. Personal property security interests under Article 9 of the UCC will be examined in considerable depth. Real property mortgages will not be covered. Not open to students who are taking or have taken Sales (LAWS 381) or Property Security (LAWS 377). Students taking this course are precluded from subsequently taking either of those courses.

**LAWS 267. Products Liability (2)**

Explores in depth the liability of manufacturers and sellers for physical injury to persons or property caused by defective products. The relevant law includes UCC warranty provisions, Restatement of Tort (Second) section 402A and other tort law, state “tort reform” statutes, and federal and state statutes regulating product safety, such as the FDA and the Consumer Product Safety Act. The course will also examine proposals to “reform” the law of products liability.

**LAWS 268. Death Penalty Law and Process (2)**

The course offers a review of the death penalty process, theory, and law from trial through execution, including examination of state laws and federal habeas corpus law. The course focuses on the legal principles implicated by the death penalty and also examines the social issues it raises including the social/legal arguments against the death penalty, race and gender issues, and the influence of political and other factors on the process. Prereq: LAWS 327.

**LAWS 274. Community Development Law (2)**

An examination of the law of economic and land development in underserved and deteriorated areas. Legal issues related to business organization, financing, real estate development, governmental programs, and regulation and taxation (among other areas) will be covered. Topics include background of urban deterioration, governmental and private sources of assistance, organizing the developing entity, financing the project, governmental programs, tax policy and programs, land assembly, and administration of developments.

**LAWS 275. Fundamentals of Law Practice Management (2)**

An overview of the components of a successful practice. Applicable to practices of any type and size, the course integrates contemporary business theories and practices with the values of the legal profession and the realities of a law practice. Topics covered include assessing and responding to the market for legal services, client development, pricing, systems to insure quality, use of technology, firm structure and governance, and financial considerations. Class sessions include lectures, discussions, analysis of business cases developed in legal settings, and guest lectures. Students work in small teams to develop a hypothetical business plan for a firm or practice group.

**LAWS 277. Immigration Law (2)**

The general principles of immigration law and procedure, including federal authority to regulate immigration, removal of aliens (deportation and exclusion), administrative and judicial review, fleeing persecution (refugees, asylees, and others), immigrant and nonimmigrant visas, and consular practice. The course will emphasize practical application of current immigration law.

**LAWS 279. Advanced Real Estate Development: Shopping Centers (2)**

The course takes the point of view of the attorney for a real estate developer with a strong emphasis on shopping center development, including apartment complex and office building developments, but provides insights useful to an attorney for the other side: a tenant, financial institution, or major department store. The approach is practical as well as academic; the course may be considered a capstone for students interested in real estate. Topics include negotiations and documentation; actual documents are used.

**LAWS 281. Environmental Anatomy of a Business Transaction (2)**

Students will explore how issues of environmental law affect the structure and progress of a business transaction. A case study will start with a letter of intent and will proceed through environmental due diligence; the drafting of environmental representations, warranties, indemnities and schedules; the closing of the transactions; the making of environmental claims under the contract; and mediation of those claims to resolution. Ethical issues of new information about violations discovered in due diligence that must be reported to government agencies will be examined. Students will divide class time among the following activities: (a) the presentation of short research memoranda on the issues in the transaction, (b) the critiquing of drafts of transaction and mediation documents, and (c) role playing as sellers, buyers, bankers, environmental consultants, government agency personnel and their lawyers at different stages of the transaction. The course is designed to allow students to integrate concepts from first- and second-year courses in contracts, business associations, property, and environmental law in a series of problem-solving exercises. Prereq: LAWS 331.

**LAWS 282. Business Tax Problems (4)**

The course is an introduction to the federal taxation of business entities (corporations, partnerships, limited liability companies, etc.) and the investors in those entities. Students will examine the tax consequences of several common transactions, such as entity formation, operating distributions, liquidations, and reorganizations. Special attention will be given to the tax considerations affecting choice-of-entity decisions. Prereq: LAWS 211, and LAWS 261 or LAWS 203 and LAWS 204.

**LAWS 283. Medical Malpractice (2)**

The course will involve liability and quality of care issues in the health care field, with an emphasis on the liability of physicians, hospitals, and to a lesser extent insurers. Topics will include defining the standard of care, theories of liability, defenses to medical malpractice, tort reform, and quality control.

**LAWS 284. Advanced Contracts eCommerce and The New Economy (1)**

The course will consolidate and expand the students’ basic understanding of contract law by focusing on the formation and enforceability of electronic contracts. Students will study recent changes in the law, including the Uniform Electronic Transactions Act, the Uniform Computer Information Transactions Act, the Electronic Signatures in Global and National Commerce Act, the European Union e-Commerce Directive, and the Canadian provincial e-Commerce law. The course will also give students a practical perspective on contractual drafting. Materials will be drawn from Maggs, P., Soma, J., and Sprowl, J., “Internet and Computer Law, Cases, Comments and Questions,” (West 2001). Class participation, a class presentation and an examination will be required. Prereq: LAWS 123.
LAW 285. Courts, Public Policy, and Social Change (3)
Examines the social impact of law and the use of social research in the legal process; assesses efforts to use law to effect social reform, and empirical studies of legal processes and institutions. Cross-listed as POSC 429.

LAW 286. Litigation Practice (4)
This course will examine the lawyer’s role in resolving disputes. The course will take the students through a case from the initial client through litigation in a trial court up to summary judgment and then on appeal from a grant of summary judgment. We will examine (1) issues pertaining to resolution of the dispute, including negotiation, alternative dispute resolution mechanisms, and the costs and benefits of litigating in court, (2) issues pertaining to the development and use of facts, including exploration of the lawyer’s role as investigator, the use of formal discovery mechanisms, and the different burdens posed by the different levels of scrutiny applied by a court at different stages, (3) issues pertaining to the role of the lawyer, including his or her role as counselor to the client, negotiator with and warrior against the adversary, and advocate to the court. The course will consist primarily of simulations and class lectures, and will also involve substantial written assignments, including the drafting of pleadings, discovery materials, and briefs. Enrollment for both terms (LAW 286 and LAW 287) is required. Students who have taken or are enrolled in Alternative Dispute Resolution (LAW 351); Appellate Advocacy (LAW 262); Lawyering Process (LAW 401); or Pretrial Practice (LAW 399) may not enroll in this course. Students who take this course are free to take either Trial Tactics (LAW 397) or Trial Practice (LAW 395). The course satisfies the Lawyering Process requirement that is a prerequisite for Clinic courses. Students who complete the course in their second year may—but are not required—to compete in the Dunmore Moot Court Competition in their third year. Limited to 12.

LAW 287. Litigation Practice (3)
(See LAW 286.) This course is the second semester of LAW 286. Enrollment in both semesters is required.

LAW 288. Environmental Law Practicum (2)
This practicum will focus on facilitating public participation in and enforcement of federal and state environmental laws. Most if not all of the projects will address existing community needs and concerns in the Cleveland metropolitan area (e.g., wetlands developments, Clean Air violations, water quality concerns, and open space issues). Students will spend most of their two credits designing and writing a variety of handbooks, brochures, and other educational materials (including developing a Website) in order to provide local citizens with the tools necessary to participate more meaningfully on specific environmental problems. Students may also conduct one or more town meetings or short courses to further educate communities or nonprofit members about specific environmental laws. The clinic will serve a greatly needed and (possibly unprecedented) role in enhancing the public’s understanding of the environmental laws. Students participating in the clinic will also find their writing and research skills are strengthened, particularly their ability to communicate complex legal requirements clearly. Prereq or Coreq: LAW 351.

LAW 289. Secured Transactions (2)
This course deals with Article 9 of the UCC and other legal and equitable rules relating to the use of personal property as security for debts. Topics covered include creation of a security interest (mortgage), rights and obligations of the debtor (mortgagor) and the secured party (mortgagee), priority of interests in the same property, redemption rights of the debtor, and foreclosure of a security interest by the mortgagee. May not be taken by students who have taken or are taking the 4-credit Sales and Secured Transactions course (LAW 266). Students who have taken or are planning to take the 3-credit Sales (LAW 381) course may enroll.

LAW 290. Federal Judicial Externship Academic Year Program (3)
Externship opportunities are available to a limited number of second- and third-year students who have not participated in the summer judicial externship program. Participants are selected by the instructor from a pool of interested students following preregistration. Students chosen will be placed by the instructor with a selected federal judge or magistrate in the Cleveland, Akron, Medina, or Youngstown areas. Throughout the semester, students will attend seminar classes at the law school for a total of 17.5 hours and will work in the judge’s chambers for a minimum of 15 hours per week. Students must keep and submit to the instructor weekly, contemporaneous time records of their work in chambers. Topics to be covered in the seminar classes will include the role of law clerks, advanced legal research techniques, the process of judicial decision making and opinion writing, learning from observation and supervision, ethics in the judicial process, reflective lawyering, what makes effective advocacy, and other topics. Students will work in chambers under the supervision of the judge and his or her law clerks where their primary role will be to perform legal research and assist in the development of judicial opinions. Copies of the students’ written work will be provided to the instructor for review. Grade is based on classroom participation and work done in the judge’s chambers. Enrollment is limited to 12. Students will be notified of acceptance into the program by August 1.

LAW 291. Appellate Institutions and Process (3)
This course will examine the role of appellate courts in our legal system and provide a practical introduction to appellate litigation. Topics to be covered will include: the role of appellate courts (federal and state) in the American legal system; their jurisdiction, the scope and standards of review; the function of appellate courts in relation to trial courts; the function of two appellate levels; the crisis of volume in the appellate system, and U.S. Supreme Court practice. Grade is based on a final examination.

LAW 292. Health Care Legislation (2)
The course will introduce students to legislative processes, interpretation, and drafting, focusing on health care legislation. The course will examine one major legislative proposal in depth and follow its progress through the Ohio General Assembly. Initial proposal documents, as well as the enacted statute (including all versions), will be studied. The views of all constituents will be examined. One class meeting will be a mock legislative session. Some of the meetings may take place in Columbus and the class may attend a committee hearing. Prereq: LAW 227.

LAW 293. Financial Principles for Lawyers (3)
This course provides an introduction to the use of financial economics that are frequently relevant in many areas of law. Topics to be covered include the time value of money, uncertainty, claim structure (including the characteristics of debt, equity, and hybrid securities, and the benefits and detriments of debt and equity financing), behavior of securities markets, and analysis of financial statements. Use of these concepts in specific areas of legal practice will be discussed.

LAW 294. eEvidence (1)
This course will focus on special problems arising from the use of electronic evidence and evidence in high-tech criminal and civil cases. Class participation, a class presentation, and an examination will be required. Prereq: LAW 327 and LAW 212.

LAW 295. Law of Health Care Organization and Finance (2)
This course presents an overview of corporate health care law issues including: public and private reimbursement systems, fraud and abuse, physician self-referrals, corporate practice of medicine/fee splitting, certificate of need, tax-exempt status of health care providers, and antitrust and insurance regulation of health care providers. The course will examine the origins and public behind current corporate health care law and regulations and the issues they present for health care providers. Enrollment is limited to 25. Prereq: LAW 227.

LAW 296. Complex Federal Criminal Investigation and Prosecution (2)
The course will explore some of the practical, substantive, and ethical issues that arise in complex federal investigations and prosecutions. Students will read cases and articles concerning topics such as the use of electronic surveillance, plea bargaining, and contacts with persons represented by counsel. They will also discuss how the law limits or enhances the powers of federal prosecutors conducting criminal investigations and prosecutions. Grade will be based on class participation and a take-home examination. Prereq: LAW 151 and LAW 327.

LAW 297. Immigration Law II: High Technology Workers (1)
The course is dedicated to the study of visas for visitors and aliens of extraordinary ability in the sciences, arts, or entertainment. Course materials will be drawn from Legomsky’s Immigration and Refugee Law and Policy, the Immigration and Nationality Act, and Title 8 (CFR). Students will be required to write a paper or prepare a visa petition. The course will likely be offered every other year. Prereq: LAW 277.
LAWS 298. Health Care Transactions (2)
This course will examine a variety of typical transactions among health care providers and payors. Students will have the opportunity to understand the financial motivation behind these transactions and to identify the unique health care law issues presented by them. Students will learn to develop alternative methods for structuring transactions to minimize or avoid such issues. The types of transactions to be examined include: physician recruitment, physician practice acquisitions, physician practice management companies, joint ventures between hospitals and physicians, mergers and acquisitions of health care providers, and formation of integrated delivery networks. Enrollment is limited to 25. Prereq: LAWS 295.

LAWS 299. Trademark Litigation (2)
This course will simulate a trademark infringement case. Students will be asked to represent a client, and in that capacity will identify issues, provide legal advice, and prepare papers and pleadings as necessary. In particular, students will be asked to conduct a limited number of the following simulations: draft a complaint and an answer to the complaint, including counterclaims; draft discovery documents; prepare witnesses, including expert witnesses; take and defend a deposition; or prepare pre-trial motions and exhibits. Trademark law is a prerequisite. Grade is based on the students work in these simulated settings.

LAWS 300. Advanced Environmental Law: Issues in Industry Compliance (3)
In-depth analysis of key issues encountered in environmental law practice from the perspectives of the regulator and the regulated entity. Introduction to environmental research and the role of agency interpretive materials. Exploration of environmental audits, ethics, and issues arising in environmental enforcement. Issues will be presented in a series of problem sets, which will form the basis for both written analysis and in-class discussion. Prereq: LAWS 331 or permission of the instructor.

LAWS 301. Administrative Law (3)
This course examines legal issues surrounding the actions of state and federal administrative agencies. Areas of emphasis include statutory interpretation; the availability, timing, and scope of judicial review of agency action; and control of agency discretion. The course emphasizes written work, including advanced legal research training.

LAWS 303. Admiralty Law (2)
The general principles of admiralty law including jurisdiction, practice, maritime liens, collisions, salvage, limitation of liability, and the rights of injured maritime workers.

LAWS 304. American Legal History (3)
This course surveys the American legal past from the Revolutionary era to the present. It examines the development of a distinct American legal culture by exploring the interrelationships among legal institutions, thought, practice, and education in various historical periods.

LAWS 307. Securities Regulation (3)
This course explores the policies and techniques of state and federal investor protection, with emphasis on the distribution of securities by issuers and their affiliates. After an analysis of express general anti-fraud remedies, the “security” concept, and the diverse philosophies underlying “value judgment” and “disclosure” approaches to regulation of business fund-raising practices, the course proceeds to a full consideration of the impact of the Federal Securities Act of 1933 on primary and secondary distributions. Concurrent as well as independent effects of state blue sky laws, typified by the Uniform Securities Act, are also treated. To round out the total pattern of investor protection in the distributional setting, the course includes limited excursions into the anti-fraud, periodic reporting, public information availability, and broker-dealer aspects of the Securities Exchange Act of 1934. Prereq: LAWS 204.

LAWS 308. Advanced Securities Regulation (3)
This course begins by treating the security assessment process engaged in by investors, and then proceeds to a discussion of regulation designed to perfect the decision-making process and to overcome informational and other-than-informational deficiencies in the trading markets. Topics include periodic reporting; annual reports to shareholders; duties of broker-dealers and advisors in the trading markets; trading on, and selective disclosure of, nonpublic material information; and the disclosure duties of quietest issuers. Attention is given to the regulation of tender offers and other large-scale acquisitions of securities, as a special problem of the trading markets. The course also deals with securities regulation which benefits holders of securities, including proxy regulation, securities regulation approaches to corporate mismanagement, and Exchange Act Section 16. Post-transaction relief is also discussed, and, if time allows, attention is given to the occupational licensing aspects of broker-dealer and advisor regulations. Prereq: LAWS 307.

LAWS 309. Antitrust Law (3)
A study of the implementation of federal trade regulation statutes with emphasis on the interrelationship of these laws with the competitive tensions of the contemporary economy.

LAWS 311. Business Planning (3)
Major events in the creation and development of a business are examined in light of partnership, corporate, and tax law problems. Students are presented with a series of hypothetical client-suggested transactions. Students seek the most appropriate means of attaining the business ends desired by the principals. From time to time, brief written memoranda covering issues raised by the problem scenarios may be required. Emphasis is placed on the interaction among partnership, corporate, tax, and securities concepts and doctrine. The significant business events that may be covered in the course include formation of a partnership; incorporation of a going concern; corporate distributions, recapitalizations, and repurchases of shares; sale of the corporate business; and corporate combination. Prereq: LAWS 203, LAWS 204, and LAWS 211.

LAWS 314. Selected Topics in Human Rights: International Crimes against Women (1)
This course will explore the development and implementation of newly recognized or emerging international human rights law. The course will draw upon at least three major lectures sponsored by the Klatsky Seminar in Human Rights in collaboration with the Frederick K. Cox International Law Center and the Journal of International Law. Students will read the works of the lecturer and other source materials and meet to discuss them in advance of the lectures, attend the lectures, and meet afterwards to explore the issues raised. Three short papers are required.

LAWS 315. Commercial Paper (3)
One of the basic courses in commercial law, dealing with the law of negotiable instruments and bank collections and deposits. These topics are considered primarily under the Uniform Commercial Code and, to some extent, recent federal banking and consumer credit legislation.

LAWS 317. Comparisons of Law (3)
This course concentrates on the comparative study of distinguishing features of the legal systems of foreign societies in order (1) to understand, by reverse projection, the unique characteristics of U.S. analogs, (2) to cultivate a cross-cultural jurisprudential understanding of law through the development of the comparative method, (3) to develop a basis for evaluating the fairness, efficiency, and integrity of legal systems currently engaged in reform efforts, (4) to appreciate obstacles to the development of international law from a comparative perspective, including distinctive problems of transnational practice.

LAWS 319. American Indian Law (2)
An introduction to the body of law governing the relationship among Indian tribes and state and federal governments. Major themes include tribal sovereignty; the federal-tribal relationship; criminal, tax, and regulatory jurisdiction on reservations; and the rights of individual Indians. Does not fulfill writing requirement.

LAWS 320. Conflict of Laws (3)
Competing approaches to choice of law in cases having multi-state and/or multi-national contacts. The course also covers personal jurisdiction, constitutional and international limitations on choice of law, and enforcement of judgments. Comparative and international perspectives are integrated throughout. Students develop their own choice of law theory in a simulated restatement conference.

LAWS 323. Debtor-Creditor Law (3)
The creditor’s power to enforce its judgments through such judicial processes as attachment, execution, levy, garnishment, and creditors’ bills. The debtor’s power to resist creditors’ claims through statutory exemptions or federal bankruptcy discharge, or because the creditor has acted inappropriately or in bad faith. Also studied is the creditor’s power to set aside and avoid fraudulent transfers made by the debtor, a power which has generated much litigation in recent years. We also study the special
rights of the federal government to enforce its claims, through the Federal Debt Collection Act of 1990, the Federal Priority Statute, and the Federal Tax Lien Statute. Finally, we survey collective creditors’ remedies under state law, including assignments for the benefit of creditors, creditors’ arrangements, and receiverships.

**LAWS 324. Bankruptcy (3)**
A study of bankruptcy, with emphasis on the current Federal Bankruptcy Act. Includes Chapter 7 (liquidation bankruptcy proceedings), Chapter 11 (business reorganization), and Chapter 13 (debt adjustment by individuals). Also noted and investigated are the quite different policies and legal rules that we apply to bankrupts because they no longer are capable of conforming to the usual legal standards. Students should take UCC and debtor-creditor courses before taking Bankruptcy.

**LAWS 325. Taxation of Corporate Reorganization (3)**
The course will examine the federal income taxation of corporate reorganizations, including mergers, stock-for-stock exchanges, assets-for-stock exchanges, split-ups, spin-offs, triangular and reverse triangular mergers, and recapitalizations. More specifically, the course will analyze the tax consequences to the corporations who are parties to the reorganization, and their shareholders and the carryover of net operating losses and other tax attributes. Prereq: LAWS 211 and either LAWS 206 or LAWS 282.

**LAWS 327. Criminal Procedure I (3)**
The investigatory stage of the criminal process. Constitutional limitations on searches and seizures, interrogation practices, and pretrial identification procedures are examined. In addition, the exclusionary rule, the principal method for enforcing Fourth, Fifth, and Sixth Amendment rights, is considered.

**LAWS 328. Discrimination in Employment (3)**
The federal laws and regulations concerning discrimination in employment. These include Title VII of the 1964 Civil Rights Act, the Equal Pay Act, the Age Discrimination in Employment Act, the Americans with Disabilities Act, and federal executive orders requiring affirmative action in employment. Regulation of discrimination based on race, sex, religion, national origin, age, and disability will be studied, with a focus on practical considerations in prosecuting and defending employment-based civil rights actions.

**LAWS 331. Environmental Law (3)**
The course is designed to provide an overview of both the breadth and depth of environmental regulation in the United States and to consider ways our environmental regulatory system might be improved. Although all of the major environmental laws will be surveyed, several statutes will be examined in greater detail. Students will be expected to navigate selected provisions of statutes and regulations through in-class problem sets. Guest speakers will also be invited to speak on topics of current interest.

**LAWS 332. Civil Rights (3)**
The course focuses on race, discrimination, and segregation in American law. It includes historical material on the Civil War amendments to the Constitution, equal protection cases, and statutory remedies under the current civil rights legislation. The substantive areas examined include segregation and discrimination in education, housing, public facilities, and voting rights. Employment discrimination is not covered in this course, but in Discrimination in Employment (LAWS 328).

**LAWS 335. Equity and Equitable Remedies (3)**
The course provides a short introduction to the equitable jurisdiction and in particular to the concept that “equity acts in personam.” The major emphasis of the course is on the specific performance of contracts and on injunctions against continuing torts. A major concern is the doctrine that equity affords a remedy only when the remedy at law is inadequate. The course also gives some attention to the law of restitution, since restitutionary remedies, even those granted by law courts, are traditionally considered to be equitable. Equitable liens, constructive trusts, equitable enforcement of “restrictive covenants,” and the doctrine of “equitable conversion” are considered. The defenses that apply to equitable remedies, such as laches, “unclean hands,” and the doctrine that “he who seeks equity must do equity” are also considered. If time permits, some consideration is given to injunctions against governmental officers and to other extraordinary remedies that form the common law basis for administrative law and judicial review of governmental actions.

**LAWS 336. Ethics in the Professions (3)**
Theories of professional ethics, as applied to the professions of law, medicine, nursing, social work, and management. A major portion of the course will be devoted to issues common to these professions, such as confidentiality, truth-telling, client or patient autonomy, decision making, and conflict of interest, comparing professional norms and practices in the light of the dominant ethical theories first developed. Open to students of law, medicine, nursing, applied social sciences, and management. May satisfy the writing requirement.

**LAWS 340. Federal Courts (3)**
This course explores the relationships between the federal courts, Congress, and state courts and governments. Topics include congressional control of federal jurisdiction, justiciability; federal court abstention, suits against state and federal governments and officials, habeas corpus, and federal injunctions on state proceedings.

**LAWS 341. Estate Planning and Taxation (3)**
This course covers disposition of individual wealth from both the property law and tax law viewpoints. Grade is based on class participation and major written project. Students may elect either to complete a research paper or to prepare an estate planning memorandum and documents for a hypothetical client. Prereq: LAWS 232 and LAWS 211.

**LAWS 343. Federal Taxation of Partnerships and S Corporations (3)**
A study of Sub-chapters K and S of the Internal Revenue Code, with emphasis on the problems of determining the tax liability of (1) partners for contributions to partnerships, distributions from partnerships, and transfers of partnership interests; and (2) shareholders for the equivalent transactions involving S corporations. Prereq: LAWS 211.

**LAWS 346. Insurance (3)**
A comprehensive introduction to the regulation of the insurance industry and to the legal issues arising from relations between the parties to insurance contracts. The course examines statutory regulation of the industry by state and federal agencies and analyzes cases involving aggressive regulation by the judiciary as well. Insurance decisions on the cutting edge of developments in contract, tort, and agency law are studied. Students are required to study the policy forms most frequently encountered in practice: the automobile policy, the homeowner’s policy, and the life insurance policy. The course also provides exposure to problems relating to other areas of insurance including commercial general liability coverage, fire insurance, professional liability (malpractice) coverage, and health insurance.

**LAWS 348. International Negotiations and Agreements (3)**
Introduces students to the role of the lawyer in the dispute avoidance (rather than dispute resolution) process in relation to international agreements. The course is taught from the simulation approach. Students take active part in a mock negotiation and drafting of the international agreement between the United States and another country to be selected (either Canada or Russia). In the mock negotiation students are divided into two six-person teams, one team representing the U.S. and the other team representing the other designated country. Prereq: LAWS 215.

**LAWS 349. International Trade and Development (3)**
The public international and United States law regulating international trade. (The private law of international trade and investment is dealt with in International Business Transactions, LAWS 354.) It includes the economic theory of international trade (although no exposure to a course in economics in secondary or undergraduate education is necessary) as well as a legal examination of issues regulating global and regional (e.g., the Canada-U.S. Free Trade Agreement, EEC) international trade. Primary emphasis is on the General Agreement of Tariffs and Trade (GATT) and the World Trade Organization (WTO) as well as such United States legislation implementing the GATT as antidumping and countervailing duties legislation and escape clause relief. The roles of trade and aid are also explored, as well as U.S. legislation affecting the transfer of resources to less developed countries.

**LAWS 350. International Arbitration (2)**
An advanced course covering the current status of arbitration as a dispute settlement mechanism in international affairs. This course will cover the use of arbitration as a means of resolving international disputes: a) between private parties; b) between private and governmental parties; and
c) between governments. It will cover possible forums and rules of arbitral dispute resolution and the problems of the enforcement of foreign arbitral awards. Special aspects of dispute resolution in certain geographical and subject areas will be covered as will be the problem of sovereign immunity. Disputes arising from multinational business transactions will be focused on as will be maritime, environmental, and border disputes.

LAWS 351. Alternative Dispute Resolution (2)
Students will examine the processes of alternative dispute resolution (ADR) through reading materials, videotapes, guest lectures, and simulation exercises. Particular emphasis will be given to the interaction of lawyers and clients in business negotiations and in litigation. Negotiation, arbitration, mediation, the summary jury trial, and the mini-trial will be examined. The class will also cover impediments to ADR, such as lack of understanding or hostility on the part of clients or lawyers. Cross-listed as LHRP 451.

LAWS 353. Philosophy of Law (3)
This is an examination of the general nature of law, the broad concerns of jurisprudence, the study of comparative law, and many of the issues raised in the literature of legal philosophy. Students will examine the principles of legal positivism, mitigated natural law, and rights theory. Selected readings and cases will illustrate these theories, which will also be examined in the context of rule selection by new governments in developing or revolutionary societies. The course also looks at the general nature of legal systems: how politics, morality, and individual views of justice and rights affect particular court cases and the course and development of law generally. Topics will include abortion, obscenity and sin, civil disobedience, affirmative action, surrogatehood, and the death penalty. This is unlike any other of the legal theory or jurisprudence courses, and those who have sampled legal theory elsewhere in a different form are welcome and encouraged to enroll. Cross-listed as PHIL 355.

LAWS 354. International Business Transactions (3)
The private law of international trade and investment. (International Trade and Development, LAWS 349, deals with the public law of international trade and investment.) The emphasis of the course is on the legal aspects of foreign market penetration by U.S. firms, including exporting, licensing, and investing. The laws studied will be host country regulations, foreign and U.S. tax, antitrust law, and export and import laws. In addition basic issues faced by multinationalals, such as co-determination, employee participation, transfer pricing, and technology transfer will be studied.

LAWS 356. Jurisprudence (3)
The main themes in the history of Western jurisprudential thought. Ideas such as the nature of justice, the definition of law, the power of the state, legal and moral obligation, and the nature of the judicial process are explored through the works of such writers as Aristotle, Aquinas, Austin, Dworkin, Holmes, Hart, and Finnis, together with selected works of literature.

LAWS 359. Labor Law (3)
The basic course in the area of union-management relations, designed both for students desiring to pursue the field further and for those whose interest lies in an introduction to legal principles in this area. The course begins with a brief historical study of the evolution of the labor movement and prestatutory law. It then considers federal regulation under the National Labor Relations Act of union organizational efforts, management-union interaction, and the representational process, then proceeds to the collective bargaining process. The collective bargaining process is examined in some depth with special emphasis on the scope and substance of the duty to bargain in good faith, the enforcement of collective bargaining agreements in courts and by arbitrators, and the legal regulation of industrial warfare, the strike and lockout.

LAWS 360. Labor Arbitration and Collective Bargaining Workshop (3)
Students participate in a collective bargaining project involving contract drafting and negotiation, with settlement required prior to a predetermined strike deadline. They also arbitrate a grievance arising under their executed agreements. The course materials deal with bargaining strategy and game theory, arbitration process and procedure, and the subject matter of collective bargaining agreements: seniority, management rights, union security, wages, vacations, holidays, discharge, and discipline. In addition, students will make use of tools of labor law research in drafting an arbitration brief. Prereq: LAWS 359 or equivalent.

LAWS 363. Land Use Control (3)
This course analyzes the public control of land use, primarily at the local and state levels. Both legal and policy perspectives are considered. Attention is given to constitutional limitations such as the takings doctrine, equal protection, and due process. Topics considered include zoning, subdivision controls, exclusionary regulations, and historic preservation.

LAWS 365. Legislation (2-3)
This course is a study of the legislative process and product. The class will examine theories of the legislative function; campaign and election regulation; the processes through which the legislature acts; and the drafting and interpreting of statutes.

LAWS 370. Intellectual Property (2-3)
The course will survey federal and state intellectual property rights, including getting, keeping, and protecting trademarks, copyrights, patents, and trade secrets. Unfair competition doctrines will also be examined. The course will emphasize a wide range of practical applications, including artistic expression, industrial espionage, corporate counseling, and employment agreements.

LAWS 373. Bioethics and Law (3)
How the legal and policy systems reconcile competing values and interests in controversies surrounding the practice of medicine. Case law, legislation, advisory policies, and institutional policies will be examined, as well as selected commentary from the legal, medical, and philosophical perspectives. Substantive topics to be addressed include definitions of death, competent patients’ right to refuse treatment, decisions on life-sustaining treatment for incompetent patients (including children), active euthanasia and assisted suicide, hospital ethics consultants and committees, organ transplantation, and selected issues raised by genetics and managed care.

LAWS 374. State and Local Government (3)
Examines the power of state and local governments. Among the topics considered are the purpose and role of local governments; the source and scope of local governmental power; state and federal constitutional restraints on local governmental activity; the distribution of powers between state government and local governments; and the various options by which state and local governments finance their activities.

LAWS 375. Professional Responsibility (3)
This course deals with questions underlying the responsibilities of the lawyer, as a professional, to self, society, client, and the profession. Premises concerning the lawyer’s role or roles within the context of the adversary system are examined in some detail, as is the idea of professionalism. The Model Code of Professional Responsibility and the Model Rules of Professional Conduct are analyzed as generalized statements of the aspirations and obligations of lawyers, and as applied to concrete problems. Required.

LAWS 377. Property Security (3)
The use of property as security for repayment of a debt is growing in all sectors of our economy. This course deals with the underlying social policies and the fundamental legal and equitable rules governing these secured transactions. In particular, we study the fundamentals of the law of security interests (historically and still commonly known as mortgages) in both real estate and personal property (the latter now codified in Article 9 of the Uniform Commercial Code), and we identify the common principles underpinning these seemingly separate bodies of law. The posing of actual problems assures that students develop strong practical capacity as well as theoretical understanding. Specific topics studied include creation of the security interest (mortgage), the legal rights and obligations of the debtor (mortgagor) and the secured party (mortgagee), the priority accorded to a security interest when in competition with competing interests in the same property, the transfer of a security interest, the redemption rights of the debtor (mortgagor), and the foreclosure of a security interest. Students may not take both LAWS 377 and LAWS 266 (Sales and Secured Financing).

LAWS 379. Restitution (3)
Studies the remedies by which one recovers specific property, the value of specific property, or a debt. A detailed examination of the remedies and legal theories that govern recovery of benefits conferred without a
contract, under a void or voidable contract, or under a contract that is broken by either the plaintiff or the defendant. The major remedies considered are those of replevin, ejectment, debt, quasi-contract, specific restitution in equity, equitable liens, constructive trust, equitable accounting, tracing assets, and subrogation. Substantive areas that are studied include frustration of purpose, fraud, mistake, duress, unjust enrichment, and protection of ideas. Since restitution is often an alternative remedy in cases where damages are also available, the course also considers the normal rules for calculating damages for breach of contract and for tort.

**LAWS 381. Sales (3)**

One of the basic courses in commercial law. It serves equally as an introduction to the general organization, structure, and appropriate application of the Uniform Commercial Code. Primarily we study the law of Sale of Goods under Article 2 of the U.C.C. Necessarily this includes a study of products liability law, which is explored under both sales warranty and strict tort liability theories. The interrelationship between these competing theories of products liability law are also investigated. Other specific topics studied are the legal rules applicable to 1) the formation of the sale contract, including the battle of the forms, statute of frauds, and parol evidence rule, 2) performance of and excuse of performance from the sales contract, 3) title warranties and title transfers, and 4) remedies for breach of the sales contract. Students may not take both LAWS 381 and LAWS 266 (Sales and Secured Financing).

**LAWS 385. Real Estate Transactions and Finance (2-3)**

Covers basic real estate transactions as well as issues involved in complex finance and development. Topics include: brokers, land contracts of sale, deeds and title covenants, the recording system, title insurance, mortgages, shopping center development, cooperatives and condominiums, ground lease financing, construction lending, distressed properties, selected federal income tax issues, and the real estate attorney’s professional responsibilities. Whenever possible, issues will be examined in the context of model transactions.

**LAWS 386. Advanced Evidence Seminar (3)**

This seminar is designed to cover specific issues in evidence, e.g., privilege, toxic torts, computer-generated evidence, expert testimony, syndrome evidence, and profile evidence. A paper and presentation are required. The paper may satisfy the writing requirement.

**LAWS 390. Advanced Labor Law (2)**

Covers relations between employers, employees, and unions not covered in the basic Labor Law course (LAWS 359). Among topics included are hot cargo agreements, obligations of successor employers, duty of fair representation, union security, federal preemption of state labor legislation, internal union affairs, and labor law reform. Prereq: LAWS 359.

**LAWS 391. Sports and Entertainment Law (2)**

Sports and Entertainment Law is the study of legal issues and problems relating to the music, television, and sports industries. This course focuses on the applicability of various legal doctrines to these industries, such as intellectual property law, labor law, and contract law. Also, emphasis will be placed on negotiation tactics and letter and contract drafting by conducting several negotiation and drafting exercises as well as a simulated representative relationship between the student and the athlete. In the context of a mock litigation/arbitration, students will also be required to draft legal briefs in support of the contractual position taken during the contract drafting exercises. Prereqs: LAWS 201 and LAWS 211. Prior course work in intellectual property, labor and employment law, or alternative dispute resolution is recommended, but not required.

**LAWS 392. Mass Media Law and Policy (3)**

This three-credit course, taught by Professor Bryan Adamson, is designed to cover the law and regulation of electronic and print media.

**LAWS 393. Trademark Law (3)**

Trademark Law is the study of how commercial entities use words and designs to identify the source of their products and services in the minds of consumers and competitors. This course focuses on domestic and international trademark acquisition, retention, transfer, registration, and infringement. In addition to the common law of trademarks and unfair competition, much of this course will be devoted to studying the statutory scheme of federal trademark law.

**LAWS 395. Trial Practice (2)**

This course provides practical training in jury and nonjury courtroom trial procedure. Students are assigned as lawyers in criminal and civil cases to conduct jury selection, examine and cross-examine witnesses, make objections, and argue motions in a simulated courtroom environment. Students may not take both Trial Practice and Trial Tactics (LAWS 397). Prereq: LAWS 207 or LAWS 212.

**LAWS 396. Civil Rights Litigation: Reproductive Rights and the First Amendment (2)**

This course will cover the basics of the Supreme Court’s reproductive rights jurisprudence, and looks at a series of topics relating to the intersection of reproductive rights and First Amendment rights, including freedom of speech and freedom of religion. In addition to reading cases, students will be assigned problems to discuss in class, with a focus on the practical problems of litigating civil rights cases (such as immunities, evidentiary concerns, and remedies). While the course is not coextensive with LAWS 003, there is some overlap, such that students should probably take only one of the two. Prereq: LAWS 202.

**LAWS 397. Trial Tactics (4)**

An intensive course in trial tactics, techniques, and advocacy. The emphasis during the first half of the semester is on practice in the separate components of a trial: direct examination, objections, cross-examination, use of rehabilitative devices, examination of expert witnesses, jury selection, opening statements, closing argument, and pretrial preparation. During the second half of the semester each student acts as co-counsel in a full trial. Videotape recording is used for critiquing student performances throughout the semester. Students may not take both LAWS 397 and LAWS 395 (Trial Practice). Prereqs: LAWS 207 or LAWS 212, which cannot be taken concurrently.

**LAWS 399. Pretrial Practice (2)**

This course picks up where most first-year legal research and writing courses leave off. We will examine intensively, among other things, the various discovery devices (including depositions, interrogatories, document requests, and requests to admit), pretrial motion practice, litigation as a means of achieving the best possible negotiated result, and alternative dispute resolution mechanisms (including mediation and arbitration). In other words, we will study the things that litigators spend most of their time doing and thinking about: how lawyers go about gathering and preserving evidence, the everyday interactions they have with courts, and the reasons they do all these things even though they rarely expect to get all the way to trial. The course will include simulations and extensive drafting assignments.

**LAWS 401. The Lawyerly Process (2)**

Certain legal skills basic to the practice of law, including interviewing, counseling, and negotiating, are discussed, and students have the opportunity to practice those skills in simulated interviews and negotiations under the supervision of the instructor. Videotapes of lawyers and/or students are shown and reading materials assigned. Class discussions of reading materials and videotapes and experience in simulations enable students to confront basic problems of interpersonal communications, role conflicts, and decision-making posed by law practice.

**LAWS 403. Criminal Justice Clinic (4)**

Students handle a limited number of misdemeanor cases in municipal courts throughout Cuyahoga County. The seminar sessions are devoted to discussions of case handling by the students and to ethical and strategic considerations of criminal law practice, trial tactics, and plea bargaining. Hypothetical case studies are also used to increase the breadth of the students’ exposure to the criminal justice system. Each student also handles some prosecution in local court. Prereq: LAWS 401 and LAWS 327.

**LAWS 411. Civil Clinic I (3)**

Students must be enrolled in and complete both semesters to receive credit. Students represent plaintiffs or defendants in a variety of matters, including landlord-tenant disputes, domestic relations cases, small business ventures, contract preparation, and administrative proceedings. A major part of the student’s responsibility is to determine whether a legal problem actually exists and, if so, to resolve it as expeditiously as possible. Seminar sessions are devoted to discussions of matters being handled by the students and to the ethical and practical problems encountered in civil law practice. Emphasis is on the use of such tools as...
negotiation, litigation, and settlement procedures to accomplish specific objectives. Prereq: LAWS 401. Prereq or Coreq: LAWS 207 or LAWS 212.

LAWS 412. Civil Clinic II (3)
Continuation of LAWS 411. Both semesters must be completed before credit is given.

LAWS 415. Family Law Clinic I (3)
Students must be enrolled in and complete both semesters to receive credit. Students represent parties in a variety of family law matters, including contested and uncontested divorces, domestic violence petitions, custody, support, and property division. A major part of the student’s responsibility is to analyze the problems and determine the best way of resolving them. Seminar sessions are primarily devoted to specific skills and to discussions of cases being handled by the students. The ethical and practical problems encountered in family practice are emphasized, as well as case theory. Prereq: LAWS 401. Prereq or Coreq: LAWS 207 or LAWS 212, and LAWS 210.

LAWS 416. Family Law Clinic II (3)
Continuation of LAWS 415. Both semesters must be completed before credit is given.

LAWS 418. Health Law Clinic I (3)
Students must be enrolled in and complete both semesters to receive credit. Students represent parties in a variety of health law matters, including premature discharge or inappropriate transfer from medical facilities; informed consent and substituted consent; entitlement to public or private insurance coverage; health services, and income benefits; and mental health issues such as guardianships and involuntary hospitalization. A major part of the student’s responsibility is to analyze the problems and determine the best way of resolving them. Seminar sessions are primarily devoted to specific skills and to discussions of matters being handled by the students. The ethical and practical problems encountered in health law practice are emphasized, as well as legal theory. Prereq: LAWS 401. Prereq or Coreq: LAWS 207 or LAWS 212; LAWS 227 or LAWS 220.

LAWS 419. Health Law Clinic II (3)
Continuation of LAWS 418. Both semesters must be completed before credit is given.

LAWS 430. Community Development Clinic I (3)
Students must be enrolled in and complete both semesters to receive credit. Students represent individuals and entities in a variety of community development matters which may include first time home buyer real estate purchases, construction and rehabilitation; business and non-profit entity formation; individual and entity representation in neighborhood rehabilitation projects; and group representation in other contexts. This clinic is primarily transactional in nature and is designed to expose students to the special problems encountered in representing entities and in structuring transactions. Seminar sessions will be devoted to discussions of applicable law pertaining to specific cases students are working on and development of the skills necessary to represent individuals and entities in transactional matters. Students also will be exposed to the ethical problems associated with entity representation. Prereq: LAWS 401 or LAWS 286/LAWS 287. LAWS 203 or LAWS 204 may be taken concurrently.

LAWS 431. Community Development Clinic II (3)
(See LAWS 430.)

LAWS 436. Immigration Law Clinic I (3)
The Immigration Clinic will be both a real client representational clinic and provide students with experience of working on consulting projects with such organizations as the American Immigration Law Foundation. Examples of the activities that students may work on include 1) representation of individuals in matters before the Immigration Court, 2) preparation of legal memoranda, briefs, or policy papers on targeted immigration law issues. Examples of the kinds of cases and issues to be included are asylum, removal, petitions based upon the Violence Against Women Act, protections of non-citizen victims of domestic violence, and legality of detention. This is a year long course.

LAWS 437. Immigration Law Clinic II (3)
The Immigration Clinic will be both a real client representational clinic and provide students with experience of working on consulting projects with such organizations as the American Immigration Law Foundation.
LAWS 554. Theories of Equality Seminar (3)
Explores fundamental concepts of equality and how those concepts have been applied by the courts in race, gender, and other status-based areas. Since familiarity with the case law will be assumed, most of the discussion will focus on writings of legal scholars and legal philosophers. May satisfy the writing requirement.

LAWS 556. Judicial Externship Seminar (4)
Students in the spring of their first year are selected for summer externships with specific federal district and circuit judges. Classes in the spring of the first year, during the externship summer, and in the fall of the second year complement the eight weeks of externing in the judge’s chamber. Prereq: Permission of the instructors.

LAWS 557. Genetics and Law (3)
The current federal Human Genome Project is attempting to understand the health and behavioral implications of the 50,000 to 100,000 genes in the human body. Genetic tests are being offered to let people know if they are at risk of having a child with a genetic defect or if they will later in life suffer from cancer or other disease. Genetic predispositions are also being investigated for certain behaviors such as gay sexual preference, intelligence, and anti-social behavior. This course will cover the tort law, family law, constitutional law, criminal law, employment law, and insurance implications of developments in genetics.

LAWS 561. International Issues in Intellectual Property Seminar (3)
This seminar will examine selected issues in comparative and international law affecting patents, copyrights, trademarks, and trade secrets. By looking at comparative systems, we will understand the differing philosophies underlying intellectual property in different legal cultures. By examining the movements to harmonize and unify national systems (looking at the process of harmonization, extraterritorial enforcement of rights, conflicts of law, and global protection), we will see how the different cultures are being merged. May satisfy the writing requirement. Prereq or Coreq: LAWS 370.

LAWS 563. Biomedical Research Law and Policy (3)
The 20th-century biomedical research revolution has generated many conflicts demanding legislative, judicial, and administrative action. This seminar will address some of the most pressing issues. Topics include: experimentation on human beings (ethical principles and regulatory system); issues raised by “rescue” research (e.g., artificial heart); random clinical trials; research on children, elderly, and mentally disabled; research involving human fetuses and embryos; research on “neomorts” (newborn dead bodies); research on the terminal phases of Nazi and other “tainted” research; experimentation on animals; scientific fraud and misconduct, and commercialization of biomedical research. May satisfy the writing requirement.

LAWS 568. Financial Markets: Law, Theory, and Practice (2)
Explores the interactions of law, principles of finance, and the theoretical underpinnings of financial markets. It introduces students to the roots of evolving financial market liabilities affecting the interests and conduct of people at all levels in those markets by examining (a) the structure and purpose of financial markets, (b) the financial and capital markets theories which today shape the contours of the law, (c) intermediation in financial markets, and (d) the challenges of global market regulation.

LAWS 569. Constitutional Law II Laboratory (2)
Some students enrolled in Constitutional Law II (LAWS 202) may enroll in this clinical or practicum seminar designed to expose them to many of the issues discussed in class as those issues arise in the context of legislative proposals and specific “client” complaints. The source of these issues will be the Ohio ACLU. Students will work in pairs and will be required to research and evaluate specific First Amendment issues, writing opinion letters, assisting in the preparation of briefs and pleadings in pending litigation, and evaluating the First Amendment consequences and implications of legislation introduced or proposed to be introduced in the Ohio General Assembly. Students need not be certified by the Ohio Supreme Court to practice as law students; second-year students may enroll. Coreq: LAWS 202.

LAWS 570. Foreign Graduate Seminar (2)
This seminar is the required introductory course for foreign students enrolled in the Graduate Program in U.S. Legal Studies. It begins with a series of lectures introducing students to American legal education; American government, courts, and culture; various common law subjects; and professional responsibility. Throughout the year seminar sessions are held with legal practitioners from law firms and corporations in the Cleveland area who are involved in an international practice. Limited to the foreign LLM students.

LAWS 571. Jurisprudence Seminar: Justice and Religion in the Liberal State (3)
The liberal theory of justice emphasizes “fairness” and a “thin theory of the Good.” Religious believers often favor substantive results across a range of law and public policy issues. How are the dilemmas posed by these seemingly contradictory visions of legal and political life to be resolved? Issues to be discussed include homosexual marriage, abortion, physician-assisted suicide, religion and education, affirmative action, and pornography. Both the religious clauses of the Constitution and the ideas of modern liberal (Dworkin, Rawls, Richards) and nonliberal (George, Carter, Finnis) thinkers will be the context for a discussion of these issues. May satisfy the writing requirement.

LAWS 572. International Law: Selected Problems in Theory and Application (3)
This applied international legal theory seminar raises foundational questions about the nature and scope of international law in the context of contemporary international legal problems. It also introduces students to the fundamentals of international legal research. Each student is expected to select a contemporary international law topic, research the relevant legal issues, conduct a classroom session on that topic, and write a substantial paper. No prerequisite, but a prior course in international or comparative law is recommended. May satisfy the writing requirement.

LAWS 573. Vietnam War and the Law Seminar (3)
This seminar explores the Vietnam War as a legal event. After an introduction to the history of the Vietnam War and U.S. involvement in Southeast Asia, we will examine several of the legal issues and events related to the war. Topics may include: the Vietnam War and international law; the Tonkin Gulf Resolutions and the constitutionality of the war; extension of the war to Cambodia; selective service, draft evasion and resistance, desertion, and amnesty; GI rights, GI dissent, and the military justice system; My Lai, the rules of engagement, and America’s conduct of the war; legal strategies of the anti-war movement; the Pentagon Papers case; and the legal legacies of the Vietnam War. May satisfy the writing requirement.

LAWS 577. European Legal Professions Seminar (3)
Introduction to the origins, histories, developments, and contemporary shapes of the legal professions in western and central continental Europe from 1500 to the present. The course will examine the development of legal education in Europe, the principal legal occupations into which graduates move (private practice, the notariate, the judiciary and state prosecutor’s office, state service, and business) and conclude with an examination of the role of lawyers in politics and in society. Concentration will be on France and Germany, with additional examples drawn from Italy, Russia, Switzerland, and elsewhere. May satisfy the writing requirement.

LAWS 579. Environmental History and Law Seminar (3)
This seminar is designed to introduce students to the relatively new and exciting field of environmental history and explain how it can help us better understand the law. Our concern in this course is not so much with black letter law, but with the larger ecological and historical context in which the law is formed. We will concern ourselves especially with the ways in which the law was used to transform the natural world, focusing exclusively on this story as it unfolded in the United States. Our goal is to see not just how law shaped nature, but also how the complexities of the natural world have affected legal doctrine. May satisfy the writing requirement.

LAWS 586. Death Penalty Seminar (3)
LAWS 587. Research Seminar in Taxation (2)
An opportunity to undertake significant research and writing in taxation, with each student expected to complete a major paper and present that paper to the class. Grade is based on the paper and class participation. Prereq: LAWS 211.
LAW 589. Law of the Workplace Seminar (2)
The research seminar affords the student and opportunity to write a substantial original research paper on a topic relating to Labor, Employment, or Employment Discrimination Law. In addition to the paper, students are required to present their topic early in the semester, and make an oral presentation of their research toward semester's end. Prereq: LAWS 359 and LAWS 328.

LAW 590. The Religion Clauses of the First Amendment Seminar (3)
This course addresses the major issues in the constitutional relationship between church and state. Specific topics include religion in the public schools, aid to parochial education, public acknowledgments of religion, and mandatory accommodation of religious practice. May satisfy the writing requirement.

LAW 592. International Economic Integration (3)
As countries open their economies to the world economy, new strains are placed on their legal systems. This course explores how legal systems adapt to open markets and free trade. Topics covered may include intellectual property, environmental, and labor laws. We will also examine specific countries' experiences (New Zealand, Chile, Mexico), the mechanisms for growing international trade agreements (expansion of NAFTA, for example), and methods of legal reform. May satisfy the writing requirement.

LAW 595. American Contract Law (3)
The subject matter and coverage of this course is approximately the same as the subject matter and coverage of first-year Contracts (LAW 123) as abbreviated and modified to reflect that it (a) is limited to foreign students who are candidates for the LL.M. in U.S. Legal Studies and (b) consists of 3 (not 5) credit hours.

LAW 596. Social History of Crime Seminar (3)
This course is designed to offer students a somewhat different optic on the way that law operates in society, different, that is, from the sense one might get from reading case books. Here our concern is with the meaning of law in the largest sense, not so much from the standpoint of legal doctrine, but in the sense of how it works as a system of power to advance certain interests in society at the expense of less powerful groups. By “social history” I refer to the study of ordinary people, as opposed to political leaders and rulers. Thus the course explores how the law played out in the lives of ordinary men and women during the period from the eighteenth century to the present. What is a crime? How have certain customary rights been criminalized and why? What are the ideological underpinnings of the law? These are some of the questions we will take up as we examine crime in Britain and the U.S. from a thematic perspective.

LAW 598. Comparative and International Dispute Resolution Seminar (3)
Students will explore a wide range of domestic, foreign, and international dispute resolution processes. The seminar will develop and apply a methodology for comparing, assessing, and reforming such processes, with significant attention to the institutional context in which the processes operate. Students will write substantial research papers on topics that they select from a menu of options, including (but not limited to) informal mediation, formal adjudication, and international dispute settlement, and they will make a presentation in class. May satisfy the writing requirement.

LAW 599. Doing Business in the United States (3)
The course is designed to introduce foreign students to many areas of U.S. domestic law through consideration of a transnational business transaction. Examples of areas of law covered: restrictions on foreign investment, regulatory agencies, banking and finance, importing and exporting, business entities, litigation and alternative dispute resolution, labor relations, immigration law, taxation. Limited to candidates for the LL.M. in the U.S. Legal Studies.

LAW 740. Journal of International Law Seminar (3)
LAW 745. Law Review Seminar (2)
LAW 746. Law Review Seminar (1)
(See LAWS 745.)
nership distributions; transfers of partnership assets and partnership interests; special rules pertaining to the death of a partner; special basis adjustments; the liquidation of a partner’s interest; the liquidation of the partnership. The substantive law and the tax aspects of limited liability companies will be analyzed and discussed.

**LLM 630. Income Taxation of Estates and Trusts (2)**
An examination of the different types of trusts including grantor trusts, simple trusts and complex trusts; consideration of the tax treatment of estates; analysis of the concept of Distributable Net Income and its effect on trusts and their beneficiaries; analysis of the tax treatment of split-interest charitable trusts.

**LLM 632. Tax Procedure and Research Methods (2)**
The procedural provisions of the Internal Revenue Code, including the provisions governing the assessment and collection of taxes; the statute of limitations; petitions to the U.S. Tax Court; the mitigation provisions governing inconsistent positions; refunds; other similar matters. Instruction on research methods, including computer research. All participants are required to perform some legal research outside class.

**LLM 634. Consolidated Tax Returns (2)**
Topics include the affiliated group; the election to file and discontinue filing consolidated returns; taxable years, income included in returns, and methods of accounting; consolidated taxable income; intercompany transactions, special limitations on deductions; net operating losses; excess loss accounts; intercompany distributions; the disposition of stock of a subsidiary.

**LLM 638. Advanced Corporate Tax Problems (2)**
A more detailed examination of corporate reorganizations (including original issue discount problems in recapitalizations), distributions, redemptions, liquidations, and S corporation taxation; personal holding companies; accumulated earnings tax; collapsible corporations; the carryover of net operating losses and other tax attributes.

**LLM 640. Executive Compensation (Nonqualified Plans) (2)**
Incentive stock options; nonqualified stock options; restricted stock plans; constructive receipt problems; “Rabbi” trusts; stock appreciation rights plans; other nonqualified deferred compensation methods; golden parachutes; other compensation methods and techniques.

**LLM 645. Criminal Tax and Procedure (2)**
The course covers the various tax and tax-related crimes under the Internal Revenue Code and Titles 18 and 31 of the United States Code. These include tax evasion and false return charges, money laundering, and currency transaction crimes. In addition, students analyze the stages of a criminal tax investigation and prosecution in both non-grand jury and grand jury settings.

**LLM 648. Federal Taxation of Exempt Organizations (2)**
This course will cover the basics of the taxation of tax-exempt organizations, including the following topics: the requirements for tax-exempt status (the organizational and operational requirements); an analysis of the application for exemption process; unrelated business taxable income, private inurement, public and private foundation status, intermediate sanctions, and various other topics.
Weatherhead School of Management
Weatherhead School of Management

Administrative Office
Peter B. Lewis Building
Phone 216-368-2030
Mohsen Anvari, Dean and Albert J. Weatherhead, III
Professor of Management

Since awarding the region’s first business degree in 1930, the Weatherhead School of Management’s spirit of innovation has been the driving force that has elevated the University’s management programs to national prominence. Among these innovations is the nation’s first Ph.D. program in operations research, one of the first academic divisions of management information systems, and the first integrated network of IBM personal computers for M.B.A. instruction.

The School of Management at Case Western Reserve University was created in 1967 through the federation of Western Reserve University and Case Institute of Technology. In 1980, in recognition of the support and achievements of Cleveland’s entrepreneurial Weatherhead family, the school was named the Weatherhead School of Management.

Today, the Weatherhead School offers academic programs leading to bachelors, masters and doctoral degrees, as well as certificate and executive education programs. Our students are an outstanding and diverse group, selected for their superb academic records, work experience and intellectual and personal attributes. This combination of excellence and diversity assures that the Weatherhead School will produce effective leaders for the regional, national and international business communities.

The Weatherhead School of Management has been fully accredited by AACSB International-The Association to Advance Collegiate Schools of Business since 1958.

Mission

The Weatherhead School is an international center of management scholarship committed to preparing and enhancing organizational leadership. The School is dedicated to making discoveries of enduring consequence, to developing innovative educational programs, to fostering strategic partnerships with students and organizations, and to providing services to multiple communities.

The School delivers measurable value to its constituencies through its scholarly commitment to discovery, learning, and service:

• Through the scholarship of discovery, we develop, integrate, and apply new ideas through traditional research and pioneering approaches that transcend conventional boundaries;

• Through the scholarship of learning, we create an environment in which students develop the knowledge and skills to be effective leaders in their professions and communities; and

• Through the scholarship of service, our faculty and students share their knowledge to achieve significant outcomes with partner organizations, our alumni, our community, and our world society.

Vision

The Weatherhead School of Management aspires to be the worldwide leader in developing an outcome orientation in its missions of discovery, learning and service, in achieving a consistent record of innovation, and in creating a learner-centered environment, emphasizing an active learning partnership among students, faculty and organizations. Because of its distinctive record of achievement in these three areas, the school will be recognized by students and key external stakeholders academic colleagues, organizational leaders, and the larger community as one of the top management schools in the United States and in the world.

Core Values

Five core values unite the faculty and staff of the Weatherhead School as management educators, scholars, and colleagues within the University community. These core values express the ethos of our School as well as our aspirations for its future. They guide us in our missions of discovery, learning and service, and will be reflected in all of our efforts:

• We have an overriding scholarly commitment to create and share knowledge for the common good.

• We aspire to make contributions of enduring consequence. We continually strive for outcomes that influence and ultimately change the way people think and act.

• We believe management should be a noble profession, committed to the enhancement of human life, to innovation, to leadership and to the creation of healthy organizations.

• We value a diverse community, characterized by open dialogue and mutual respect among individuals with different specializations, backgrounds, cultures and perspectives.

• We are a learning organization, valuing the abilities to reflect upon and alter assumptions and to pioneer in unexplored territory. We are committed to increasing individual creative capacities, nurturing new and expansive patterns of thought, achieving collective aspirations, and encouraging lifelong learning.

Academic Degree Programs

Undergraduate Programs

Degrees granted by the Weatherhead School of Management

- Bachelor of Science in Accounting
- Bachelor of Science in Management
- Bachelor of Arts in Economics (awarded by the College of Arts and Sciences)

Professional Programs

Degrees granted by the Weatherhead School of Management

- Master of Accountancy
- Master of Business Administration (M.B.A.)
- Executive M.B.A.
- Master of Science in Management - Operations Research
- Master of Science in Management - Supply Chain
- Executive Doctor of Management (E.D.M.)
- Master of Nonprofit Organizations (M.N.O.)

Joint Degree Programs

(Degrees granted by the Weatherhead School and other schools of the University)

- B.S. in Mathematics/M.S. in Management
- J.D./M.B.A.
- M.N.O./J.D.
- M.N.O./M.S. in Social Administration
- M.N.O./M.A. in Music History
- M.S. in Management/M.B.A.
- M.S. in Nursing/M.B.A.
- M.B.A./M.S. in Social Administration
Undergraduate Programs

Degrees granted by the Weatherhead School of Management

- B.S. in Accounting
- B.S. in Management
- B.A. in Economics (Degree granted by the University's College of Arts and Sciences)

Graduate Programs

Degrees granted by the University's School of Graduate Studies

- M.S. in Organization Development and Analysis
- Ph.D. in Management
- Ph.D. in Operations Research
- Ph.D. in Organizational Behavior

Non-Degree Certificate Programs

- Certificate in Health Systems Management
- Certificate in Management Information Systems
- Certificate in Nonprofit Management
- Certificate in Operations
- Certificate in Public Policy
- Professional Fellows Program

Administration

Mohsen Anvari  
Dean and Albert J. Weatherhead, III Professor of Management

John Aram  
Director, Executive Doctor of Management

Richard Bennett  
Director of Development

Deborah L. Bibb  
Director, Placement Administration

Barbara J. Bolek  
Director, Health Systems Management Center

Kevin Carduff  
Director, Undergraduate Program Services

Bo A. Carlsson  
Director of Research and Graduate Programs

Pamela J. Chamar  
Registrar and Financial Aid Administrator

Frances B. Cort  
Assistant Dean for Professional Programs

Denise M. Douglas  
Director, Career Planning and Student Life

Ronald Fountain  
Director, Professional Fellows Program

Ronald Fry  
Director, Executive M.B.A. Program

Christine Gill  
Director, Marketing and Admissions for M.B.A. Programs

Julia E.S. Grant  
Associate Dean for Graduate Programs

Larry Goodpaster  
Director, Financial Planning and Analysis

Marion J. Hogue  
Assistant Dean for Academic Affairs

James Hurley  
Director, Undergraduate Support Services

Mindy Kannard  
Director, Employer Relations

Todd Lloyd  
Associate Director, Admissions and International Programs

Ellen M. Machan  
Director of Communications

Gary J. Previts  
Associate Dean for Undergraduate and Integrated Studies Programs

N. Mohan Reddy  
Interim Associate Dean for Executive Education

Diann Rucki  
President, EDI

J. B. Silvers  
Associate Dean for Resource Management and Planning

Peggy Sobul  
Director, Alumni Affairs

Ellen Brooks Van Oosten  
Assistant Dean and Executive Director, Lifelong Learning

Emeriti Faculty

Theodore M. Alfred  
Professor Emeritus of Management Policy and Dean Emeritus, Weatherhead School of Management

Julio N. Berrettoni  
Professor Emeritus of Operations Research

David A. Bowers  
Professor Emeritus of Banking and Finance

Andrew D. Braden  
Professor Emeritus of Accounting

K. Laurence Chang  
Associate Professor Emeritus of Economics

Miles Kennedy  
Associate Professor Emeritus of Information Systems

Lucille Mayne  
Professor Emerita of Banking and Finance

S. Sterling McMillan  
Professor Emeritus of Economics

William S. Peirce  
Professor Emeritus of Economics

Gerhard Rosegger  
Frank Tracy Carlton Professor Emeritus of Economics

Donald M. Wolfe  
Professor Emeritus of Organizational Behavior

Weatherhead Degree Programs

Undergraduate Programs

Bachelor of Science in Accounting

The importance of accountancy to business, government and society is well recognized. Like the professions of architecture, law, engineering and medicine, accountancy demands of its students both a high degree of technical training, a broad knowledge of the fundamentals of economics and business, and a commitment to public well being. Career opportunities in accounting include the public, corporate, government, nonprofit and health care sectors. The undergraduate program in accountancy is designed to prepare students for entrance into these careers and to provide a foundation for the examination to become a Certified Public Accountant (CPA) or to achieve other professional certifications.

As part of the sequence of courses leading to the Bachelor of Science degree in Accounting offered through the Weatherhead School of Management, the student takes required and elective courses in related fields of banking and finance, economics, marketing, organizational behavior, management information decision systems, management policy and operations.

Twelve semester hours of accountancy taken at another accredited institution may be considered in transfer toward the Bachelor of Science degree in Accounting. Transfer credit for
An undergraduate major in economics provides an excellent preparation for a variety of professional careers, such as management, law, and government service. A major is essential for those wanting to pursue graduate work in economics.

**Major (for B.A. degree)**

A major in economics consists of 33 hours, with a minimum of 27 hours of economics courses. It leads to the Bachelor of Arts degree.

**Degree Requirements**

**Core Theory**

- ECON 102 and 103
- STAT 201 or STAT 207
- ECON 307
- ECON 308 or 309
- ECON 326

**Electives**

12 ECON credits (at least 6 credits in each of two concentrations)

**Senior Capstone**

Required, to be chosen from a menu of options and in coordination with your major advisor.

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**Bachelor of Science in Accounting**

### Fall Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<td>MATH125</td>
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<tr>
<td>ENGL150</td>
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<tr>
<td>Natural Science</td>
<td>3</td>
</tr>
<tr>
<td>PSYC101</td>
<td>3</td>
</tr>
<tr>
<td>SOCI112</td>
<td>3</td>
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<tr>
<td>History, Philosophy, Religion</td>
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<tr>
<td>Physical Ed (Full semester)</td>
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</tbody>
</table>

**First Semester Credits** ........................................ 16

- ACCT101 Intro. to Financial Accounting .................... 3
- ACCT102 Intro. to Managerial Accounting ..................... 3
- ECON102 MicroEconomics ........................................... 3
- STAT207 Statistics for Business ................................ 3
- COSI100 Communications or ...................................... 3
- COSI 236 Public Speaking ....................................... 3
- Non-Weatherhead Elective ...................................... 3
- Non-Weatherhead Elective ...................................... 3

**Third Semester Credits** ........................................ 15

- ACCT300 Corporate Reporting I ................................ 3
- ACCT302 Managing Costs ........................................... 3
- MIDS308 Intro to Mgmt Information Systems ................ 3
- BAFI355 Corporate Finance ....................................... 3
- ECON341 Money & Banking ........................................ 3

**Fourth Semester Credits** ...................................... 15

- ACCT305 Income Taxation ......................................... 3
- ACCT314 Attestation and Assurance Services ................. 3
- BLAW331 Legal Environment of Management .................... 3
- Weatherhead Elective ............................................. 3
- Non-Weatherhead Elective ...................................... 3

**Fifth Semester Credits** ........................................ 15

<table>
<thead>
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<tr>
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<td>OPMT301</td>
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</tr>
<tr>
<td>MIDS309</td>
<td>3</td>
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<tr>
<td>MKMR301</td>
<td>3</td>
</tr>
<tr>
<td>Non-Weatherhead Elective</td>
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</tr>
</tbody>
</table>

**Sixth Semester Credits** ...................................... 15

- ACCT304 Advanced Financial Reporting ....................... 3
- PLCY399 Business Policy .......................................... 3
- ACCT306 Accounting Information Systems ..................... 3
- Weatherhead Elective ............................................. 3
- Weatherhead Elective ............................................. 3

**Seventh Semester Credits** .................................... 15

**Total Minimum Degree Credit Hours** ....................... 122

Notes about the Accountancy Curriculum:

- Introductory Accounting may be taken the first year.
- Accounting majors may not take Weatherhead classes on a pass/no-pass basis.
- Of the 9 credit hours in Weatherhead electives, no more than 6 hours can be in Accounting.
Economics Concentrations

Resources & Markets
ECON 255 - Economic History of the United States
ECON 306 - History of Economic Thought
ECON 352 - Economics of Labor Markets
ECON 341 - Banking and Finance
ECON 367 - Economics of Energy
ECON 368 - Environmental Economics

Industrial Organization
ECON 328 - Experimental Economics
ECON 329 - Game Theory
ECON 361 - Managerial Economics
ECON 364 - Competition and Public Policy
ECON 369 - Economics of Technological Innovation

Public Economics
ECON 338 - Law and Economics
ECON 342 - Public Finance
ECON 343 - Economics of State and Local Governments
ECON 345 - Public Choice
ECON 377 - Economics of Nonprofit Organizations
ECON 378 - Health Care Economics
ECON 386 - Urban Economics

International Economics
ECON 372 - International Finance
ECON 373 - International Trade
ECON 375 - Economics of Developing Countries

Bachelor of Science in Management

Fall Semester
Course Credits
MATH125 Calculus-I 4
ENGL150 Expository Writing 3
Natural Science 3
The Arts 3
History, Philosophy, Religion 3
Physical Ed (Full semester) 0
First Semester Credits 16
ACCT101 Introduction to Financial Accounting 3
ECON102 MicroEconomics 3
STAT207 Statistics for Business I 3
Arts/Humanities Elective Sequence Course 3
Non-Weatherhead Elective 3
Third Semester Credits 15
LHRP251 Labor Relations or 3
LHRP311 Labor Problems 3
ORBH 250 Organizational Behavior 3
MIDS308 Intro to Mgmt Information Systems 3
BAFI355 Corporate Finance 3
OPRE201 Operations Research 3
Fifth Semester Credits 15
Management Seq. Elective 3
Management Seq. Elective 3
Open Elective 3
Open Elective 3
Non-Weatherhead Elective 3
Seventh Semester Credits 15
Total Minimum Degree Credit Hours 122

Notes about the Weatherhead Curriculum:
- Introductory Accounting may be taken the first year.
- Management majors may not take Weatherhead classes on a pass/no-pass basis.
Management Elective Sequences (B.S.)

Sequence I: Finance
- BAFI 341 - Money and Banking
- BAFI 356 - Investments
- BAFI 359 - Intermediate Corporate Finance
- ECON/BAFI 372 - International Finance

Sequence II: Information Systems
- MIDS 310 - Technology of Information Systems
- MIDS 326 - System Design & Analysis
- MIDS 327 - Database Management
- MIDS 329 - Design of Object Oriented Systems

Requirement:
Three approved electives for sequence (9 hours)
Weatherhead elective (3 hours)
Total 12 hours

Entrepreneurial Studies Minor
- ENGR 131 or MIDS 307
- MIDS 308, 309, and two additional MIDS or other courses approved by the Minor advisor.

Integrated Study Programs
Highly qualified students who are candidates for either the B.S. in Accounting or the B.S. in Management may be eligible to accelerate their programs toward completion of one of two graduate degree programs, the Master of Accountancy (M.Acc.) and the Master of Business Administration (M.B.A.). Because of this acceleration opportunity, successful candidates are able to complete their graduate programs of study in two semesters after completing their undergraduate requirements.

Integrated Study Program Options in Accountancy
There are two programs, which integrate graduate and undergraduate work in Accountancy. These programs are strongly recommended for those individuals planning to become certified accounting professionals, particularly as CPAs (Certified Public Accountants). Beginning in the year 2000, CPA candidates must have completed 150 semester hours of study at the university level in order to qualify to sit for the professional Certified Public Accountant examination. The B.S./Master of Accountancy (M.Acc.) program enables the individual to earn efficiently both the undergraduate and the graduate degrees within the required hours of study. (Those individuals pursuing other non-accounting career alternatives need to complete only the 122 hours of study required by the B.S. in Accounting degree program. However, the M.Acc. is still highly desirable and strongly encouraged.) Highly qualified students who are candidates for the B.S. in Accounting may be eligible to accelerate their programs toward completion of the Master of Accountancy (M.Acc.). Because of this acceleration opportunity, successful candidates are able to complete their graduate programs of study in two semesters after completing their undergraduate requirements.

Joint B.S./Master of Accountancy (M.Acc.)
This program allows students to begin graduate course work while studying for the award of their undergraduate accounting degree. Undergraduate accounting majors accepted for this opportunity will be permitted to enroll for 6 credit hours of Weatherhead School graduate courses during the senior year. These hours will also be part of the undergraduate business elective requirements. These hours of credit will count toward the satisfaction of the M.Acc. degree program requirements, reducing the graduate program requirements from 36 to 30 hours. Before taking graduate course work, the student must have completed all prerequisites for the course on the undergraduate level and have a “B” average in those prerequisites. Students will complete and be awarded their Bachelor of Science in Accounting prior to their Master’s program.

Accelerated B.S./Master of Accountancy (M.Acc.)
This program allows motivated students to accelerate their pursuit of both the B.S. and M.Acc. degrees. In addition to applying the six credit hours of Weatherhead graduate course work toward their undergraduate degree program, students in this program may begin taking more graduate course work before completing all of their undergraduate degree requirements. To enroll in this program, students must have:
- Completed 90 hours of undergraduate course work
- Completed all of the undergraduate Weatherhead General Education Requirements
- Completed 36 hours of the Weatherhead Management requirements (including 18 hours of the required Accountancy course work)
- Achieved at least a 3.0 overall GPA

Students in this program will receive both the B.S and the Master’s degree at the end of the program. For the first eight semesters of study, the student will register as undergraduates in Case Western Reserve University; thereafter, students will register in the graduate professional degree program in the Weatherhead School of Management.

Application to either Integrated Study program in Accountancy should be made in the junior year to the Director of the Master of Accountancy Program. Also, the GMAT (Graduate Management Admission Test) should be completed during the junior year. In addition, students in the Accelerated Program should design a
professional study plan of course work with the Coordinator for Integrated Studies.

**Professional Practicum**

The primary goal of this active learning experience is the intellectual, personal and professional growth of the student in an area related to the student’s academic goals. Students develop new skills and gain insights into their career and academic goals. The Practicum should provide the students with new skills, insights and experiences that are transferable to the academic setting. A practicum is a planned, structured supervised workplace experience at an approved “site” organization.

The Practicum is an experiential learning arrangement between the student, the employer and the practicum advisor in conjunction with the Career Center. Employers provide appropriate supervision and work related learning. The practicum advisor guides and evaluates the student’s experience. All Practica developed through Career Center must be taken for transcript notation and have a faculty member serve as a Practicum Advisor. If a student elects to work in an internship / practicum without enrolling in the course for academic notation, they will not have the benefits of a full-time student status nor do they represent the Practicum Program in any official capacity.

**Program Requirements**

The Practicum Program is administered by the Career Center in collaboration with the Weatherhead School of Management. To be eligible, a student must have completed 60 credit-hours prior to the start of the work assignment, must be enrolled as a full-time student, and must be in good academic standing. To participate in the program students apply to the Career Center in the semester preceding the work assignment. A student may participate in up to two practica, but must spend at least one intervening semester on campus.

(See course descriptions listed other Management Courses near the end of the Weatherhead School section of this Bulletin.)

**The M.B.A. Program**

In 1990, the Weatherhead School of Management introduced an innovative M.B.A. program, based on the underlying philosophy that our graduates must create value for organizations and society. The Weatherhead M.B.A. curriculum emphasizes the assessment and development of management skills along with knowledge of the functional areas of business, and offers a liberalizing experience through exploration of the diverse contexts of management.

In 1997, the Weatherhead School introduced a new, integrated core curriculum, which will enhance the potential of each student to create value by:

- drawing from different perspectives to identify, analyze and resolve complex problems;
- being creative and agile in designing systems and adapting to change;
- developing and enhancing organizational leadership;
- making a personal commitment to life-long learning;
- adding value in a special area of expertise;
- contributing to the betterment and communities and society.

**M.B.A. Program Structure**

The full-time M.B.A. is delivered as a 63-hour program for candidates with diverse academic backgrounds, and as a 42-hour program for students with undergraduate business degrees from U.S. universities. Part-time instruction is available as a 51-hour program for candidates with diverse academic backgrounds, and as a 47-hour program for students with undergraduate business degrees from U.S. Both programs involve the same required courses. The part-time curriculum has fewer elective options. The M.B.A. program is divided into management assessment and development, the core curriculum, the perspectives courses and the elective sequence. See the Departmental Course Offerings section for detailed course descriptions.

**Full-time M.B.A. Program**

63-hour curriculum Core Courses: 33 hours

Because of the integrative nature of the full-time core, no courses may be waived, regardless of undergraduate equivalent courses.

MBAC 410: Leadership Assessment and Development I (2)
MBAC 410L: Team Skills Lab (1)
MBAC 411: Strategic Issues and Applications I (2)
MBAC 411L: Negotiations Lab (1)
MBAC 412: Management and Career Skills I (1)
MBAC 413L: Human Value in Organizations (1)
MBAC 413: Human Value in Organizations (1)
MBAC 413L: Negotiations Lab (1)
MBAC 414: Statistics and Decision Models (1)
MBAC 415: Financial Reporting and Control (1)
MBAC 416: Financial Management (1)
MBAC 421: Strategic Issues and Applications II (1)
MBAC 422: Management and Career Skills II (2)
MBAC 423: Information Design and Management (1)
MBAC 424: Marketing (3)
MBAC 425: Operations Management (3)
MBAC 426: Economics (3)
MBAC 440: Leadership Assessment and Development II (1)

47-hour curriculum Core Courses: 17 hours –

Because of the integrative nature of the full-time core, no courses may be waived, regardless of undergraduate equivalent courses.

MBAC 410: Leadership Assessment and Development I (2)
MBAC 410L: Team Skills Lab (1)
MBAC 411: Strategic Issues and Applications I (2)
MBAC 411L: Negotiations Lab (1)
MBAC 412: Management and Career Skills I (1)
MBAC 413L: Human Value in Organizations (1)
MBAC 413: Human Value in Organizations (1)
MBAC 413L: Negotiations Lab (1)
MBAC 414: Statistics and Decision Models (1)
MBAC 415: Financial Reporting and Control (1)
MBAC 416: Financial Management (1)
MBAC 421: Strategic Issues and Applications II (1)
MBAC 422: Management and Career Skills II (2)
MBAC 423: Information Design and Management (1)
MBAC 424: Marketing (1)
MBAC 425: Operations Management (1)
MBAC 426: Economics (1)
MBAC 440: Leadership Assessment and Development II (1)

**Thematic Electives: 6 hours**

Students choose from a group of 30 courses that approach management decision making from a broad, non-functional perspective, selecting no more than one course from the following themes:

- the Global Manager
- Technology Issues and the Manager
- Leadership and Ethics in Management
- the Manager and Society

**Advanced Electives: 24 credits**

There are no requirements to achieve a concentration to complete degree requirements, however, some students may wish to pursue one (or more) of the concentrations below.

Note that a maximum of 12 hours of Accounting (ACCT) elective credit (beyond ACCT 401) can be counted toward degree requirements, although all course work necessary to meet Certified Public Accountant (CPA) examination requirements is offered through the Weatherhead School.
Concentrations will be designated on the academic transcript at the time of graduation. Courses can not be double-counted for more than one concentration.

Functional Concentrations
Concentrations in the functional areas below are defined as a minimum of nine bours of electives completed under a single course area designation (i.e., BAFI, MKMR, etc.).

- FAC Financial Analysis and Control
- BAFI Banking and Finance
- ECON Economics
- HSMG Health Systems Management
- LIHRP Labor and Human Resource Policy
- MIDS Management Information Systems
- MAND Nonprofit Management
- PLCY Management Policy
- OPMT Operations Management
- ORBH Organizational Behavior

International Management Concentration
Completion of three (nine bours) of the following courses meets the requirement for a concentration in International Management:

- ACCT 416 International Accounting for Management
- BAFI 480 International Financial Management
- ECON 472 The World’s Regions and Strategic Advantage
- ECON 473 International Economics for Management
- ECON 474 International Trade
- ECON 475 International Finance
- ECON 476 Fundamentals of International Business
- LIHRP 435 Human International Resource Management
- MGMT 460 Managing in a Global Economy

The existence of the above concentrations is not intended to discourage students from pursuing elective course work that would represent a particular area of applied study, such as management control or financial reporting. Faculty advisors in the appropriate departments will be available to develop individual elective sequences as well as counsel students regarding all elective course work. Other course sequences may be organized as specialization (i.e., construction management, nonprofit management, etc.) but will not appear as a concentration on the transcript.

Entrepreneurship Concentration
Completion of three (nine credits) of the following courses meets the requirement for a concentration in entrepreneurship.

Required course(s):
- ENTP 429 New Venture Creation or
- ENTP 427 Entrepreneurial Behavior and ENTP 440 -Entrepreneurial Finance

Operations Research Concentration
Completion of three (nine credits) of the following courses meet the requirement for a concentration in Operations Research.

- OPRE 411A&B Linear Programming and Deterministic Models
- OPRE 413 Business Applications of Decision Models
- OPRE 419 Game and Decision Theory
- OPRE 425A&B Probability
- OPRE 428A&B Statistics; Regression and Experimental Design
- OPRE 435C Data Structures
- OPRE 432A&B Simulation Models and Design
- OPRE 435A&B Computer Programming and Integrated Problem Solving

Supply Chain Management Concentration
Completion of nine credits among the following courses meet the requirement for a concentration in Supply Chain Management.

Students with a strong interest in Operations should select the following path:

MKMR/OPMT 407 Supply Chain Management
OPMT 477 Enterprise Resource Planning and one of the following courses:

OPMT/MKMR 475 Logistics/Physical Distribution Management
or OPMT/MKMR 476 Purchasing/Materials Management
Students with a strong interest in Marketing should select the following path:

MKMR/OPMT 407 Supply Chain Management
and two courses from the following list:
MKMR/OPMT 475 Logistics/Physical Distribution Management
MKMR/OPM 476 Purchasing/Materials Management
MKMR 421 Product and Brand Management

**e-Business Concentration**
Completion of the required course and two additional courses (for a total of 9 credits) meet the requirement for a concentration in e-Business.

**Required courses:**
MIDS 445 The Technology of e-Business
or
MIDS 446 Managing E-Business Technologies
or
PLIC Y 473 E-Commerce Strategies

**Remaining courses (total of 6 credits):**
ECON 436: Economics of Organizations
ECON 462: E-Commerce and the New Economy
MKMR 407: Supply Chain Management
MKMR 412: e-Marketing
MKMR 450B: Entrepreneurial Marketing
MIDS 411: Advances in Information Systems Technology
MIDS 415: Multimedia Systems
MIDS 433: Managing Electronic Teams in a Global Economy
MIDS 458: Managing Corporate Knowledge
MIDS 470: Analyzing Mobility and Mobile
MIDS 485: Web Systems Integration
OPMT 422: Service Operations Management with e-Commerce
OPMT 477: Enterprise Resource Planning
PLIC Y 429: New Venture Creation
PLIC Y 440: Entrepreneurial Finance
PLIC Y 441: Technology-Based Entrepreneurship

**Independent Study**
M.B.A. students are limited to six hours of elective credit as independent study. Any hours greater than six will be subject to petition and approval by the Associate Dean for Graduate Programs. Other courses at the University may be eligible for M.B.A. elective credit. Contact the registrar for additional information.

**Non-Credit Supplemental Instruction in Computer Familiarization.**
The Weatherhead School offers noncredit supplemental instruction to M.B.A. students in computer familiarization.

**Statistics Preparation Workshop**
All admitted students in the 63-hour curriculum must demonstrate proficiency in quantitative skills in order to enroll in the M.B.A. program. They can satisfy this requirement by having completed a college-level statistics course. Students who have not completed a statistics course must take the Statistics Preparation Workshop, offered one week before the start of the first semester.

**Evening M.B.A. Program**
The Evening M.B.A. program is designed for qualified students who wish to pursue their graduate management education by taking evening courses. The majority of these students work full-time for organizations in the Cleveland area. The same full-time faculty teach both evening and daytime classes. The full-time and evening programs have the same admission standards, and both are accredited by the AACSB.

Evening instruction is available as a 51-hour program for candidates with diverse academic backgrounds, and as a 42-hour program for students with undergraduate business degrees from U.S. Residency Requirement. With one or two “overload” semesters, the 51-credit hour program can be completed in three years, and the 42-hour program can be completed in two years.

**Evening 51-hour Curriculum Core Courses: 33 hours**
Students who have completed undergraduate equivalent course work may substitute
MGMT 403: Leadership Assessment and Development
MGMT 499: Strategic Issues and Applications (3)
MGMT 418: Management and Career Skills (3)*
MGMT 413: Human Value in Organizations (3)
QUMM 414: Statistics and Decision Models (3)
ACCT 401: Financial Reporting and Control (3)
BAFI 402: Financial Management (3)
MIDS 409: Information Design and Management (3)
MKMR 403: Marketing (3)
OPMT 405: Operations Management (3)
MIDS 409: Information Design and Management (3)
ECON 403: Economics (3)

**Evening 42-hour Curriculum Core Courses: 24 hours**
Students with undergraduate business degrees may waive or replace four or more courses from the list below as long as their total core curriculum totals no less than 24 hours.
MGMT 403: Leadership Assessment and Development
MGMT 499: Strategic Issues and Applications (3)
MGMT 413, Human Value in Organizations (3)
MGMT 418, Management and Career Skills (3)
QUMM 414, Statistics and Decision Models (3)
ACCT 401, Financial Reporting and Control (3)
BAFI 402, Financial Management (3)
MIDS 409, Information Design and Management (3)
MKMR 403, Marketing (3)
OPMT 405, Operations Management (3)
ECON 403, Economics (3)

**Evening Thematic Elective: 3 hours**
Students choose one course from a group of 30 courses that approach management decision making from a broad, non-functional perspective, selecting no more than one course from the following themes:
- The Global Manager
- Technology Issues and the Manager
- Leadership and Ethics in Management
- The Manager and Society

**Evening Advanced Electives: 15 hours**
There are no requirements to achieve a concentration to complete degree requirements. For more information about choosing a concentration please refer to the section describing concentrations in the full-time program description.

**Executive Master of Business Administration**
The Executive Master of Business Administration (E.M.B.A.) program, a two-year, five-semester program, is specifically designed to prepare experienced managers with the knowledge, skills and perspective required for expanded general manager and executive responsibility. An applicant to the program must have 10 years of experience, 5 of those in a management capacity, company endorsement, and an in-person interview. The program is conducted every week in all-day sessions on alternating Fridays and Saturdays, plus three, 3-4 day off-site residencies and the 10-
day international study tour. For more information call Christine Miller, Assistant Director at 216-368-5149.

Executive Doctor of Management
The Executive Doctor of Management (E.D.M.) Program is an interdisciplinary, doctoral degree program designed specifically for experienced, and practicing executives. The E.D.M. program focuses on the broad economic, political, social, and technological forces shaping contemporary institutions including business. Qualifications for the E.D.M. Program include a master’s degree, at least 15 years of experience, including a minimum of 10 years in management positions, and a personal commitment to seeking a broader and deeper understanding of the global context of management today. For further details, a program brochure and information on applying to the E.D.M. Program contact Sue Nartker, Managing Director, at 216-368-2042.

Master of Accountancy
The Master of Accountancy is an integrative program, which builds directly upon the student’s undergraduate education. Entering students must have an undergraduate degree in accountancy from an accredited U.S. program, or the equivalent. Students who do not have an accountancy degree may still be admitted, but will need to take courses to provide an appropriate foundation in business and accountancy. The program is normally 36 semester hours for those who have an undergraduate accountancy degree. Entering students without an accountancy degree will usually require an extended period of study in the program to meet prerequisites in the following areas:

- General Business. Business law, corporate finance, marketing, micro and macro economics, organizational behavior, operations management and statistics
- Accountancy. Principles, intermediate financial accounting, advanced financial accounting, managerial accountancy, U.S. taxation and auditing

The program is primarily designed for students interested in full-time study. Part-time students are also admitted, contingent upon their commitment to complete the program on a timely basis. Students may be admitted for study at the beginning of the Fall, Spring or Summer terms, but it is generally advantageous to begin study in the Fall term. Some scholarships are available to exceptional applicants for the full-time program.

Undergraduate accountancy students at Case Western Reserve University are strongly advised to enter and complete the Master of Accountancy program in their fifth year. University policies permit such students an opportunity to complete the Master of Accountancy in 30 hours, rather than 36, if course selection is properly planned. Certain highly qualified Case Western Reserve University students in Accountancy may be eligible to accelerate their completion of the B.S. in Accountancy and the Master of Accountancy through the integrated studies program. This program allows such students to enroll as both an undergraduate and a graduate student during the senior year. Because of the necessity for proper planning of course work and programs, undergraduate students are strongly encouraged to apply for the Master of Accountancy in the junior year.

A typical 36-hour course of study for a student with an undergraduate accountancy background:

Accountancy Core (6 hours)
ACCT 520 Advanced Financial Accountancy Theory (3)
ACCT 540 Analysis of Contemporary Accountancy Issues (3)

Accountancy Electives (12 hours)
Students may choose any 12 hours from any graduate accountancy courses (excluding basic courses in the MBA core). A concentration is not required, but students may develop a concentration in taxation, reporting and assurance services, or managerial accounting.

Supporting Electives (18 hours)
The electives allow students to develop a background in areas that complement and support careers in professional accountancy. Concentrations are not required, but students may choose concentrations in certain areas such as corporate finance, human resources, information systems, policy formulation, operations management, international management and other areas. No more than 3 hours of accountancy course work may be taken as a supporting elective. Courses must be taken in at least two areas (not including accountancy). These electives may not include basic courses in the MBA core. Courses will be selected in consultation with the graduate program advisor.

Contact Professor Larry M. Parker, Director of the Master of Accountancy Program, for further information. (216) 368-2065; LMP3@PO.CWRU.EDU

Master of Science in Management in Operations Research (M.S.M.-OR)
Operations research (or management science) uses mathematics, statistics and computers to help managers make decisions regarding complex organizational problems. These types of problems arise in manufacturing and service companies as well as many other kinds of organizations. Decision problems may be solved by developing mathematical models of the problem, using a computer to obtain a solution, then validating that the solution can be implemented and performs as predicted by the model.

Purpose of the M.S.M.-OR
The 36-credit-hour M.S.M.-OR Program trains students in the techniques and applications of operations research and provides them with a basic understanding of business fundamentals in order to contribute value to organizations and communicate effectively with managers.

M.S.M.-OR Curriculum
Requirements for the M.S.M.-OR degree are typically completed in 18 months of full-time study, or in one calendar year by taking 6 credit hours in the Summer semester and 15 credit hours in both the Fall and Spring semesters. The program is also available part-time. Contact the Department of Operations for more detailed information (216-368-3845) or e-mail at msm-oper@po.cwru.edu.

The M.S.M.-OR curriculum comprises three components: the Business Core, the Operations Research Core, and a Specialty Track.

Business Core (6 credit hours total):
The Business Core provides students with an introduction to the major principles and concepts of business operations. Subject areas addressed in the Business Core could include Accounting, Economics, Finance, Information Systems, Marketing and Operations. The specific set of courses selected depends on the specialty track chosen.

Operations Research Core (18 credit hours total):
The Operations Research Core provides a solid grounding in the techniques of management science. Course requirements include:

Prerequisite Mathematics Courses (if needed)
Required Courses (1.5 credit hours each):
- Linear Programming
- Deterministic Models with Applications
- Stochastic Models with Applications

...
Probability Applications  
Probability II  
Statistics  
Regression and Experimental Design  
Simulation Design  
Simulation Models with Applications  
Integrated Problem Solving  
Computer Programming  
Data Structures  

Specialty Track (12 credit hours total):  
To obtain an in-depth, marketable set of skills in one area of concentration, students take a coherent sequence of courses in one of four tracks. Representative courses include the following:  

Operations Research  

Operations Management  

Finance  

Information Systems  

Master of Science in Management in Supply Chain (M.S.M.-SC)  
Supply chain management deals with the coordination of all activities that impact a product flowing from its sources of raw materials to customers for the purpose of creating time, place, and from values in the end product. The product may be a physical good, a service, an idea, information or other entity that flows through a defined pipeline or channel.  

Purpose of the M.S.M.-SC  
The 36-credit-hour M.S.M.-SC Program trains students at the masters’ level in supply chain methods and concepts, business fundamentals, and quantitative techniques in order to be effective analysts in manufacturing and service companies.  

M.S.M.-SC Curriculum  
Requirements for the M.S.M.-SC degree may be completed in one calendar year by taking 6 credit hours in the Summer semester and 15 credit hours in both the Fall and Spring semesters. Students wishing to complete the program in 18 months or less must begin the program in the Summer semester. The program is also available part-time. Contact the Department of Operations for more detailed information (216-368-3845) or e-mail at msm-oper@po.cwru.edu. Visit the Department website at http://weatherhead.cwru.edu/orom.  
The M.S.M.-SC curriculum comprises three components: the Business Core, the Supply Chain Core, and Specialty Electives.  

Business Core (6 credit hours total):  
The Business Core provides students with an introduction to the major principles and concepts of business operations. Subject areas addressed in the Business Core could include Accounting, Economics, Finance, Information Systems, Marketing and Operations.  

Supply Chain Core (24 credit hours total):  
The Supply Chain Core provides coverage of the techniques of Management Science as well as the fundamentals of Supply Chain Management. Course requirements include:  

Prerequisite Mathematics Courses (if needed)  
Required Courses  
Quantitative (1.5 credit hours each):  
Linear Programming  
Deterministic Models with Applications  
Statistics  
Regression and Experimental Design  
Simulation Models with Applications  
Simulations Design  
Integrated Problem Solving  
Managerial (3 credit hours each):  
Supply Chain Management  
Logistics/Physical Distribution Management  
Purchasing/Materials Management  
Enterprise Resource Planning  

Specialty Elective (6 credit hours total):  
With the recommendation of their program advisor, M.S.M.-SC students select courses from Operations Research and/or Operations Management appropriate to their career goals.  

Master of Nonprofit Organizations (M.N.O.)  
(Weatherhead School of Management and Mandel School of Applied Social Sciences)  
The M.N.O. is an advanced professional degree offered through the Mandel Center for Nonprofit Organizations, a University-wide center for education, research and community service. The Mandel Center is a partnership of the Mandel School of Applied Social Sciences, the Weatherhead School of Management, the School of Law, and the College of Arts and Sciences.  
The M.N.O. degree is a 60-credit-hour program, including 33 hours of required course work, 12 hours from a menu of 10 “choice” courses, and an additional 15 hours of elective courses. Electives may be selected from either the “choice” courses or from an array of relevant courses offered by the University’s professional schools and the College of Arts and Sciences. One course (MAND 425) requires four, all-day sessions of intensive study in January. Students may pursue the M.N.O. on a full- or part-time basis.  
The Mandel Center also offers a 45-credit-hour Executive M.N.O. degree program option for candidates with demonstrably high potential as nonprofit leaders. Applicants to this program option should have ten years of professional and/or volunteer experience, five years of managerial and/or supervisory experience, and excellent academic qualifications. The foundation for this option is the curriculum of the 60-hour M.N.O. degree with an emphasis on the 33-credit “core” of the degree plus 12 credits of “choice” courses. For further information, contact the Mandel Center’s Director of Recruitment and Admissions, Rebecca W. Zirm, J.D. at (216) 368-6025.  

Admission Requirements  
For additional information concerning the M.N.O. Program (including scholarship information), contact the Director of Recruitment and Admissions at (216) 368-6025, by e-mail at
Students may be admitted through the Weatherhead School of Management on a space-available basis. Contact the Weatherhead School Admissions Officer at (216) 368-2030 for an application and additional information.

**Joint Degree Programs**

**J.D./M.B.A. Joint Degree Program**

The Weatherhead School of Management at Case Western Reserve University has a formal full-time joint degree program with the School of Law. Students enrolled in the program who fulfill the requirements set for graduation by both schools will receive both a J.D. and an M.B.A. degree.

**Purpose**

For those who wish to specialize in the governmental aspects of management, the M.B.A. and J.D. degree programs complement each other. J.D./M.B.A. graduates from Case Western Reserve have worked in the areas of labor law, tax law, health law, legal aspects of systems management, etc., for law firms, corporations and government agencies. J.D./M.B.A.s often join entrepreneurial firms that are in special need of business and legal advice during the period of rapid organizational growth.

**Program Structure**

The Weatherhead School of Management offers two curriculum options for M.B.A. students: the accelerated, 11-month M.B.A. Program (for students with undergraduate business degrees); and the traditional, two-year M.B.A. program (for students with all other undergraduate degrees).

Students enrolled in the traditional M.B.A. Program may complete the three-year J.D. program and the two-year M.B.A. program in four academic years (including a 9-credit overload which can be taken during the academic year or during the summer semester). Students in the accelerated M.B.A. Program may complete the J.D./M.B.A. Program in 3 years, plus one semester. Joint degree candidates may start the J.D./M.B.A. program at either school.

The School of Law allows joint degree students to use 12 credit hours from the M.B.A. to fulfill both J.D. and M.B.A. requirements. The Weatherhead School allows joint degree students to use 12 credit hours from the School of Law to fulfill both M.B.A. and J.D. requirements. Students must achieve a grade of C or better to receive double-credit for the courses. This reduces the total number of hours required for the two degrees by 24 credit hours (if the residence requirement for each school is met).

Students in the joint program are encouraged, but not required, to make use of the summer programs of the two schools in planning their joint programs. (They may also opt for enrolling in additional courses during the fall or spring semesters.). The School of Law is a full-time day school with no evening division. Therefore, J.D./M.B.A. students may enroll only on a full-time basis, except during summer sessions.

Joint degree students must receive both the J.D. and the M.B.A. degrees simultaneously upon completion of degree requirements at both schools in order to receive the 21 hours of cross-credits described above.

**Admission to the J.D./M.B.A. Program**

J.D./M.B.A. applicants must meet all of the admission requirements of both schools, including taking both the LSAT and the GMAT and completing separate applications to both schools (indicating in the section on both applications that they are applying for the J.D./M.B.A.) and paying both application fees. Students may defer the decision to apply to the J.D./M.B.A. program until after enrolling in either the M.B.A. or J.D. program provided that the application to the second school is received.
before the beginning of the third semester in either program. Normally, students are expected to take one full year of study in one program followed by one full year of study in the other. During the third and fourth years of the J.D./M.B.A., students combine courses in both schools each semester. Best J.D. contact for joint degree candidates: Andrew Morriss—368-3302. Best M.B.A. contact for joint degree candidates: Linda Gaston—368-2031.

Registration
Throughout the joint degree program, J.D./M.B.A. students continue to register in the first school they attended. After completion of both degree programs, two separate transcripts and diplomas are awarded. Course work for both programs must be completed within six years of the date of initial enrollment in either program.

**M.D./M.B.A. Joint Degree Program**

The M.D./M.B.A. degree was developed to respond to the growing need in the medical and health care community for doctors who have management skills and knowledge.

**Program Structure**

In the M.D./M.B.A. Program, students may double count elective courses from the M.D. and reduce hours from the M.B.A., which shorten their M.B.A. degree by 10 credit hours. Students can complete the four-year M.D. degree and two-year M.B.A. degree in five years (including taking a course overload for four semesters).

**Admission to the M.D./M.B.A. Program**

M.D./M.B.A. applicants must meet all of the admission requirements of both schools, including taking both the MCAT and the GMAT and completing separate applications to both schools (indicating in the section on both applications that they are applying for the M.D./M.B.A.) and paying both application fees. Students may defer the decision to apply to the M.D./M.B.A. program until after enrolling in either the M.B.A. or M.D. program providing that the application to the second school is received before the beginning of the third semester in either program.

**Registration**

M.D./M.B.A. students register at the medical school for all years except for the year (Year 1 or Year 3) and any summer session in which they take only M.B.A. courses. During these periods, M.D./M.B.A. students register and pay tuition at the WSOM. Joint degree students must receive both the M.D. and the M.B.A. degrees simultaneously upon completion of degree requirements at both schools in order to receive the 12 hours of cross-credits described above.

If the M.D. is registering through the Medical School, WSOM will not charge for the seminars during which the students are taking one-two additional M.B.A. courses as an overload. During the summer—and when the student is taking a full-time course load at school—the student will register and pay tuition to WSOM.

**Structure of the M.B.A. Curriculum in the M.D./M.B.A. Program**

**Core Curriculum (33 credits)**

- Financial Reporting and Control
- Financial Management
- Health Care Economics*
- Health Care Marketing*
- Operations Management for Service Orgs.*
- Systems Design and Management
- Statistics and Decision Modeling
- Human Value in Organizations
- Strategic Issues and Applications
- Management Assessment and Development
- Career Management Skills
- Strategic Issues in Health Care Management
- Management of Health Care Provider Organizations
- Health Care Information Systems
- Health Care Finance
- Health Care Executive Seminars

Because of electives completed at the School of Medicine, M.D./M.B.A. students may reduce their elective requirements in the M.B.A. program.

- M.D./M.B.A. students wishing to organize a different course of study must contact Fran Cort, Assistant Dean for Professional and International Programs (216-368-3315; fxc@po.cwru.edu).
- Students who wish to pursue the M.D. and M.B.A. degrees as a joint degree program may consider three options for integrating the two programs, depending on the time at which they plan to begin the M.B.A. portion of the joint degree. Medical school students may choose between two plans to begin the joint degree program:

**Plan A: (54 credit M.B.A.)**

**Year 1 At Weatherhead**

- Fall Semester: (17 credits)
  - Strategic Issues and Applications
  - Management Assessment and Development
  - Career Management Skills
  - Financial Reporting and Control
  - Introduction to Financial Management
  - Statistics and Decision Models
  - Human Value in Organizations

- Spring Semester: (15 credits)
  - Health Care Marketing*
  - Health Care Economics*
  - Operations Management for Service Organizations*
  - Systems Design and Management
  - Strategic Issues and Applications

**Summer Semester (6 credits)**

- Summer Institute in Europe or
- Two electives

**Year 2 at Medical School**

- Standard Medical School Curriculum
- plus

**Fall Semester (3 credits)**

- Health Systems Finance*

**Spring Semester (4 credits)**

- Strategic Issues in Health Care*

**Year 3 at Medical School**

- Standard Medical School Curriculum plus

**Fall Semester (6 credits)**

- Health Law*
- Elective
Admission Requirements

Candidates must apply separately to the M.S.S.A. program at the Mandel School of Applied Social Sciences and the M.B.A. program at the Weatherhead School of Management, and complete all application requirements of both schools, indicating on both applications their intent to join the joint degree program. Admission decisions are made independently by each school. After admission, each school will copy the other school on the admission decision. Candidates to the joint program will be expected to meet admission standards for academic records, test scores, and other criteria set by both schools. In addition, candidates must have completed a minimum of two years of full-time experience in a social service organization.

Program Structure

M.S.S.A./M.B.A. students may begin the joint degree in either school. Students will continue to register in the school at which they began the program, regardless of the school they are attending. When students have completed all degree requirements for both degrees, they will receive separate transcripts and diplomas for each degree.

Students in the joint M.B.A./M.S.S.A. degree program may begin their program at either MSASS or WSOM. Students who prefer to be considered for an internship between the first and second years of the program may prefer to begin the curriculum at WSOM.

Part-time Program Structure

Although the following curriculum structure has been designed for the traditional full-time programs at both schools, it can be adjusted for students who wish to complete the M.S.S.A./M.B.A. at a part-time pace.

Credit Requirements

There are 105 credits in the joint M.S.S.A./M.B.A. Program (51 credits at MSASS, 54 credits at WSOM), compared with 125 credits if both degrees were completed separately. By integrating the course work, completing some course work over the summer, and reducing the elective requirements in each program, joint degree students may complete the M.S.S.A./M.B.A. in three years, instead of the four years required if both degrees were to be completed separately. Students will be charged the MSASS tuition rate for all M.S.S.A. course work and the WSOM tuition rate for all M.B.A. course work.

Joint M.B.A./M.S.M.-OR Degree Program and Joint M.B.A./M.S.M.-SC Degree Program

Contact the Operations Department at (216) 368-3845 or msm-oper@cwru.po.edu, for detailed information about the M.S.M. degrees offered through the Department of Operations (Operations Research and Supply Chain), or visit the Department website at http://weatherhead.cwru.edu/orom.

Degree Requirements

Students may pursue the M.S.M.-OR/M.B.A. or M.S.M.-SC/MBA on a full-time or part-time basis. Students planning to attend part-time should confer with an advisor to determine the appropriate sequence of courses in the program. Full-time and part-time students who already have begun the M.S.M. or M.B.A. program must complete their application to the joint degree program no later than upon completion of 18 credit hours in the M.S.M. program or 30 credit hours in the M.B.A. program (12 credit hours in the accelerated M.B.A. program).
Students in the joint degree program will receive both degrees simultaneously, regardless of whether course work for one of the degrees has been completed. Course work for both programs must be completed within six years of the date of initial enrollment in either program. Students in the joint degree program will be granted an automatic one-year extension to the five-year deadline for completion of the M.S.M. degree.

Retention Requirements

GPAs of students in the joint degree program will be calculated separately to determine compliance with retention requirements in each program. Students may have up to six additional credit hours beyond the minimum to meet degree requirements to improve their cumulative GPA in order to attain the graduation GPA requirement for the appropriate program.

Students must also comply with the 36-credit-hour residency requirement of the M.B.A. program and the 36-credit-hour requirement for the M.S.M. OR/SC.

M.B.A./M.S.M. Program Structure

Contact Fran Cort, Assistant Dean for Professional and International Programs to discuss curriculum options (phone: 216-368-3315, e-mail: fxc@po.cwru.edu).

The Joint M.B.A./M.I.M. Degree

Program Description

The Weatherhead School of Management and the American Graduate School of International Management—better known as the Thunderbird School—in Glendale, Arizona, jointly offer a graduate level program in both management and international studies.

This combined degree program, the Master of Business Administration/Master of International Management, provides the strengths and career planning advantages of both schools for students who wish to build a career in international business by offering:

- a unique management skills assessment and development process and strong functional concentrations in finance, marketing, MIS, operations, human resource management, entrepreneurship and health care management available through the M.B.A. program at the Weatherhead School
- foreign language fluency, with an emphasis on business communications, and a wide range of course offerings in international studies and world business through the M.I.M. program at Thunderbird
- access to all placement services and alumni networks at both schools, both during enrollment in the joint degree program and as a graduate of the joint degree program

Program Structure

Because of the interdisciplinary advantages achieved when taking both degrees simultaneously, students in the M.B.A./M.I.M. joint degree program are able to accelerate and streamline course work in both schools. As a result, most students can complete the joint program in 78 hours (2 years, including summers), as compared to the 102 hours (3 years) required to complete the two programs separately. Students with undergraduate degrees in business may be able to complete the joint program in 66 hours, or 21 months. * In order to progress through the joint degree program at the most efficient pace, students should plan to first enroll at the Weatherhead School and complete the program at the Thunderbird School.

Both degrees must be awarded simultaneously at the completion of all joint degree requirements.

The following is a typical curriculum structure for the 78-hour M.B.A./M.I.M. program for a student whose undergraduate degree is not in business administration.

The 78-Hour Curriculum for Non-Business Undergraduate Degree Holders

At Weatherhead (52 hours)

Fall Semester I (17 credits)
- Business Core (17 cr.)

Spring Semester I (18 credits)
- Business Core (15 cr.)
- Open elective (3 credits)

Fall Semester II (17 credits)
- Thematic elective (non-global) (3 credits)
- Open electives (12 cr.)
- Exit assessment (1 credit)
- Executive dialogues (1 credit)

The Weatherhead School will accept credit for one perspectives course (3 cr.) and three electives (9 cr.) from Thunderbird course work.

At Thunderbird (30 hours)

Winter Session I (3 weeks/3 credits)
- Foreign language or International Studies (3 cr.)

Summer Semester II (12 credits)
- World Business (6 cr.)
- International Studies (6 cr.)

Spring Semester II (15 credits)
- World Business (9 cr.)
- International Studies (6 cr.)

Part-time Enrollment Option

Both schools offer part-time enrollment options. Students who wish to pursue the joint degree program on a part-time basis should speak with curriculum advisors at each school before applying to either school.

Application/Admissions Process

Prospective students who are interested in applying to the joint M.B.A./M.I.M. program offered by the Weatherhead School and the Thunderbird School should apply separately to each school. (Applicants to the Weatherhead School should indicate their interest in the M.B.A./M.I.M. in the appropriate area under “Intended Program” at the top of the first page of the Weatherhead M.B.A. application.) Separate transcripts, GMAT and TOEFL scores, recommendations, essays and other materials required to complete application at each school must be sent individually to each school.

The admissions committees of each institution will maintain independent control over its admissions criteria and procedures. Students must be admitted separately to each of the programs. Admission to one school has no bearing upon admission to the other.

Students who have already been enrolled in the M.B.A. or M.I.M. program before pursuing their interest in the joint M.B.A./M.I.M. degree will be permitted to apply to the joint degree program provided they have completed no more than 27 hours in either program.

Students applying to the joint degree program are also eligible to apply for scholarships, fellowships and loan programs at both schools. Please refer to the application catalog of each school for information regarding tuition, financial aid, etc.

For other information about the joint degree program please contact:
M.S.N./M.B.A. Degree Program

The Master of Science in Nursing/Master of Business Administration (M.S.N./M.B.A.) joint degree is designed to provide nurses with the managerial and organizational skills needed to manage patient care environments or health programs and, at executive levels, to participate fully in the strategic and operational leadership of hospitals, other health care agencies or corporations. Graduates will have developed the critical and creative thinking skills needed to function fully in a variety of management contexts.

M.S.N./M.B.A. students will participate in a condensed version of both individual degree programs. The core curricula from each school remain intact, but the two degrees can be completed jointly in 75% of the time needed to complete each individually. Candidates entering the program must bring with them a strong clinical background, possess current assessment skills, and have at least two years of clinical nursing experience.

Program Description

There are two tracks available to an M.S.N./M.B.A. student: 1) a management track; and 2) a clinical specialty track. At least nine hours of practice in either specialty are included. The managerial practicum will be coordinated with community health care organizations and industries; the clinical specialty with a local hospital.

The 72-hour course of study is designed to integrate nursing and management courses by having students take both concurrently throughout the program. For those who select the management track, a nine-hour practicum must be taken in one semester. For those who select a clinical specialty track, the practicum will be arranged according to the varying specialty requirements.

The following course sequence represents a suggested order in which courses may be taken. With the exception of the statistical courses (QUHM 403 and QUHM 405) and the three nursing inquiry courses, which must be taken in sequence, there are few prerequisites for the other courses. This enables the program to be very flexible and allows the students to establish their own schedule according to their specific needs.

The M.S.N. curriculum component consists of scientific inquiry (9-11 hours), professional development (6 hours), clinical specialty (9 hours) and career options (3 hours), for a total of 27 credit hours. The M.B.A. curriculum component consists of management assessment (3 hours), perspectives (3 hours), M.B.A. core (33 hours) and electives (6 hours), for a total of 45 credit hours.

Admissions

M.S.N./M.B.A. students must be admitted to both the Frances Payne Bolton School of Nursing and the Weatherhead School of Management. Applicants should write to the admissions offices of both schools for application materials and indicate that they are applying to the M.S.N./M.B.A. program. Separate application fees are charged by each school. For additional M.S.N. admissions information, contact:

Office of Admissions
Frances Payne Bolton School of Nursing
Case Western Reserve University
2121 Abington Road
Cleveland, Ohio 44106-4904

The Commonwealth Fund Nurse Executive Fellowship Program

The Commonwealth Fund granted funds to develop this M.S.N./M.B.A. joint degree program and has continued its support by offering a $15,000 one-time grant to full-time candidates enrolled in this program. For further information, contact the School of Nursing.

Academic Information

All M.S.N./M.B.A. students register through the Weatherhead School of Management. Degrees are awarded simultaneously upon completion of requirements for both.

M.S.N./M.B.A. Program structure

Contact Fran Cort, Assistant Dean for Professional and International Programs for full-time and part-time options (phone 216-368-3315; e-mail: fxc@po.cwru.edu).

The Master of Business Administration/Certificate in Nonprofit Management Dual Program (M.B.A./CNM)

M.B.A. students with a career focus in the management of nonprofit organizations may obtain a Certificate in Nonprofit Management (CNM) by completing an M.B.A. specialization in nonprofit management (nine credit hours) plus six credit hours of nonprofit management course work above their M.B.A. requirements. By enrolling in one additional course during each of the last two semesters of the M.B.A. program, full-time students may complete the M.B.A. and the CNM without extending their course of study or incurring additional tuition fees.

Credit Requirements for the M.B.A./CNM

Students in the dual program must fulfill 15 credits toward the CNM certificate and 65 or 47 hours (traditional or accelerated full-time curriculum) toward the M.B.A. degree. These students may double count nine credit hours of Mandel Center courses that have been approved for credit in both programs.

Courses in the CNM/M.N.O. curriculum currently approved for M.B.A. and CNM credit

There is one required course for the M.B.A./CNM, Introduction to the Nonprofit Sector. The most appropriate sequence of study would generally include Law of Nonprofit Organizations as well. In addition, students choose three courses selected from among the following:

- Business and Nonprofit Entrepreneurship
- Community Organization and Development Strategies
- Decision Making for Nonprofit Leaders
- Earned Income for Nonprofit Organizations
- Ethics and Professionalism for Nonprofit Leaders
- Government Funding for Nonprofit Organizations
- International Non-Governmental Organizations
- Leadership for Nonprofit Organizations
- Leading and Managing Nonprofit Arts and Cultural Organizations
• Management of Community-Based Development
• Managing Human Resources in Nonprofit Organizations
• Nonprofit Organization and Management
• Nonprofit Public Policy and Advocacy
• Organizational Assessment and Program Evaluation in Nonprofit Organizations
• Philanthropic Fundraising for Nonprofit Organizations
• Strategic Planning for Nonprofit Organizations: Practicum I
• Strategic Planning for Nonprofit Organizations: Practicum II
• Trusteeship: The Governance of Nonprofit Organizations

Students wishing to propose any modification in the recommended sequence of study on the basis of prior course work, past experience, or professional interest must present a request in writing, for consideration by the Weatherhead M.B.A./CNM faculty advisor.

Students pursuing the M.B.A./CNM are also expected to attend all meetings of the Mandel Center’s Nonprofit Leadership Dialogs series.

Admission/Enrollment Procedures in the dual M.B.A./CNM Program

Candidates must complete both applications and be admitted to each program separately. M.B.A. students must apply to the dual credential program by no later than the first of the year in the M.B.A. Program (or at the end of the first semester in the 42-hour M.B.A. curriculum). Candidates who have already completed the M.B.A. degree or the Certificate in Nonprofit Management may not apply for the dual M.B.A./CNM program.

M.S.S.A./CNM

The M.S.S.A./CNM combines the Master of Social Science Administration (M.S.S.A.) with the Certificate in Nonprofit Management. It provides excellent preparation for students who have a career focus in the management of economic and community development and nonprofit organizations.

The program consists of five courses that must include MAND 406. The remaining four courses are chosen in consultation with the M.S.S.A./CNM faculty advisor.

For more information, contact Rebecca W. Zirm, J.D., Director of Recruitment and Admissions, 216-368-6025 or by e-mail at admissions@mcno.cwru.edu.

J.D./CNM

The J.D./CNM combines the Doctor of Jurisprudence (J.D.) with the Certificate in Nonprofit Management. It provides preparation for students who desire to practice law as it relates to nonprofit organizations, serve as managers of nonprofit organizations, or work in the field of planned giving.

For more information, contact Rebecca W. Zirm, J.D., Director of Recruitment and Admissions, 216-368-6025 or by e-mail at admissions@mcno.cwru.edu.

Certificate Programs

Professional Fellows Program

The Professional Fellows Program is an eight-month program for the executive or accomplished professional seeking an educational experience spent with peers who share a passion for discovery, learning and growth. Weatherhead faculty, industry experts and member of the Society of Professional Fellows serve as instructors and facilitators, while group members play an active role in shaping course curriculum. This collaborative approach creates a truly personalized learning environment where seminars are meaningful, discussions are lively and assignments are relevant.

Upon completion of the program, participants are inducted into the Professional Fellows Society, a group dedicated to lifelong learning. Participants also receive six credits of advance course work upon completion of the program. For more information call Christine Miller, Assistant Director at 216-368-5149.

Certificate in Health Systems Management

Admissions qualifications: Bachelor’s degree, professional experience in health care delivery system or graduate degree in the health sciences: Contact Fran Cort to apply (216-368-3315).

Suggested curriculum and sequence of courses: Fall Semester

(Pre-semester preparation as pre-requisites to Fall courses: selected readings in accounting and financial management)

HSMC 420: Health Finance and Economics (3 credits)
OPMT 420: Managing Quality in Organizations (3 credits)
HSMC 501: Health Care Executive Education - Student’s choice of three out of four Friday seminars in the Fall Series (partial fulfillment of 3 credits)

Spring Semester

(Pre-semester preparation: selected readings in the marketing concept and marketing dynamics; three-page application of the concepts in a health systems context)

HSMC 422: Health Systems Marketing (3 credits)
HSMC 456: Issues in Health Care Management (3 credits)
HSMC 501: Health Care Executive Education - (continued from Fall semester) Student’s choice of three out of four Friday seminars in the Spring Series, plus completion of paper covering an aspect of the management of health care systems (with HCEE Fall Series, 3 credits)

Alternately, courses may be taken at a slower pace, during a two-year sequence.

Please note: Students who have completed MIDS 409 or the equivalent may substitute MIDS 432, Health Care Information Systems, for HSMC 420, HSMC 422 or OPMT 420.

Tuition Payment

Tuition for each 3-credit course will be charged at the current rate for the semester in which the student registers.

Academic Policy

Courses in the HSM Certificate Program are documented on an academic transcript from Case Western Reserve University. A Certificate in Health Systems Management will be awarded after the student completes five courses with passing grades and completes a graduation application through the Professional Degree Programs Administrative Office. All HSM Certificate participants who matriculate into the M.B.A. Program within five years of completion of the Certificate may transfer the five courses toward completion of M.B.A. degree requirement.

Certificate in Nonprofit Management (CNM)

The Certificate Program in Nonprofit Management is designed for practicing managers and leaders in human service, fine and performing arts, cultural, educational, community development, religious and other nonprofit organizations who aspire to top-level executive positions.

CNM students must satisfactorily complete five approved courses (15 hours), including one required course, Introduction to the Nonprofit Sector. Admission criteria include satisfactory undergraduate work, the ability to master graduate-level course work, experience and familiarity with nonprofit organizations, and leadership potential for executive-level management.
Certificate in Operations

Program Objective and Requirements
The Department of Operations offers a graduate certificate consisting of 15 credit hours of coherent course work. Designed for practicing professionals who seek greater expertise, the Certificate in Operations program can be tailored to specific interests. Sample areas are the following: Supply Chair Management, Operations Research, and Quantitative Finance.

Illustrative programs of study consist of the following courses:

**Supply Chain Management**
- OPMT 405: Operations Management (3 credits)
- OPMT 407: Supply Chain Management (3 credits)
- OPMT 475: Logistics/Physical Distribution Management (3 credits)
- OPMT 477: Enterprise Resource Planning (3 credits)
- QUMM 414: Statistics & Decision Modeling (3 credits)

**Operations Research**
- OPRE 411A: Linear Programming (1.5 credits)
- OPRE 411B: Deterministic Models with Applications (1.5 credits)
- OPRE 425A: Probability and Applications (1.5 credits)
- OPRE 425B: Probability II (1.5 credits)
- OPRE 428A: Statistics (1.5 credits)
- OPRE 428B: Regression and Experimental Design (1.5 credits)
- OPRE 432A: Simulation Models with Applications (1.5 credits)
- OPRE 432B: Simulation Design (1.5 credits)
- OPRE 402: Stochastic Models (1.5 credits)
- OPRE 435C: Data Structures (1.5 credits)

Upon completion of all requirements below, the student should request the certificate through the Registration Staff in the Professional Degrees Program Administration Office.

1. Completion of 15 credit hours of the courses selected in collaboration with the Department’s Director of Graduate Programs.
2. Maintain a B (3.0) grade point average through all course work.

The program must be completed within six years.

Application Procedures
Requests for application materials should be sent to:
Sue Rischar
Department of Operations
Weatherhead School of Management
Case Western Reserve University
Cleveland, Ohio 44106-7235

Contact information: sjr14@po.cwru.edu or (216) 368-3845.

The following materials are required for admission to the program:
1. A completed application accompanied by a $50 nonrefundable application fee (waived for students previously enrolled at Weatherhead).
2. A bachelor’s degree (evidenced by a transcript sent directly to the Operations Department from the university in question).
3. An official transcript from each college or university attended.
4. At least one letter of reference.
5. A current resume.

Certificate in Public Policy

In a continuing effort to liberalize M.B.A. students’ perspectives on management issues, the faculty of the Weatherhead School has developed a Certificate in Public Policy, which may be completed within the time scope and tuition coverage of the full-time M.B.A. curriculum.

Requirements for the Certificate in Public Policy

- Students must take five courses (15 credits) which have been approved for the Certificate in Public Policy.
- Three of these courses (9 credits) may be double-counted for both M.B.A. degree credit and certificate credit. (To complete the additional six credits for the certificate, full-time M.B.A. students will need to take a one-course overload in their final two semesters.)
- MGMT 455: Public Policy Analysis is required to complete the certificate.
- The remaining courses for completion of the Certificate in Public Policy may be selected from the list below, or may be proposed by petition. This course list may be changed or expanded in the future.
- Students who are interested in completing the Public Policy Certificate on a part-time basis should be aware that they will be charged tuition for any additional credits for up to 12 credit hours per semester. Moreover, some courses listed below are offered only during the day, or in alternate years.

Courses Approved for Credit in the Public Policy Certificate Program

**Law School Courses**
- LAWS 227: Health Law (also listed as HSMC 227)
- LAWS 244: Poverty, Social Inequality and the Law
- LAWS 278: Regualatory Law and Policy
- LAWS 285: Social Science and the Law
- LAWS 292: Health Care Legislation
- LAWS 301: Administrative Law
- LAWS 309: Antitrust Law
- LAWS 331: Environmental Law
- LAWS 332: Civil Rights
- LAWS 363: Land Use Control
- LAWS 365: Legislation
- LAWS 374: State and Local Government
- LAWS 392: Media Law
- LAWS 512: Tax Policy Seminar
- LAWS 537: Health Care Controversies
- LAWS 563: Biomedical Research: Law and Policy

**Mandel School of Applied Social Sciences Courses**
- SPPP 470: Social Policy
- SPPP 502: Alcohol and Drug Abuse Policy and Service Delivery
- SPPP 510: Mental Health Policy and Service Delivery
- SPPP 511: Issues in Health Policy and Service Delivery
- SPPP 512: Legislative and Political Process
- SPPP 513: Aging Policy and Service Delivery
- SPPP 525: AIDS Seminar
- SPPP 529: Family, Child Policy and Service Delivery
- SASS 606: Theories of Social Welfare
- SASS 646: International Social Welfare
- SASS 695: Social Welfare and Planning Models

**Arts and Sciences Courses**
- ANTH 459: Introduction to International Health
- HSTY 477: U.S. Social Policy Since 1900
The Department of Organizational Behavior offers a 24-month master’s program for students who are employed full-time. The M.S.O.D.A. program combines academic and work experience in the theory and techniques of analysis and intervention for constructive change in organizations. Students combine intensive academic learning with program-related activity in the organizations in which they are employed. The program stresses the development of applied skills in support of planned change processes in organizations. Classes are held in modular format, approximately 3 days a month, in addition to four workshops distributed throughout the two-year program. The following is the general design:

**Year 1:**
- Opening Off-Site Workshop: Overview & Team Community Building (4 work days, one Saturday—early September)
- Three, 3-day classes, September, October, November—Class Content: Leadership Skills; Organizational Analysis; Projects & Exercises for Understanding Human Systems
- Second Off-Site Workshop: Laboratory on Group, Interpersonal & Intergroup Relations (4 work days, one Saturday—early December)

**Semester II (10 credit hours)**
- Three, 3-day classes, January, February, March—Class Content: Management of Work; Managing Organizational Change; Practicum in Organization Development

**Year 2**

**Semester I (10 credit hours)**
- Third Off-Site Workshop: Training Design & Presentation Skills Workshop; Competency-Based Learning Activities (three work days, one Saturday)
- Three, 3-day classes, September, October, November—Class Content: Design of Organization Development and Analysis Projects; two electives, i.e., Labor & Human Resource Policy, Diversity in the Workplace, Global Leadership, Overseas Study Experience, etc.

**Semester II (10 credit hours)**
- Three, 3-day classes, January, February, March—Class Content: Organization & the Environment; Individual Field Project Presentations; Two Year Workshop credit
- Fourth Off-Site Workshop: Evaluation of Academic Experience and Future Career Planning and Professional Development Choices (two workdays, one Saturday)

For additional information contact: Richard E. Boyatzis, Chair, Department of Organizational Behavior

**Graduate Programs**

**Master of Science in Organization Development and Analysis**

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**Ph.D. in Management**

The Ph.D. in Management program is designed for individuals whose career goals are to conduct research and teach in academic, policymaking or research institutions. The program provides both a strong background in management and strong specialization in the individual’s choice of major field (accountancy, economics, entrepreneurship, information systems, labor and human resource policy, marketing and policy). A program of study is tailored to each student’s needs and career goals. Students are encouraged to engage in publishable research before receiving their doctorates. They also are given the opportunity to teach courses after admission to candidacy.

An integral strength of the Ph.D. in Management program at the Weatherhead School of Management is its attention to the individual. A successful doctoral experience requires more than course work. Frequent one-to-one interaction with faculty in the area of one’s specialization is necessary for developing conceptual and methodological skills. Only a few students are admitted to the doctoral program each year, guaranteeing direct communication with faculty in research, teaching and advanced independent study courses.

The Ph.D. in Management program has been designed so that the student, in cooperation with an advisor, can develop the plan of study that best meets his or her career objectives. Students are encouraged to be eclectic and take course work outside of the Weatherhead School.

Specific requirements for completion of the program are detailed in its rules and regulations; fundamentally, the requirements are:
- A full-time commitment to the program.
- Completion of prerequisite courses deemed essential to the student’s area of specialization.
- Involvement in classroom activities to develop teaching skills.
- A minimum of 12 courses covering the student’s major and minor fields and foundations courses supporting the major field.
- The foundations courses include a three-course, required sequence in research methods. Some of this work might be fulfilled through courses in the Departments of Operations or Organizational Behavior, or outside of the Weatherhead School of Management in areas such as sociology and computer science.

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- The foundations courses include a three-course, required sequence in research methods. Some of this work might be fulfilled through courses in the Departments of Operations or Organizational Behavior, or outside of the Weatherhead School of Management in areas such as sociology and computer science.
Successful completion of written and oral general examinations, typically within two years of admission.

Completion of a satisfactory dissertation. Because only a small number of applicants can be admitted each year, selection is limited to those whose credentials are strong and whose interests match well with the faculty's. Each applicant is required to furnish an official copy of his or her GMAT score, official transcripts, at least three letters of recommendation, and a statement of his or her area of interest. Financial aid is available on a competitive basis, ranging from graduate assistantships to fellowships and lectureships.

For further information and application materials, write or call: Amy Marino, Admissions Coordinator Ph.D. in Management Program Weatherhead School of Management Case Western Reserve University Cleveland, Ohio 44106-7206
(216) 368-2970 adm14@po.cwru.edu

Ph.D. in Operations Research
For the Ph.D. degree in operations research, a number of required courses in specific areas must be taken. Required and elective courses form a coordinated program of study that provides depth of knowledge of the field as well as a comprehensive understanding of related subjects. The program culminates in a dissertation, which presents new significant research findings.

Contact the Department of Operations for further information (216-368-3815) or e-mail at phd-oper@po.cwru.edu. You may also visit the Department website at http://weatherhead.cwru.edu/orom.

Ph.D. in Organizational Behavior
The doctoral program offered by the Department of Organizational Behavior focuses on the development of competence in creative inquiry and the understanding and management of planned change activities in social systems. Conceptual and empirical analysis and understanding at various levels (e.g., individual, group, organizational, societal) are stressed. Students also are encouraged to develop the skills necessary to use their knowledge to promote constructive change.

Requests for information should be addressed to: Richard E. Boyatzis, Chair Department of Organizational Behavior Weatherhead School of Management Case Western Reserve University Cleveland, Ohio 44106-7235
(216) 368-2055

Weatherhead Centers
The Weatherhead School of Management's George S. Dively Conference Center provides an ideal setting for executive programs as well as special events of the Weatherhead School. Weatherhead Executive Education creates and maintains educational linkages between the Weatherhead School and regional organizations and executives. Program offerings include The Corporate University, The Weatherhead Affiliate Program and the Family Business Program for organizations; two-degree programs The Executive MBA and Executive Doctor of Management, and one certificate program – Professional Fellows Program for advanced professionals. (N. Mohan Reddy, Interim Associate Dean: 368-2042).

Center for Regional Economic Issues (REI) improves the quality of information about the regional economy and makes this information available for public and private sector decision making. REI staff monitor economic conditions throughout the Great Lakes region, conduct research on issues of long-term significance to the region, provide policy analyses for organizations and maintain an extensive communications program. (Director: 368-5534)

Enterprise Development, Inc. (EDI) was created through the merger of Cleveland Tomorrow's Center for Venture Development and the Entrepreneurial Programs at the Weatherhead School of Management. EDI promotes economic development through entrepreneurship in northeast Ohio by identifying opportunities and mobilizing the necessary resources to create new businesses and facilitating the translation of research into the entrepreneurial process. (Diann Rucki, President: 229-9445)

The Health Systems Management Center (HSMC) is an interdisciplinary education and research center jointly sponsored by the Weatherhead School and the School of Medicine. HSMC focuses its programming on issues involving three key groups in the health care delivery system: medical providers, institutional providers and purchasers of health care services. (Barbara Bolek, Director: 368-2143)

The Mandel Center for Nonprofit Organizations is a partnership of the Mandel School of Applied Social Sciences, the Weatherhead School of Management, the School of Law and the College of Arts and Sciences. Among its diverse programs in education, research and community service, the Mandel Center administers the Master of Nonprofit Organizations degree program and the Certificate Program in Nonprofit Management as well as several dual degree and dual credential options. (Susan Lajoie Eagan, Executive Director 368-2275)

Weatherhead Undergraduate Student Organizations

Alpha Kappa Psi
Alpha Kappa Psi is a national professional business fraternity whose objective is to help develop well-trained, ethical, and skilled leaders. Members interact with speakers from the business community, attend conferences with other Alpha Kappa Psi chapters, and organize social events on and off campus.

Beta Alpha Psi
Beta Alpha Psi is the honorary accounting fraternity. Case Western Reserve is home to one of the oldest chapters in the country, founded in 1930. Professionals from all major accounting and consulting firms come to campus to talk about career opportunities in the management profession. The fraternity also sponsors field trips to accounting firms and corporations. Membership to this fraternity is restricted to accounting, finance and information systems majors; however, all students can attend meetings and attend the presentations of the guest speakers.

Omicron Delta Epsilon
Omicron Delta Epsilon is the international honor society in economics. Students who maintain a high academic record are invited to join the organization. Meetings and activities are held throughout the year and highlighted by the McMyler Memorial Lecture at the end of the school year.
Weatherhead Graduate Student Organizations

Graduate Business Student Association (GBSA)

The GBSA was formed by Weatherhead graduate students to serve as a liaison with WSOM faculty and staff on issues pertaining to student life. The organization’s primary focus is to enhance each student’s experience in and out of the classroom in the areas of professional development, academic achievement and community involvement. GBSA acts as an umbrella group for all student organizations by facilitating communication with the Advisory Council of Club Presidents, allocating resources to student organizations, organizing social activities and operating the WSOM Coffee Bar.

Graduate Business Student Association

Community Service Committee, Dean’s Receptions, the Social Committee, and the Student Learning Management Committee (SLMC).

Black M.B.A. Student Association (BMBASA)

The Black M.B.A. Student Association provides business, academic, and social support for students at WSOM through sponsored seminars, forums, and social activities.

Business Technology Association (BTA)

The BTA provides supplemental learning and exposure to new technology and innovation across functional business disciplines by sponsoring extracurricular activities related to technology in the workplace, and offering opportunities to network with local professionals.

Career Day Committee and the Career Management Center Task Force

These committees offer students an opportunity to work with the Career Management Center to design programs and seminars to prepare students for their career search.

Entrepreneurs Club

This club introduces students to opportunities to create new businesses utilizing the resources available in the Case Western Reserve community. In addition to Weatherhead, Case Western Reserve has nationally recognized capabilities in Medicine, Computer Science, MEMS, and Engineering. By linking novel technologies to energetic, capable Weatherhead students, we are working to create opportunities for new businesses with unlimited possibilities.

Finance and Investment Club

This club offers seminars and lectures to introduce students to career opportunities in banking and finance, and to innovative concepts in both corporate and personal financial planning.

Health Systems Management Association (HSMA)

The HSMA helps students interested in careers in health care to learn about the many career opportunities in the field through seminars and meetings with faculty from the Health Systems Management Center.

Human Resource and Organizational Behavior Group

Affiliated with the Society for Human Resource Management (SHRM), this club provides excellent opportunities to meet human resource professional on both an educational and social basis, and to broaden members’ exposure to human resource issues and problems at the practical and academic levels.

Insight-2-Excel

Insight-2-Excel provides high school students the opportunity to participate in a yearlong program with Insight volunteers. Through interactive, experiential exercises the students are offered mentoring, business and life skill development, and career/ life action planning. In addition to being in a formal classroom setting, the students partake in events outside the classroom. For instance, the students participate in and lead several community service events throughout the year.

International Business Group (IBG)

This group provides a forum for the informal exchange of international business ideas and the promotion of cross-cultural awareness. Among other things, activities include topical forums, spears, parties and field trips. The IBG also serves as a source of information for students about international career opportunities in the U.S.A. and abroad.

J.D./M.B.A. Student Association

Founded in 1995, the J.D./M.B.A.S.A. is a student organization of the Weatherhead School of Management and the School of Law of Case Western Reserve University. Its purpose is to assist J.D./M.B.A. students in their educational and professional development. The organization serves as a source of information and guidance to students from the time that they manifest interest in becoming a J.D./M.B.A. joint-degree student, through the completion of their program and into their respective careers.

Operations Management Organization (OPMT)

The OPMT organization is comprised of students who have an interest in planning, control, procurement, production and distribution functions.

Multicultural Task Force

The Multicultural Task Force coordinates the International Fest and the Workforce 2000 Conference on Diversity. This task force also offers a forum to discuss and address issues of diversity at WSOM and in our world.

Speaker’s Corner

Speaker’s Corner offers students opportunities to hone their public speaking skills through special extemporaneous sessions.

Students for Responsible Business

Students for Responsible Business at the Weatherhead School of Management at Case Western Reserve University is a local chapter of the national Students for Responsible Business organization, a national association of graduate students interested in socially responsible business practices.

Weatherhead Consulting Group (WCG)

The WCG provides an educational link between the consulting industry and WSOM students and offers actual consulting experiences to students interested in exploring consulting as a career.
Weatherhead Marketing Association

The Marketing Association brings members of the business community to campus to speak about a wide variety of marketing issues and career paths available to marketing students.

Weatherhead Women in Business

This organization provides professional and social development opportunities for women at the Weatherhead School of Management and opportunities to share the diversity of women’s experiences and perspectives with the WSOM community. The association represents women’s issues to the WSOM administration and facilitates an exchange of ideas and information with the student community and with other women’s organizations and business groups in Cleveland.

Weathervane (student newspaper)
http://universe.som.cwru.edu/Weathervane/

This on-line student newspaper provides students with the opportunity to gain publishing, management and sales experience while delivering a responsible, high-quality, thought provoking, and timely newspaper.

INFORMS Student Chapter (Institute for Operations Research and the Management Sciences)

The professional chapter of this organization at the Weatherhead School of Management offers students a variety of academic and social activities and provides a direct link to individuals with careers in the profession. The chapter serves to provide information to students on the professional characteristics and practice of operations research as a field of applied science in management.

Alumni Association

Members of the Weatherhead School of Management Alumni Association include all alumni of the Weatherhead School’s graduate and professional programs. The Association works to promote the welfare and advance the objectives of the school and sponsors a range of activities and services for alumni and students that encourage professional development, provide for the exchange of ideas and stimulate social interaction. Each year, the Association selects a graduating student to receive the Student Leadership Award and an incoming M.B.A. student to receive the WSOM Alumni Association scholarship. In addition to a very active Weatherhead School Alumni Association, numerous Case Western Reserve University alumni chapters throughout the country are open to all University graduates.

Honorary Societies

Beta Gamma Sigma is a national scholarship honorary society in the field of business administration and commerce. M.B.A. candidates whose academic performance is outstanding (usually in the top 20% of the graduating class) may be elected to membership in the Eta Chapter of Ohio, which was established at Case Western Reserve University in 1958.

Beta Alpha Psi is a national professional honorary accountancy fraternity. The Weatherhead School of Management is home to the Pi Chapter, which was chartered in 1930. The organization’s primary purpose is to encourage higher standards in accountancy education and to develop a closer relationship among professional accountants, faculty and students.

Omega Rho is an international honor society founded in 1975 to honor academic excellence in operations research and closely allied intellectual disciplines. As a founding chapter of Omega Rho, the Case Western Reserve University unit recommends membership for students who have achieved high honors in the graduate program in operations research. The Department of Operations initiates chapter members annually.

Teaching Excellence Award Program

Each May, an award for teaching excellence at the undergraduate, master’s, and doctoral levels, is awarded. The Teaching Excellence Award Committee is composed of student representatives. This committee administers the voting procedure, and determines the winner, and, presents the award at an awards ceremony and at the graduation ceremony.

Student Leadership Award

The Student Leadership Award is presented each year at commencement to a graduating student who has demonstrated leadership characteristics by providing a model for other students, enhancing student life and atmosphere, promoting the Weatherhead image in a positive way and contributing to the total community. The recipient of this award is chosen by a selection committee comprising alumni representatives of all Weatherhead programs. Students, alumni, faculty, staff and friends of the Weatherhead School may make nominations.

Registration and Academic Information

Course Loads

Full-time graduate students must register for at least nine credit hours per semester to maintain full-time status. A typical full-time course load, however, is 15-17 credit hours per semester. Part-time students who are employed full-time generally register for a maximum of six hours per semester and three hours in the summer, which is considered halftime status. Requests for course overloads are approved by the Academic Support Services Coordinators.

Course Registration

The student’s social security number is the identification number for all university documents and records.

A student may enroll during each registration period through the last day of late registration, as set by the official University calendar. Exceptions will be granted only upon the recommendation of the Dean of the Weatherhead School of Management. A fee of $25 is charged during the late registration period.

To register, students must have a clear balance and submit a completed student schedule form or register on-line. (Students who wish to obtain information on federal loans should contact the Professional Degrees Program Administrative offices to obtain an information packet.)

Course registrations are processed with a 5-digit course registration number (CRN). CRN numbers are produced as follows:

1st digit = department letter (A=Acct or Blaw, B=Bafi, E=Econ, H=Hsmc, U=Lhrp, W=MBAC, G=Man or Mgmt, S=Mids, K=Mkmr, P=Plyc, T=Opmt, R=Opre, Z=Orbh, Q=Qumm)
2nd 4th digit = course number;
5th digit = section number.

For Example: Acct 401, section 2 = A4012; Plyc 418, section 1 = P4181.

Independent study courses will have system assigned CRN numbers. Please indicate course, Professor, and number of credit
hours (i.e., Plcy 501 Feldman 3 hrs.) on your course schedule form.

During any semester, students may not register in more than one school or college of Case Western Reserve University. Transfer within the University requires the approval of the deans of the schools or colleges involved. Special arrangements are made for students in joint degree programs. (See the appropriate section of this bulletin for details.)

If at any time a student fails to register in two consecutive semesters, excluding the summer session, he or she must reapply for admission to the Weatherhead School of Management unless a prior arrangement has been made.

**Course Changes**

Requests for changes in courses and sections may be processed on-line or by the Academic Support Services Coordinator by the last day of the drop/add period.

**Withdrawals**

To withdraw from all courses in a semester, the student must contact the Professional Degree Programs Administrative Office (PDPAO) in person or by phone, before the University deadline for withdrawal to have an official withdrawal form processed. All withdrawals after the official drop/add periods will result in a transcript entry. Failure to attend class, giving notice to the instructor or nonpayment of fees will not be regarded as official notice of withdrawal. A grade of F may be assigned to each course from which the student has not officially withdrawn.

Tuition charges for withdrawals after the drop/add deadline are prorated based upon the week of withdrawal and according to the schedule published in the semester registration materials.

Note: A student is not entitled to any tuition adjustment for a course dropped after the drop/add deadline (unless student withdraws from all course work for the semester. If a student must drop a course for circumstances that are unavoidable and unforeseen, he or she may petition (in writing to Weatherhead School registrar) for a partial tuition refund for the course.

**Grades**

The grading system for Weatherhead School of Management students is:

- A—4 quality points
- B—3 quality points
- C—2 quality points
- D—1 quality point
- P—Pass 0 quality points (with degree credit)
- S—0 quality points (with degree credit)
- F—0 quality points (averaged in cumulative grade point average, no degree credit)
- I Incomplete (no degree credit)
- AD Audit (no degree credit)
- NG Unsatisfactory audit
- W Withdrawal from a class (no degree credit)
- WD Withdrawal from all courses in a semester (no degree credit)

**Incomplete Grade**

The grade of I is assigned at the discretion of an instructor, provided that two criteria are met:

1. There are extenuating circumstances, explained to the instructor before the assignment of the grade, which clearly justify an extension of time beyond the requirements established for other students in the class. It is the students’ responsibility to notify the instructor of the circumstances which prevent completion of the course.

2. The student has been passing the course and only a small segment of the course remains to be completed, such as a term paper, for which the extenuating circumstances justify a special exception.

In order to receive credit for a course marked I, the student must complete the work by the date specified by the instructor, and in no event later than the end of the next regular semester (fall or spring). If the student fails to remove the incomplete within the specified time, he or she forfeits the privilege of completing the course for credit and the grade becomes a permanent I unless the instructor elects to give the grade of F.

Any student who wishes to petition to extend an I grade beyond the stated university deadline of the next regular semester must obtain approval from the faculty member who assigned the I grade. Student requests must be in writing and convey: (a) extenuating circumstances justifying the extension, and (b) the expected date of completion of the work. If approved, the request should be initialed by the faculty member and delivered by the student to the Professional Degrees Program Administrative offices for inclusion in the student’s file. Failure to complete course requirements by an extended date will result in a permanent I grade or an F grade, at the discretion of the instructor.

**Withdrawn Grade**

The grade of W will be given if a student officially withdraws from a semester-length course by the deadline specified in the official university calendar. A student withdrawing after this date will receive the grade of F unless, in the judgment of the Associate Dean of the Weatherhead School of Management, there are valid reasons for recording the grade of W.

**Audit Grade**

The grade of AD (audit) will be given when a student has officially registered to audit a course and has satisfied the requirements specified by the instructor for this grade. The instructor may designate that the student has not completed all requirements for auditing the course and that NG (no grade) be recorded on the students transcript. The designation of NG is not available under any other circumstances.

Students will be permitted to change their registration in a course from credit to audit (AD) only if the change is officially made by the deadline specified in the University calendar. Students may audit only with permission of the instructor and may not audit a required course in the M.B.A. curriculum. Any course that has been audited may not be repeated for credit.

**Satisfactory Grade**

The grade of S indicates passing performance only in designated courses approved by the Professional Degree Programs Committee.

The grade of S is not counted in determining quality average and an S, once entered on the students record, may not be changed. Under no circumstances should some students in a course receive an S while other students receive grades of A, B, C or D.

No student can receive credit for more than six semester hours of grades of S toward the M.B.A. degree.

**Extra Assignments**

No student is permitted to do extra assignments beyond the work assigned to all students in a course in order to obtain a higher grade. This policy applies to changing an I grade to a regular grade or changing one regular grade to another. However, faculty may replace or substitute assignments for individual students in a course, depending on extenuating circumstances.
Retention Requirements

For retention in the M.B.A., E.M.B.A., M.S.M. and M.Acc. degree programs of the Weatherhead School, a student must meet the following academic requirements: (1) a quality-point average of 2.25 at the completion of 12 semester hours of graduate study; and (2) a quality-point average of 2.4 or higher at the completion of 21 semester hours or more of graduate study. In calculating the quality-point average, all graduate courses for which quality points are given are counted, including courses that may have been repeated. (Refer to the M.N.O. degree information in this bulletin or the School of Graduate Studies section for retention requirements for other degree programs.)

Graduation Requirements

A cumulative quality-point average of 2.50 in all graduate courses taken for credit in the M.B.A., E.M.B.A. M.S.M. or M.Acc. degree programs is required for the award of these degrees. All requirements for each of the professional degree programs must be fulfilled within six years from the date of the student’s initial registration in graduate study in the Weatherhead School of Management.

A candidate for a degree awarded by the Weatherhead School of Management must make an application for the degree in the PDPAO no later than two months before the commencement at which the degree is expected to be awarded. Upon receipt of the student’s application, the PDPAO will verify that the student is eligible to graduate at the time requested. Students are advised to contact the PDPAO if they have any questions regarding the time or the requirements for graduation.

An annual convocation ceremony is held in May. Candidates who are awarded degrees in August or January will be invited to attend the ceremony the following May.

Transcripts

Case Western Reserve University considers grades and other information about students’ performance at Case Western Reserve University to be a private matter and will release such information to students only upon written request. Transcripts will not be issued to or on behalf of students who have not discharged all financial obligations to the University.

Transcripts of work completed at other institutions will not be completed prior to a student’s enrollment in courses at another university. Approval of course work is acknowledged in writing. An official transcript from the other school, mailed directly to the Weatherhead School registrar, must be on file before the transfer of credit can be completed. Graduate courses counted toward another degree are not eligible for transfer credit.

Double-Counting of Courses for Joint Degree Students

Any student wishing to double-count courses for any joint degree program in the Weatherhead School of Management will be subject to the following restrictions:
1. A minimum of 36 hours of course work will be required for each degree awarded by the Weatherhead School of Management, over and above all courses taken in any other degree program at Case Western Reserve University.
2. In the M.B.A. program, elective courses may be double counted within the limits of Item 1 above, with the further provision that a minimum of three electives must be Weatherhead School of Management elective courses. A grade of C or higher must be received for any elective taken outside the Weatherhead School of Management in order to be counted for M.B.A. credit.

DEPARTMENTAL COURSE OFFERINGS

Department of Accountancy

Peter B. Lewis Building
Timothy J. Fogarty, Chair
Phone 216-368-2073; Fax 216-368-4776

Specified advanced undergraduate major courses, numbered on the 300 level, are open to graduate students. When these courses are taken for graduate credit, the instructor assigns additional work, usually research. Graduate courses are numbered 400 and above. Listed below are all graduate course offerings for the master’s and doctoral degree programs and the certificate programs described earlier in this bulletin.

The Accountancy Department prepares students for professional careers in public accountancy, financial management and academia. The faculty offers course work leading to the Bachelor of Science in Accounting and the Master of Accountancy. A major field in accountancy in the Ph.D. in Management program is also offered. In addition, the faculty provides service courses to M.B.A. students seeking elective course work in accounting, taxation, auditing and related subjects in preparation for professional examinations. University-wide general service courses are also provided for students not enrolled in Weatherhead School of Management or the School of Graduate Studies.

Faculty

Timothy J. Fogarty, Ph.D. (Pennsylvania State University), J.D. (State University of New York at Buffalo)
KPMG Peat Marwick Faculty Fellow; Professor of Accountancy,
Chair, Accountancy Department, Undergraduate Accountancy Program

Individual income taxation, business law
Robert J. Bricker, Ph.D. (Case Western Reserve University)
Ernst and Young Faculty Fellow; Professor of Accountancy
Financial accounting
Julia E. S. Grant, Ph.D. (Cornell University)
Associate Professor of Accountancy, Associate Dean for Graduate Programs: Financial accounting
Accounting (ACCT)

Undergraduate Courses

ACCT 101. Introduction to Financial Accounting (3)
This course covers concepts, software, principles, and practices including the preparation and interpretation of financial reports, record-keeping procedures, and internal controls.

ACCT 102. Introduction to Managerial Accounting (3)
This course examines the collection, classification and analysis of information for management. It focuses upon how managers coordinate, plan and control operations, and how decisions in business are made. Prereq: ACCT 101.

ACCT 300. Corporate Reporting I (3)
This course covers financial theory and reporting practice, including evaluation of current issues and practices related to asset valuation and present value, including receivables, inventory and fixed assets. Software applications and international aspects are considered. Prereq: ACCT 101 and ACCT 102.

ACCT 301. Corporate Reporting II (3)
This course covers financial accounting theory, technique and reporting practices. Areas of focus include: liability determination; equity measurement; principles of revenue and expense measurement; earnings per share; inflation and interim reporting; pensions; and lease accounting. Software applications and international aspects are considered. Prereq: ACCT 300.

ACCT 302. Managing Costs (3)
This course covers internally-generated reports and information for management decisions. Subjects include standard and product cost systems, cost-volume-profit relationships, budgeting, systems design and relevant cost studies. Prereq: ACCT 102 or ACCT 401.

ACCT 303. Survey of Accounting (3)
The course covers the principles of financial and managerial accounting for non-management students, including the framework that underlies financial and managerial accounting and how accounting information should be used by: (1) parties external to the firm, and (2) internal management to fulfill the planning, control and performance evaluation functions. Enrollments are limited to students who are neither management or accounting majors nor enrolled in the Weatherhead School of Management. This course cannot be substituted for ACCT 101 - 102 without a waiver from the chair.

ACCT 304. Advanced Financial Reporting (3)
This course covers partnerships, consolidations, fiduciaries, receiverships, estate and trusts and foreign exchange. Computer spreadsheet applications are utilized. Prereq: ACCT 301.

ACCT 305. Income Taxation: Concepts, Skills, Planning (3)
This course covers underlying federal income tax and concepts and law applicable to individuals. May not be taken for credit if ACCT 430 is taken for credit. Prereq: ACCT 102 or ACCT 401.

ACCT 306. Accounting Information Systems (3)
This course addresses the intersections of information technologies and accounting. Current themes include corporate communications/investor relations, as well as e-commerce. The corporate communications/investor relations module focuses on the use of technology in communicating with investors, particularly in terms of investor relations websites, XBRL (an electronic financial reporting format), the use of online investment analysis tools, and trends in the use of technology in communicating with investors. The e-commerce module focuses on functionality and security issues related to e-commerce web platforms.

ACCT 314. Attestation and Assurance Services (3)
This course covers methods for the examination of financial statements, internal control and internal audit, auditing, inventory analysis, fraud, professional ethics, legal responsibilities, emerging assurance services, and the recent developments in the auditing profession. Prereq: ACCT 301.

ACCT 360. Independent Study (1-18)

Graduate Courses

ACCT 401. Finance and Managerial Accountancy (3)
This course examines the framework that underlies financial and managerial accountancy and how reports and information should be used by: (1) parties external to the firm, i.e., stockholders, creditors and government, to evaluate the financial performance of an organization; and (2) internal management to fulfill the planning, control and performance evaluation functions.

ACCT 403. Survey of Accounting (3)
(See ACCT 303.)

ACCT 405. Advanced Federal Taxes (3)
Corporate income taxes, estate and gift tax, partnerships and hybrid forms of organization are covered. Computer-related analysis and assignments are made. Prereq: ACCT 305.

ACCT 406. Accounting Information Systems (3)
(See ACCT 306.)

ACCT 413. Seminar in Financial Management Control Systems (3)
This is an integrative case oriented course intended to examine the characteristics and elements of planning and control systems and the requirements for the development and implementation of such systems. Planning control systems in service, nonprofit and multinational organizations are analyzed. The course explores the role accounting plays in the development and support of planning and control systems, and the problems and implications for accounting of developing systems for different types of organizations. Prereq: ACCT 401 or MBAC 415.

ACCT 414. Corporate Reporting and Analysis (3)
This course provides a basis for evaluation of traditional and proposed uses of report and information for decision making in investment, credit and internal planning and control. Students are introduced to concepts and analytical techniques that can be used to critique and interpret the financial health of the organization. At a practical and theoretical level, the course integrates research in the areas of accounting, quantitative methods and finance which has proved useful in the financial analysis of organizations. Prereq: ACCT 401 or MBAC 415.

ACCT 415. Managerial Accounting-E.M.B.A. (2)
This course examines the framework that underlies financial and managerial accountancy and how reports and information should be used by: (1) parties external to the firm, i.e., stockholders, creditors and government, to evaluate the financial performance of an organization; and (2) internal management to fulfill the planning, control and performance evaluation functions. This course is open only to students in the Executive M.B.A. program.

ACCT 419. Financial Reporting and Capital Structure (1.5)
Corporations require sources of capital, which typically include both debt and equity financing. These different contract forms lead to different financial statement implications due to the rules of accrual account-
This course covers the detailed financial reporting techniques and procedures related to these contracts that affect the information produced and subsequently used in capital markets. Prereq: MBAC 415 or equivalent.

ACCT 430. Taxes and Management Decisions (3)
This course is designed to sensitize students to the importance of tax planning opportunities and pitfalls inherent in management decisions. The course will focus on helping students recognize potential tax opportunities and problems by examining a variety of practical managerial decision contexts. The course is specifically designed for students preparing for careers in management as opposed to accounting or tax. Prereq: ACCT 401 or MBAC 415 or MAND 425 and MAND 426.

ACCT 431. Tax Research Methods (3)
This course concentrates on the basic nature of the tax research process, identification of pertinent facts, evaluation of authoritative sources, problem definition, evaluation of alternative courses of action, and recommendation of solutions to the problem. Library research materials are used, including tax services, journal articles, analyses of court cases, and administrative rulings. Tax research cases are employed as the basic methodology for simulating actual tax research problems. Computer applications for tax research are assigned. Prereq: ACCT 405.

ACCT 432. Advanced Corporation and Shareholder Tax Problems (3)
This course includes federal tax problems of corporations and their shareholders: corporation formation; liquidation; reorganization; reincorporating; dividends, earnings and profits; stock redemptions; problems of choice of business organizations; thin capitalization; and special designations. There is extensive use of journal articles, treasury regulations and codes, and corporate tax search and planning cases. Computer applications for tax research are assigned. Prereq: ACCT 405.

ACCT 433. Partnership Taxation (3)
This course provides in-depth analysis of the federal income taxation of partners and partnerships. Topics covered include partnership formation, transfers of partnership interests, distributions of partnerships' property, and rules governing the termination of a partnership. Prereq: ACCT 405.

ACCT 434. Estate and Gift Taxation (3)
This course covers code, regulations, and case law in the federal estate and gift area. Family financial planning to minimize income and transfer taxes is included. Prereq: ACCT 405.

ACCT 435. Special Topics in Federal Taxation (3)
This course includes tax practice and procedure, tax policy, consolidation, tax returns, international taxation, and deferred compensation. Prereq: ACCT 405.

ACCT 436. International Taxation (3)
This course provides a basic understanding of U.S. taxation of foreign-source income of multinational corporations, U.S. citizens and residents, and includes: taxation of foreign subsidiary versus branch operations; Sec. 861 and Sec. 482 income and expense allocation problems; foreign tax credits; tax treaties; tax policy issues of equity and neutrality; and Foreign Sales Corporations. Prereq: ACCT 405.

ACCT 439. Regulation of Accountancy (3)
This course examines the role and structure of standard-setting agencies in the private and public sectors, including FASB, AICPA boards and divisions, the Securities and Exchange Commission, and other regulatory bodies. The 1933 and 1994 securities acts, the disclosure and independence aspect of securities regulation, and elements of professional behavior, international reporting and measurement requirements are also explored. Extensive use is made of web-based information including company and mutual fund sites and databases. Prereq: ACCT 405.

ACCT 444. Advanced Auditing Theory and Practice (3)
This course examines auditing concepts and issues in depth including: the philosophy of auditing operational auditing compilation and review; ethics; analytical review procedures; fraud; the computer as an audit tool; and statistical sampling. Students are exposed to judgment making through the use of audit cases. Prereq: ACCT 314 or permission of instructor.

ACCT 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

ACCT 520. Advanced Accounting Theory (3)
This course studies contemporary issues in theory. Topics are considered from their historical development to contemporary circumstances. Academic and professional literature are employed to gain a variety of perspectives on current matters. The development of communication skills, written and verbal, and use of support technology for presentations is emphasized throughout. Students are required to make several individual and team presentations, to conduct data base and periodical research, and to provide frequent written and oral research reports. The development of communication skills, written and verbal, and use of support technology for presentations is emphasized throughout. Students are required to make several individual and team presentations, to conduct data base and periodical research and to provide frequent written and oral research reports. Prereq: ACCT 405 or consent of instructor.

ACCT 540. Contemporary Accountancy Policy (3)
This is a seminar on subjects of contemporary concern to the profession which are currently being debated and researched by professional bodies and the academic community. These subjects include: independence; scope of services; litigation; relationships with financial and non-financial management; social accounting; and education and competency issues. The seminar provides a participative understanding of the press of various economic and accounting environments. Prereq: ACCT 405 and ACCT 520.

ACCT 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

ACCT 701. Dissertation Ph.D. (1-18)
ACCT 702. Appointed Dissertation Fellow (9)
Undergraduate Courses

BAFI 341. Money and Banking (3)
This course emphasizes the importance of financial markets, the nature and role of the financial system, and the linkages between these—money and banking—and the economy. Emphasis is placed on both theoretical and practical constructs, on major innovations and contemporary changes, and the closely intertwined condition of financial and economic systems with monetary and fiscal policy. Prereq: ECON 103. Cross-listed as ECON 341.

BAFI 342. Public Finance (3)
(See ECON 342.) Prereq: ECON 102 and ECON 103. Cross-listed as ECON 342.

BAFI 355. Corporation Finance (3)
This course emphasizes the identification and solution of the financial problems confronting the business enterprise. Designating the goal of the firm to be maximization of shareholder wealth, topics include financial analysis, valuation, capital budgeting, and financial structure. Prereq: ACCT 102.

BAFI 356. Investments (3)
This course discusses the theory and application of the modern portfolio theory. The focus is on investment analysis and asset allocation. Prereq: ECON 102 and ECON 103. Cross-listed as ECON 356.

BAFI 359. Intermediate Corporate Finance (3)
This is the second course in corporate finance. It is a case-based course that will apply and amplify concepts developed in the first course (BAFI 355 Corporate Finance). The cases covered in BAFI 359 will cover, among other topics, Cash Budgets and Working Capital Management, Capital Budgeting, Capital Structure/Dividend Policy Concepts, IPO Process and Valuation. The objectives of the course are to develop both conceptual and financial-modeling skills. Prereq: BAFI 355.

BAFI 360. Independent Study (1-18)
This course is offered for candidates undertaking reading in a field of special interest. Permission of department chair required.

BAFI 372. International Finance (3)
(See ECON 372.) Cross-listed as ECON 372.

Graduate Courses

BAFI 402. Financial Management I (3)
In this course, students are introduced to the basics of corporate finance, including the objectives, tasks, and decisions made by corporate financial managers. The course covers discounted cash flows, bond and stock valuation, cost of capital, capital budgeting, asset risk and return, and short-term and long-term financial management. Coreq: MBAC 415 or ACCT 401.

BAFI 403. Financial Management II (3)
This is a continuation of BAFI 402 and serves as a prerequisite for several advanced electives in banking and finance. Its purpose is to familiarize the student with the theory and application of additional models used in financial decision-making by corporations. Issues relating to efficient markets, dividend policy, capital structure, financing decisions, option pricing, leasing, and risk management are among the topics considered. In addition, special topics may include mergers and acquisitions, pension funds, and international financial management. Prereq: ACCT 401 or BAFI 402 and QUMM 414 or MBAC 415, MBAC 416 and MBAC 414. Prereq or Coreq: ECON 403.

BAFI 404. Financial Modeling (1.5)
Financial Modeling is the practical skill that combines financial theory, business planning, forecasting, and sensitivity and simulation analysis to produce computer models that are useful for a variety of decision-making purposes. Prominent purposes include project and company valuation, strategic planning, cash planning, credit evaluation, and the tactical implementation of business plans. Financial Modeling is a threshold skill for several careers attractive to M.B.A. graduates, including investment banking, equity analysis and management, and corporate treasury. Financial Modeling is a 1.5 credit hour course designed for M.B.A. students who anticipate either internships or careers in the financial services industry or in corporate financial management. The course aims to develop students’ skills in implementing models that operationalize the core tools and concepts developed in other finance and accounting classes. Coreq: BAFI 403.

BAFI 420. Health Finance (3)
Exploration of economic, medical, financial, and payment factors in the U.S. healthcare system sets the framework for the study of decisions by providers, insurers, and purchasers in this course. The mix of students from various programs and professions allows wide discussion from multiple viewpoints. Prereq: ACCT 401 or MBAC 415 or consent of instructor. Cross-listed as HSMC 420.

BAFI 422. Management of Financial Institutions (3)
This course applies the principles of financial management to financial institutions, especially commercial banks. The impact of monetary and fiscal policies and the changing regulatory, legislative, and technological environments are studied. Specific problem-solving techniques and decision-making are emphasized. Prereq: MBAC 416 or BAFI 402 or consent of instructor.

BAFI 423. Managerial Finance-E.M.B.A. (3)
This course, which is limited to students in the Executive M.B.A. program, analyzes the policies and problems of obtaining and managing funds for operation, expansion and diversification.

BAFI 424. Managerial Finance II-E.M.B.A. (3)
This course applies the principles of financial management to financial institutions, especially commercial banks. The impact of monetary and fiscal policies and the changing regulatory, legislative, and technological environments are studied. Specific problem-solving techniques and decision-making are emphasized. Prereq: MBAC 416 or BAFI 402 or consent of instructor.

BAFI 426. Applied Security Analysis (3)
This is a course for those seeking an in-depth examination of equity investment decisions. The course is funded by a grant and involves the continuing analysis, review, and reinvestment of the funds in an actual portfolio dedicated to this course. There is active involvement with members of The Cleveland Society of Securities Analysts, including attendance at Corporate Investor Relations presentations. The course emphasizes the application of particular analytical models of stock selection. Prereq: BAFI 403, ECON 403, MBAC 414 or QUMM 414.

BAFI 428. Financial Strategy and Value Creation (3)
The intersection between the theory of perfect markets and the reality of market imperfections provides the basis for the exploration of value creation in this course. Opportunities in both product and financial markets are explored using case studies to develop a framework for strategic financial decisions. Prereq or Coreq: BAFI 403.

BAFI 429. Investment Management (3)
This course explores the characteristics of financial investments and markets and develops modern techniques of investment analysis and management. The goal is to help students develop a level of analytical skill and institutional knowledge sufficient to make sensible investment decisions. Topics include: an overview of stock, debt and derivative asset markets.
practical applications of modern portfolio theory, equilibrium and arbitrage-based approaches to capital market pricing, the debate over market efficiency, the term structure of interest rates, bond portfolio management, and uses of derivative assets in investment portfolios. Coreq: BAFI 403.

BAFI 430. Options and Futures (3)
This course is intended to give students an understanding of options and futures markets both in theory and practice. The emphasis is on arbitrage and hedging. The course concentrates on listed common stock and index contracts as well as commodity markets. Various theories for trading strategies are studied. Coreq: BAFI 403.

BAFI 431. Fixed Income Markets and Their Derivatives (3)
This class is concerned with fixed income securities, interest rate risk management, and credit risk. Fixed income securities account for about two thirds of the market value of all outstanding securities, and hence this topic is important. The course covers the basic products of fixed income markets including treasury and LIBOR products, such as interest rate swaps. Risk management and hedging strategies are covered as well as selected topics in credit risk models and mortgage-backed securities. Prereq: BAFI 440.

BAFI 432. Risk Management and Financial Engineering (3)
This is a risk management course aimed at developing an understanding of the risks faced by financial and nonfinancial firms, learning techniques to identify and measure these risks, and understanding how financial engineering (especially derivatives) can be used to manage these risks and advance the strategic goals of the firm. Main topics include Value-at-Risk (VaR) techniques and implementation of VaR systems (RiskMetrics, Delta-normal, Historical Simulation, Structured Monte-Carlo); financial risk measurement and management using forwards, futures, options, swaps, and exotics; and credit risk management, including implementing various credit risk and credit VaR models, estimating capital at risk, and using credit derivatives for managing credit risk. Several classes are devoted to discussing recent risk management debacles and relating them to theory. Prereq or Coreq: BAFI 440.

BAFI 440. Advanced Corporate Finance (3)
This course exposes the students to a more in-depth treatment of some of the topics covered in BAFI 402 and BAFI 403 and introduces them to new topics. These topics deal with the choices that have financial implications for a firm’s stakeholders and include investment decisions, financing decisions, payout decisions, contracting decisions and performance metrics, internal control systems, risk management, real options, reorganization, and valuation. The topics covered may vary from semester to semester. Prereq: BAFI 403.

BAFI 441. Economics of Financial Intermediation (3)
Institutions such as commercial banks, investment banks, insurance companies, and mutual funds perform important financial intermediation roles in an economy. This course provides a conceptual framework that allows the exploration of how these financial institutions perform their intermediation role through their different activities, such as loan origination, underwriting, insurance, and asset management. This framework also lends itself to the study of how and why regulation can be critical in constraining discretion. Topics covered include contract law, the Uniform Commercial Code (UCC), professional business ethics, and crimes and torts.

BAFI 445. Money and Capital Markets (3)
This course provides an examination of the current structure, pricing, competition and financial innovations in money and capital markets. Theory is coupled with contemporary events to study the impact of the secular rise and cyclical variability of interest rates, the proliferation of financial instruments, deregulation and the wider competition in financial markets. Individual segments of the money market such as the commercial paper and acceptances markets are examined, as are capital market segments such as the various bond markets, mortgages and derivative instruments. Prereq: ACCT 401 or MBAC 415, MBAC 416 or BAFI 402, ECON 403 or MBAC 426, and QUMM 414 or MBAC 414. Cross-listed as ECON 441.

BAFI 450. Corporate Restructuring (3)
This course examines the economic rationale and motivation for the different merger & acquisition and recapitalization activities undertaken by firms and individuals in the U.S. market. Emphasis is on the different three (3) methods of valuing a firm, the various forms of debt and equity capital employed to fund mergers & acquisitions and recapitalizations, how lenders and investors structure their loans and/or investments, and how investors realize the gains through different exit strategies. The course presents an excellent understanding of the roles that senior commercial banks, insurance companies, pension funds, LBO funds, investment banking firms, and venture/growth capital investors play in mergers and acquisitions. Prereq: BAFI 405.

BAFI 460. Investment Banking (3)
This course will conduct a detailed examination of the role of the investment banker in the corporate capital acquisition process. Emphasis is on the process of raising public equity capital and understanding the various steps/functions involved. Additional topics to be covered will include debt capital, venture capital and buyouts, as well as the financial models that support these transactions. Prereq: BAFI 403 and consent of instructor.

BAFI 470. Finance and Law (3)
Motivated by recent financial crises and attempts to develop new financial systems, recent research has investigated the importance of legal systems for the development of securities markets, banking systems, accounting standards, dispersed share ownership, and even economic growth. Related research examines the importance of particular laws and regulations for specific financial outcomes, including venture capital, the market for takeovers and corporate control, the market for securities trading services, and the value added (or destroyed) by lawyers’ activities. This seminar course will use readings, presentation, and discussion to learn about these issues. Prereq: BAFI 402 or MBAC 416 or LAWS 293. Coreq: BAFI 403.

BAFI 480. International Financial Management (3)
This course introduces students to international finance and foreign exchange risk management by corporations. Topics include foreign exchange markets and international financial institutions; financial contracts; exchange rate risk and corporate risk management; and international aspects of long-term financing. Prereq: BAFI 403.

BLAW 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

BLAW 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

Business Law (BLAW)

Undergraduate Course

BLAW 331. Legal Environment of Management (3)
This course is designed to foster an appreciation for how the legal system shapes the current practice of management. Emphasis will be placed on how the law allows private sector transactions to have consequence and how governmental agencies constrain discretion. Topics covered include contract law, the Uniform Commercial Code (UCC), professional business ethics, and crimes and torts.

Graduate Courses

BLAW 417A. Legal Environment for Managers-E.M.B.A. (2)
This course will provide an overview of the legal environment in which business transactions take place. Through coverage of a number of topical areas, the student will be given a broad understanding of how the law impacts upon their daily decisions. More specifically, the student will be better able to identify and understand how the legal issues facilitate or hinder the conduct of business. Topics covered will include torts, contracts, products liability, employment law, and corporations. Special emphasis is placed on regulatory areas.

BLAW 417B. Legal Environment for Managers-M.B.A. (3)
This course will provide an overview of the legal environment in which business transactions take place. Through coverage of a number of topical areas, the student will be given a broad understanding of how the law impacts upon their daily decisions. More specifically, the student will be better able to identify and understand how the legal issues facilitate or
hinder the conduct of business. Topics covered will include torts, contracts, products liability, employment law, and corporations. Special emphasis is placed on regulatory areas.

**Department of Economics**

Peter B. Lewis Building  
James B. Rebitzer, Chair  
Phone 216-368-2970; Fax 216-368-5039

**Faculty**

Eric Bettinger, Ph.D. (Massachusetts Institute of Technology)  
Assistant Professor of Economics

Bo A. Carlsson, Ph.D. (Stanford University)  
E. Mandell deWitt Professor of Industrial Economics; Director of Research and Graduate Programs  
Managerial economics, industrial economics

David J. Cooper, Ph.D. (Princeton University)  
Assistant Professor of Economics  
Industrial Organization, Microeconomic Theory

Avi Dor, Ph.D. (City University of New York)  
John R. Mannix Blue Cross & Blue Shield Associate Professor of Health Care Economics  
Health care economics, industrial economics

Robin A. Dubin, Ph.D. (The Johns Hopkins University)  
Associate Professor of Economics  
Spatial econometrics, urban economics, regional economics

Asim Erdilek, Ph.D. (Harvard University)  
Professor of Economics  
International economics, international finance

Susan Helper, Ph.D. (Harvard University)  
Associate Professor of Economics  
Economic history, technical change, economics of supplier relations

James B. Rebitzer, Ph.D. (University of Massachusetts-Amherst)  
Frank Tracy Carlton Professor of Economics; Chair, Department of Economics  
Economics of organizations, employment relationships and labor markets, human resource management and industrial relations, behavioral economics

Mari S. Rege, MS (University of Oslo)  
Assistant Professor of Economics  
Environmental Economics, Game Theory, Evolutionary Game Theory, Behavioral Economics

Robert L. Slonim, Ph.D. (Duke University)  
Assistant Professor of Economics  
Game theory, learning, behavioral economics, reference theory, price theory, auctions, decision theory and experimental economics

Marcus Stanley, Ph.D. (Syracuse University)  
Assistant Professor of Economics

Mark E. Votruba, M.A. (Princeton University)  
Instructor of Economics

**Secondary Appointments**

David C. Hammack, Ph.D. (Columbia University)  
Elbert Jay Benton Professor of History, College of Arts and Sciences; Professor of Economics  
Nonprofit organizations, urban and social policy history

Dennis R. Young, Ph.D. (Stanford University)  
Professor of Nonprofit Management, Mandel School of Applied Social Sciences; Professor of Economics  
Economics of nonprofit organizations, economics of public services, entrepreneurship

**Adjunct Faculty**

Martine Lussier, Ph.D. (University of Toronto)  
Instructor of Economics

Ayhan Talu, Ph.D. (Arizona State University)  
Lecturer

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**Bachelor of Arts Degree**

*(College of Arts and Sciences)*

Economics is concerned with the problems of allocating scarce resources to meet human needs. Students who study economics gain an understanding of how consumers (households), producers (firms) and governments make decisions affecting the allocation of resources and, therefore, a society’s economic performance. Economics also involves an examination of how the interaction of these decisions in markets and in the political process produces certain outcomes, and how legal and institutional arrangements can influence these outcomes. Finally, the study of economics leads to a better appreciation of the ways in which trade, investment and the movement of people and information across national boundaries tie the global economy together.

An undergraduate major in economics provides an excellent preparation for a variety of professional careers, such as management, law and government service. A major is essential for those wanting to pursue graduate work in economics.

**Major**

*(for B.A. degree)*

A major in economics consists of 30 hours, with a minimum of 24 hours of economics courses. It leads to the Bachelor of Arts degree.

**Minor**

*(for B.A. or B.S. degree)*

A minor in economics consists of 15 hours, as follows:

- ECON 102, ECON 103, and three additional economics courses (9 hours) selected in consultation with the minor advisor.

**Social Science Sequence**

*(for B.S. based upon Engineering Core Curriculum)*

The sequence requirement is satisfied by taking ECON 102, ECON 103, and one other 200- or 300-level ECON course.

**Economics (ECON)**

**Undergraduate Courses**

**ECON 102. Principles of Microeconomics (3)**

This course covers how productive resources are allocated in a market economy, the determination of individual prices and costs of production, consumer behavior, the consequences of governmental controls over prices and wages, and problems related to allocating resources between the private and public sectors.

**ECON 103. Principles of Macroeconomics (3)**

This course covers how incomes, employment, inflation, and the national output of goods and services are determined, as well as the monetary system and its management. Government revenue and expenditure policies and their influence on economic stability and growth are also studied.

**ECON 205. Economic Perspectives (3)**

This course examines important contemporary and historical issues from an economic perspective. It enables students to think about the world “like an economist.” Possible topics of current interest include the transformation of Eastern Europe, ethnic and racial strife, environmental policy and sustainable development, and professional sports.

**ECON 255. The Economic History of the United States (3)**

(See HSTY 255.) Cross-listed as HSTY 255 and PLCY 255.

**ECON 306. History of Economic Thought (3)**

In this course you will study first hand the writings of the great economists. The course focuses on such famous thinkers as Adam Smith, David Ricardo, Karl Marx, Leon Walras, John Maynard Keynes, Milton Friedman, and Ronald Coase. For many of these writers, economics went beyond
contemporary boundaries and encompassed the study of history, philosophy and sociology. Their original texts are "classics"—books that everybody talks about yet nobody reads. As such they are often misinterpreted. In this course you should develop your own interpretation—hopefully it will surprise you. Prereq: ECON 102 and ECON 103.

ECON 307. Intermediate Macroeconomy (3)
This course examines the theories of the determination of national income, the unemployment rate, inflation, and the rate of interest, as well as alternative theories of income determination, the theory of capital, monetarists vs. Keynesians, and dynamic analysis. Prereq: ECON 103.

ECON 308. Intermediate Microeconomy (3)
This course examines pricing and resource allocation, welfare economics, general equilibrium, and alternative economic efficiencies of capitalist and alternative forms of economic organization. Prereq: ECON 102.

ECON 309. Intermediate Microeconomy: Math Based (3)
Course covers the same topics as ECON 308 but uses calculus. Prereq: MATH 121 or MATH 125 and ECON 102.

ECON 320. Econometrics (3)
This course covers the techniques used by economists to estimate the parameters of economic relationships such as demand curves and consumption functions. Prereq: ECON 102 and ECON 103 and one semester of statistics.

ECON 328. Experimental Economics (3)
This course covers the methods of experiments to study economic behavior. This course will examine the role of market institutions, game theory, and individual choice. Specific topics will depend on both the instructor and student interest, but will include market organization, game theory and rational choice and recent modifications to economic thinking on this topics. Prereq: ECON 102.

ECON 329. Game Theory: The Economics of Thinking Strategically (3)
The term "game theory" refers to the set of tools economists use to think about strategic interactions among small groups of individuals and firms. The primary purpose of this course is to introduce students to the basic concepts of game theory and its applications. The class will stress the use of game theory as a tool for building models of important economic phenomena. The class will also include a number of experiments designed to illustrate the game theoretic results, and to highlight how reality may depart from the theory. The course will stress the value of thinking strategically and provide students with a framework for thinking strategically in their everyday lives. Rather than approaching each strategic situation they encounter as a unique problem, students will be taught to recognize patterns in the situations they face and to generalize from specific experiences. Prereq: ECON 102.

ECON 332. Economic Analysis of Labor Markets (3)
This course examines the determinants of the demand for and supply of labor, the operation of labor markets under differing degrees of competition, and the relationship between the operation of the labor market and the level of inflation. Prereq: ECON 102.

ECON 335. Comparative Economic Systems (3)
This course examines the way that different institutions affect economic performance. An alternative course title might be "Comparative Institutional Analysis." In particular, we look at the economic institutions of three capitalist economies (the U.S., Japan and Sweden), one socialist economy (the former Soviet Union), and two economies in transition (Poland and Hungary), together with the unique institutional arrangements in Iran (the "Islamic Model") and the former Yugoslavia ("worker self-management"). We combine insights from traditional economic theory, recent developments in "information economics," and the use of case studies. Prereq: ECON 102 and ECON 103.

ECON 338. Law and Economics (3)
This course examines legal institutions and rules from an economic perspective. Students will learn when and how legal rules can be efficient. Topics will depend on both the instructor and student interest, but will include commercial law, accident law, property rights, contracts, and polycentric legal systems. Prereq: ECON 102.

ECON 341. Money and Banking (3)
(See BAFI 341.) Prereq: ECON 103. Cross-listed as BAFI 341.

ECON 342. Public Finance (3)
This course covers economic aspects of government spending and taxing, allocation of scarce resources among competing claims in the public and private sectors, application of equity and efficiency criteria to tax and expenditure systems, and theories of bureaucratic performance. Prereq: ECON 102 and ECON 103. Cross-listed as BAFI 342.

ECON 343. Economics of State and Local Governments (3)
This course examines economic analysis of the roles of federal, state, and local government; economic effects of state and local property, sales, and other taxes; effects of intergovernmental grants; public school finance; the urban fiscal crisis. Prereq: ECON 102.

ECON 345. Public Choice (3)
This course covers economic theory and empirical analysis of the behavior of politicians, bureaucrats, and voters based on the assumption of rational pursuit of self-interest, comparison with other approaches to the study of political behavior, and implications of alternative collective decision procedure. Prereq: ECON 102 and ECON 103.

ECON 361. Managerial Economics (3)
This course explores the economic principles that underlie strategic decisions in firms. Topics include the determination of vertical and horizontal boundaries of firms, strategic positioning and the sources of competitive advantage. Prereq: ECON 102.

ECON 364. Competition and Public Policy (3)
This course covers alternative market structures and their performance in terms of profit, prices, and productivity, as well as antitrust laws and regulations and their importance to industrial organization. Prereq: ECON 102.

ECON 365. Economics of Energy (3)
The economic aspects of energy are studied. Long term trends in consumption, sources of supply, the theory of nonrenewable resources, interactions with environmental problems, and current questions of energy policy are included. Prereq: ECON 102.

ECON 366. Environmental Economics (3)
This course examines the economics of both the causes of pollution and the remedies for it. Among the topics covered will be: citing of environmentally undesirable facilities (such as nuclear waste repositories), tradable air pollution emissions permits, pesticide use in agriculture, and international cooperation in cleaning up the Great Lakes. Prereq: ECON 102.

ECON 369. Economics of Technological Innovation (3)
This course looks at the process of technological change. We will explore topics such as: the computer/internet revolution, Japanese manufacturing techniques, the mechanization of housework, the impact of new technology on workers and consumers, and how managers and government policy-makers can affect the nature of technological change. Prereq: ECON 102.

ECON 370. International Finance (3)
This course deals with open-economy macroeconomics and international financial markets, covering open-economy national income analysis, international macroeconomic policy coordination, exchange rate determination, foreign portfolio investment, and global financial crises. Prereq: ECON 102 and ECON 103. Cross-listed as BAFI 372.

ECON 373. International Trade (3)
This course deals with international trade theories and policies, covering gains from and patterns of trade, immigration, foreign direct investment, protectionism, multilateral trade liberalization, regionalism and the costs and benefits of globalization within as well as among nations. Prereq: ECON 102 and ECON 103.

ECON 375. Economics of Developing Countries (3)
This course examines the problems of less developed countries, including theories of economic growth, policies for capital accumulation, criteria for resource allocation, foreign trade problems, inflation, population trends, and development planning. Prereq: ECON 102 and ECON 103.

ECON 377. Economics of Nonprofit Organizations (3)
The purpose of this course is to familiarize students with the private nonprofit sector of the U.S. economy, with economic theory contributing to our understanding of this sector, and with economic analysis of policy and management issues affecting nonprofit organizations. Topics include
understanding the different types of nonprofit organizations; the size, scope and economic impact of the nonprofit sector; economic theories of why nonprofit organizations exist and how they behave; economic analysis of tax and regulatory policy issues affecting nonprofits. Prereq: ECON 102.

ECON 378. Health Care Economics (3)
This course deals with the health care system, the fastest growing sector of the U.S. economy. Because of its complexity and sheer size, the health care system affects virtually every facet of the economy, including labor productivity, income distribution and international competitiveness. The course will foster an understanding of economic analysis of health care markets and related public policy issues by developing a general understanding of the health care system, and then focusing on (1) the behavior of consumers; (2) the supply side (physicians, hospitals and their markets); (3) insurance and regulation with special emphasis on current events. Prereq: ECON 102; ECON 103 recommended.

ECON 386. Urban Economics (3)
Microeconomic theory as taught in principles (and even intermediate) does not usually take into account the fact that goods, people, and information must travel in order to interact. Rather, markets are implicitly modeled as if everyone and everything is at a single point in space. In this course, we examine the implications of spatial location for economic analysis. One of the most important implications is that households and firms can find it advantageous to cluster together in cities in order to reduce transportation costs. The course will emphasize applying the theoretical analysis to real world issues, with a special emphasis on important problems facing the Cleveland metropolitan area. Prereq: ECON 102.

ECON 397. Honors Research I (1-3)
Prereq: ECON 397.

ECON 399. Individual Readings and Research (1-6)
Intensive examination of a topic selected by the student.

Graduate Courses

ECON 403. Economics for Management (3)
This course surveys the basic principles of micro and macroeconomics. Topics covered in microeconomics include supply and demand, the theory of production and costs, market structures and factor markets. Macroeconomics topics are the national incomes accounts, the determination of national income, employment and inflation, fiscal and monetary policies and international trade.

ECON 415. Economic Analysis for Managers-E.M.B.A. (2)
This course, which is limited to students in the Executive M.B.A. program, explores the basic elements of the economic system which the executive needs to know in order to understand how the firm interacts with the system and how economic factors affect decision making.

ECON 421. Health Economics and Strategy (3)
This course has evolved from a theory-oriented emphasis to a course that utilizes economic principles to explore such issues as health care pricing, anti-trust enforcement and hospital mergers, choices in adoption of managed care contracts by physician groups, and the like. Instruction style and in-class group project focus on making strategic decisions. The course is directed for a general audience, not just for students and concentration in health systems management. Prereq: ECON 403 or MBAC 426. Cross-listed as HSMC 421 and MPH 421.

ECON 431. Economics of Negotiation and Conflict Resolution (3)
Students frequently enroll in a negotiation class with one thought in mind—negotiating a better job offer from an employer. They soon learn, however, that negotiation skills can do far more than improve a pay check. Negotiations occur everywhere: in marriages, in divorces, in small work teams, in large organizations, in getting a job, in losing a job, in deal making, in decision making, in board rooms, and in court rooms. The remarkable thing about negotiations is that, wherever they occur, they are governed by similar principles. The current wave of corporate restructuring makes the study of negotiations especially important for M.B.A.s. Mergers, acquisitions, downsizing and joint ventures call into question well established business and employment relationships. Navigating these choppy waters by building new relationships requires negotiation skills. The increased stress on quality and other hard-to-measure aspects of relationships with customers and suppliers makes the process of negotiation even more complex and subtle. For these reasons, negotiation courses have taken center stage in the study of management. Every major business school now offers classes in negotiation and these classes are overflowing with students. Cross-listed as LHRP 413.

ECON 434. Business and Nonprofit Entrepreneurship (3)
This course examines the power of entrepreneurship in the nonprofit sector. It will cover large scale policy initiatives, new services and for-profit activities. Course elements include vision, staffing, leadership, and funding. Cross-listed as ENTP 434 and MAND 434.

This course, which is limited to students in the Executive M.B.A. program, presents the basic elements in the analysis of production and technological change. It explores the uses and limitations of theory in analyzing innovative activity in industry and examines the role of technological progress in the growth of firms and industries.

ECON 436A. Economics of Organizations-E.M.B.A. (2)
Dramatic changes in technology, work force demographics and economic competition are forcing firms to rethink their internal organization. Implementing new internal strategies is remarkably hard for organizations and managers to do. This class is designed to provide the economic tools that managers need to understand why their organizations are the way they are and why change can be as difficult as it is important. This course focuses on two elements of a firm's internal strategy: structuring incentives and investing in relationships. In the incentives section, we analyze how organizations: allocate decision rights; evaluate performance; and implement motivation strategies. In the relationships section, we analyze how organizations sustain functional, long-term relationships in competitive or conflictual environments. A small number of surprisingly simple economic models, it turns out, offer important insights into incentive design and investments in long-term relationships.

ECON 436B. Economics of Organizations-M.B.A. (3)
Dramatic changes in technology, work force demographics and economic competition are forcing firms to rethink their internal organization. Implementing new internal strategies is remarkably hard for organizations and managers to do. This class is designed to provide the economic tools that managers need to understand why their organizations are the way they are and why change can be as difficult as it is important. This course focuses on two elements of a firm's internal strategy: structuring incentives and investing in relationships. In the incentives section, we analyze how organizations: allocate decision rights; evaluate performance; and implement motivation strategies. In the relationships section, we analyze how organizations sustain functional, long-term relationships in competitive or conflictual environments. A small number of surprisingly simple economic models, it turns out, offer important insights into incentive design and investments in long-term relationships.

ECON 441. Economics of Financial Intermediation (3)
(See BAFI 441.) Cross-listed as BAFI 441.

ECON 461. Managerial Economics (3)
This course explores the economic principles that underlie strategic decisions in firms. What determines their boundaries - i.e., Which activities do they expand, acquire and divest? What are the sources of competitive advantage, and how do firms position themselves strategically? Prereq: ECON 403 or MBAC 426.

ECON 462. E-Business and the New Economy (3)
This new economy course focuses on the following questions: What is this phenomenon variously called the digital economy, the global information economy, the new economy, or the networked society? How is it related to E-business or E-commerce? What are its most important features? What impact will it have on competition, business organization, and business strategy? What does it mean for businesses in Cleveland (U.S. vs. other countries)? Why is the stock market valuation of Procter and Gamble lower than that of companies that have been around for only a couple of years and never made a profit? Prereq: ECON 403 or MBAC 426.
ECON 472. The World's Regions and Strategic Advantage (3)
This course will focus on business decisions in an increasingly complex regional and global economic environment and the significance of place in business success. Every company decision involves location—recruiting, locating headquarters or an R&D lab, choosing where to invest, evaluating a merger, evaluating the investment portfolio of a bank, locating a new facility, and marketing your product. Topics include: high technology development, interpreting business climate indexes, the business location decision, sources of regional advantage, case studies of the world’s important cities, geographic clustering of industries, and business partnerships for improving regional economics. Prereq: ECON 403.

ECON 474. International Trade (3)
This course deals with the causes and effects of international trade and investment. Its coverage includes the local and regional commercial agreements and institutions that affect the international business environment. The European Union, the North American Free Trade Agreement, and the World Trade Organization are treated extensively. Prereq: ECON 403.

ECON 475. International Finance (3)
This course covers the global financial markets that multinational corporations, government agencies, and banks use in conducting business. These financial markets include the market for foreign exchange, the Eurocurrency and global equity markets, the commodity markets, the markets for forward contracts, options, swaps, and other derivatives. Prereq: ECON 403.

This course deals with the fundamentals of business activities that cross national boundaries. It focuses on not only exports and imports, but all other issues, such as foreign direct investment, international technology transfer, organizational structure, and financial management, that required a corporate strategy in establishing and maintaining global competitiveness. It covers the basic international business activities within an interdisciplinary framework, drawing from economics, finance, accounting, marketing, organizational behavior, political science, and history. Its aim is not only to enable an understanding of such technical issues as how the effects of tariffs and quotas differ or how foreign exchange rates are determined, but also to provide a systemic view of how government policies and corporate strategies interact in changing the environment of international business. The basic premise of the course is that to formulate successful global corporate strategies, we must comprehend and cope with the political, cultural, and economic environment of international business.

ECON 482. High-Tech Regions and Business Strategy (3)
Many regions of the world seek to emulate Silicon Valley’s success as a high-tech center. These include Taiwan, Israel, India, Britain, Cote d’Azur (“Europe’s California”), Pyramid Technology Park of Egypt, and Malaysia. A region’s innovation system serves as both a source of strategic advantage for high-tech companies and as a critical infrastructure for supporting the development and use of new technology by a region’s companies and industries. In this course we look at what makes Silicon Valley so successful as a high-tech region, and whether it can be used as a model for high-tech development in other countries and regions. We examine alternative systems of innovation in other regions of the world and the U.S., including older industrial regions. Countries and regions will be selected depending on class composition. The class will focus on the critical ingredients that form a regional innovation system and their effect on the performance of companies and industries. Prereq: ECON 403 or MBAC 426 or equivalent.

ECON 486. Value Creation through Real Estate (3)
Introduction to economic analysis of real estate markets, with focus on development of urban land. Introduction to financial instruments used in development, and to the role of government in facilitating and constraining the use of real property. Prereq: MBAC 426 or ECON 403 or instructor permission.

ECON 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

ECON 601. Special Problems and Readings (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

ECON 701. Dissertation Ph.D. (1-18)

ECON 702. Appointed Dissertation Fellow (9)

Department of Marketing and Policy Studies

Peter B. Lewis Building
Leonard H. Lynn, Chair
Phone 216-368-6048; Fax 216-368-4785

Division of Labor and Human Resource Policy

Paul F. Gerhart, Head
Phone 216-368-2045; Fax 216-368-4785

Faculty
Melissa Cardon, Ph.D. (Columbia University)
Assistant Professor of Labor and Human Resource Policy
Paul F. Gerhart, Ph.D. (University of Chicago)
Professor of Labor and Human Resource Policy
Collective bargaining, conflict management and dispute resolution, labor markets, wage and salary administration
Gil A. Preuss, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor of Labor and Human Resource Management
Strategic human resource management, high performance work systems, organizations and information
Paul F. Salipante, Jr., Ph.D. (University of Chicago)
Professor of Labor and Human Resource Policy
Human resource management in private and nonprofit organizations, theories and procedures of employment conflict, including tension between tradition and change

Adjunct Faculty
Norman G. Halpern, M.A. (Case Western Reserve University)
Adjunct Professor of Labor and Human Resource Policy

Labor and Human Resource Policy (LHRP)

Undergraduate Courses
LHRP 251. Labor and Human Resources Management (3)
The main objective of this course is to discuss four forms of employment relationships (old non-union, old union, new non-union, and new union). The topics include an overview of the legal basis for the employment relationship in the non-union sector (employment standards), a detailed discussion of collective bargaining (the history of the labor movement, the legal basis for unions, the major actors in the employment relationship, the process of collective bargaining, the grievance arbitration process, and the future of the labor movement), the development of human resource management, and the prospects for labor-management co-operation. The course includes a bargaining simulation, which highlights the complex nature of the collective bargaining process. One of the main advantages of the course is the way it relates the dimensions of the employment relationship with appropriate career paths for undergraduate students.

LHRP 311. Labor Problems (3)
This course examines labor/capital/government relations from current and historical perspectives. It reviews sociological, political, psychological, and economic explanations for conflicts and cooperation between labor and management. Selected aspects of law and negotiated institutions, such as individual rights and grievance procedures and a comparison of the U.S. with other countries, are also covered.
LHRP 409B. Unions, Collective Bargaining and Management Policy (2)

The course examines why and how employees join or do not join unions; the processes of certifying and decertifying unions; alternative strategies used by management in dealing with unions; and models of union-management cooperation in traditional manufacturing, transportation, and service industries. The course is focused on U.S. managerial practice, but public policies and practices among selected major trading partners are also considered briefly. Ordinarily an all-day collective bargaining simulation is part of the course. Students enrolling in the 2.0 credit version of the course develop an independent reading assignment on grievance arbitration and attend and analyze a live grievance arbitration hearing.

LHRP 413. Economics of Negotiation and Conflict Resolution (3)

LHRP 421. Strategic Human Resource Management (3)

The effective motivation and management of human resources within the enterprise is treated in this course with special emphasis on the integration of Human Resources strategy into the overall competitive strategy of the enterprise. Implications of the inevitable conflict of goals and interests among organization members are considered, covering such areas as hiring, performance appraisal, labor-management relations, employee rights, pay systems, grievance systems, and worker participation.

LHRP 424. Developing High Performance Work Systems (3)

This course will focus on understanding the factors shaping high performance work systems (HPWS) in organizations. Overall, an HPWS is based on a philosophy of using people to provide a sustainable competitive advantage; a reorganization of work structures and processes to maximize organizational learning and customer responsiveness; a set of human resource policies that seeks to build employees' motivation and skills, and align individual interests with those of the organization; and new approaches to managing employees that are consistent with these philosophies, work organizations, and policies. The content of the course is divided in three parts: 1) an introduction to HPWS, 2) components of HPWS, and 3) factors beyond the work systems that shape adoption and outcomes. Course work will include a combination of readings from various sources as well as several cases for class discussion. Class grade will be based on participation, individual case analyses, a paper addressing a topic within HPWS, and a final exam. Prerequisites: MBAC 413 or MGMT 413.

LHRP 425. Managing Human Resource Issues in Entrepreneurial Firms (3)

This course examines how entrepreneurial firms can develop human resource strategies and practices to sustain their vision, grow their businesses, and create value for customers, shareholders, and employees. The first half of the course will be devoted to exploring the distinctive challenges entrepreneurial firms encounter in aligning organizational goals and human resource strategy and practices. Among those practices to be studied in the first half of the course are staffing, recruitment and selection, compensation, and employee motivation. The second half of the course will explore these issues further in the context of key organizational phases ranging from firm foundings, the transition from entrepreneurial to professional management, the development of “entrepreneurship” in existing organizations, and the spin-off of the new corporate ventures. Cross-listed as ENTP 425.

LHRP 431. Advanced Negotiations (3)

This course builds negotiation concepts and principles introduced in the Negotiations Lab (MBAC 413L or MGMT 413L). The focus is on enhancing individual as well as organizational performance and competitive advantage through “principled negotiation,” “win-win” bargaining; and collaborative approaches to bargaining. Concepts, strategies, and models of negotiation are drawn from social psychology, economics, labor, relations, and legal literature. Students will also be introduced to mediation (both as mediators and negotiators); to the complex art of advocacy and to the latest alternative dispute resolution (ADR) techniques. There is heavy reliance on role-play and simulations to introduce the main ideas developed in the course. There is no prerequisite for the course. The first week of the course is devoted to a review of concepts introduced in the 1.0 credit hour Negotiations Lab for students who have not taken it.

LHRP 435A. International Human Resources Management (1.5)

This course examines the unique challenges of managing Human Resources globally. Particular emphasis is on cultural and other contextual differences, and their influence on other HR practices such as selection, training, performance management, compensation, and union relations. The course establishes a conceptual foundation in cross-cultural cognitive and behavioral differences. Heavy emphasis is on case analysis. Students enrolling in the 2.0 credit version of the course will select a particular region or country (other than the one where they hold citizenship) and develop an independent analysis of particular advantages and challenges facing the human resource manager assigned to this country or region. The instructor may approve alternative projects. There is no formal prerequisite, but it is recommended that students have either completed, or are taking concurrently, the Human Values in Organizations course (MBAC 413 or MGMT 413) or LHRP 421.

LHRP 435B. International Human Resources Management (2)

This course examines the unique challenges of managing Human Resources globally. Particular emphasis is on cultural and other contextual differences, and their influence on other HR practices such as selection, training, performance management, compensation, and union relations. The course establishes a conceptual foundation in cross-cultural cognitive and behavioral differences. Heavy emphasis is on case analysis. Students enrolling in the 2.0 credit version of the course will select a particular region or country (other than the one where they hold citizenship) and develop an independent analysis of particular advantages and challenges facing the human resource manager assigned to this country or region. The instructor may approve alternative projects. There is no formal prerequisite, but it is recommended that students have either completed, or are taking concurrently, the Human Values in Organizations course (MBAC 413 or MGMT 413) or LHRP 421.

LHRP 440. Human Resources Policy for Executives-E.M.B.A. (2)

This course focuses on managing human resources from the viewpoint of the general or line manager. It considers strategic, practical and legal aspects of hiring, performance appraisal, grievance systems, pay systems, worker participation and unions. Some emphasis is given to the enhancement of negotiating skills to improve outcomes for all organizational participants. This course is limited to students in the Executive M.B.A. program.

LHRP 445. Compensation and Benefits (3)

Strategic management of compensation and benefits for effective motivation of managers and employees is introduced through the use of cases and student development of a wage and salary system based on a live organization. Since government-mandated and voluntary benefits comprise a third of compensation costs for many firms, significant attention is given to the attraction, retention, and motivational effects of benefits such as tuition reimbursement and training programs. Contingent compensation as a motivator and employment cost control device are also given significant attention.

LHRP 451. Alternative Dispute Resolution (2)

(See LAWS 351.) Cross-listed as LAWS 351.

- **LHRP 501. Special Problems and Topics (1-18)**
  - This course is offered, with permission, to students undertaking individual reading or research projects in a field of special interest.
LHRP 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

LHRP 701. Dissertation Ph.D. (1-18)
LHRP 702. Appointed Dissertation Fellow (9)

Division of Management Policy
Robert D. Hisrich, Head
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Faculty
Robert D. Hisrich, Ph.D. (University of Cincinnati)
Professor of Management Policy; Mixon Chair of Entrepreneurship

Entrepreneurship, venture capital and international business
John D. Aram, Ph.D. (Massachusetts Institute of Technology)
Professor of Management Policy; Director, Executive Doctor of Management Program
Management policy and practices, socio-economic development, institutional analysis
Sayan Chatterjee, Ph.D (University of Michigan)
Associate Professor of Management Policy
Diversification, mode of entry, mergers and acquisitions
David L. Deeds, Ph.D. (University of Washington)
Assistant Professor of Management Policy and Entrepreneurship
Steven P. Feldman, Ph.D. (The Wharton School, University of Pennsylvania)
Associate Professor of Management Policy
Business ethics and professional ethics, leadership, business-society relations
Moren Levesque, Ph.D. (University of British Columbia)
Assistant Professor of Management Policy and Entrepreneurship
Ernesto J. Poza, M.B.A.,M.S. (Massachusetts Institute of Technology)
Professor for the Practice of Management; family business continuity and governance
Richard L. Osborne, M.S. (Case Western Reserve University)
Professor for the Practice of Management

Vasudevan Ramanujam, Ph.D. (University of Pittsburgh)
Associate Professor of Management Policy
Strategic management technological innovation and change, international management
William S. Schulze, Ph.D. (University of Colorado at Boulder)
H.R. Horvitz Professor of Family Business; Assistant Professor of Management Policy and Entrepreneurship

Secondary Appointments
Peter Gerhart, J.D.
Professor of Law, Professor of Management Policy
Eric Youngstrom, Ph.D.
Assistant Professor of Psychology, Assistant Professor of Management Policy

Management Policy (PLCY)

Undergraduate Courses

PLCY 200. Social and Political Environment of Management (3)
This course covers the impact of the legal and regulatory environment of business on the policies and practices of the firm. Director fiduciary responsibility, product liability, antitrust and corporate political action and major issues in the public policy environment of business are also examined.

PLCY 255. The Economic History of the United States (3)
(See HSTY 255.) Cross-listed as ECON 255 and HSTY 255.

PLCY 360. Independent Study (1-18)
Prereq: Consent of instructor.

PLCY 399. Business Policy (3)
This course uses case analysis to develop perspective and judgment on business problems through the integration of functional areas. Formulation, development, and implementation of organization goals and policies, the development of strategy in relation to the competitive environment, and applications of quantitative and behavioral decision-making techniques are examined. Prereq: Senior standing.

Graduate Courses

PLCY 401. SME Management in Europe (3)
The objective of the course is to develop understanding of SMEs and their institutional environment, particularly in the European context, to inspire to entrepreneurial thinking and behavior, to enhance the ability to create and manage SMEs successfully.

PLCY 418. New Enterprise Development (3)
This entrepreneurship course teaches how to start, acquire and manage one’s own business. Valuation, capital acquisition, turnarounds and growth strategies are featured, utilizing successful entrepreneurs and their companies to assure a real world learning experience. Cross-listed as ENTP 418.

PLCY 419. Entrepreneurship (3)
Utilizing active entrepreneurs, class exercises and original case studies, this course will explore the roles of the chief executive in smaller enterprises as negotiator, manager, leader and strategist. Cross-listed as ENTP 419.

PLCY 420. Managing the Family Firm (3)
The vast majority of U.S. firms are family controlled and present special problems in strategic management including the interaction of family and firm objectives, executive succession, management development and motivation, finance, estate planning, etc. This course explores solutions to these problems in the context of guiding the firm’s growth through the threshold between personal and professional management. The course pedagogy is participative and experiential. Cross-listed as ENTP 420.

PLCY 422. Managing an Emerging Growth Enterprise (3)
Students are exposed to what it is like to work in an emerging growth company with sales under $100 million. Prospective students might be individuals who are considering employment with middle market company, entrepreneurs who may start a company, or business persons who may buy a middle market company. The learning experience will stem from participating in an actual semester-long project. In-class discussions include: business planning, selling, managing technology transfer, and creativity/innovation, and guest presentations by CEOs from middle market companies. Prereq: ACCT 401 and BAFI 402 and MKMR 403 and MIDS 409 and consent of instructor. Cross-listed as ENTP 422.

PLCY 424. Advanced Principles of Entrepreneurship (3)
This course will provide students with in-depth information on the entrepreneurial process by cross-cutting the stages of venture development with key functional business areas including marketing, operations, strategic planning, finance, and human resources. Each student will complete a practicum with a host company that consists of a weekly time commitment (work schedules will be set and agreed to by the course instructor, the host company and the student). Prereq: Approval of Ellen Blahut, EDI. Cross-listed as ENTP 424.

PLCY 425. Chief Executive Officer (3)
This course is designed for students who aspire to become a chief executive officer. The unique role, responsibilities, and requirements of the CEO will be explored. Students will benchmark CEO best practices through exposure to leading chief officers, study the paths to and preparation for the top job, and develop a personal career strategy to increase their chances of becoming a CEO.

PLCY 425H. Chief Executive Officer (3)
This course is designed for students who aspire to become a chief executive officer. The unique role, responsibilities, and requirements of the CEO will be explored. Students will benchmark CEO best practices through exposure to leading chief officers, study the paths to and preparation for the top job, and develop a personal career strategy to increase their chances of becoming a CEO.

PLCY 426. International Entrepreneurship (3)
This course introduces the area of international entrepreneurship by focusing on various aspects of this area. Topics to be covered include: conditions making small, medium-sized, and new ventures increasingly important in international business; information sources relevant to interna-
PLCY 427. Entrepreneurial Strategy (3)
This course focuses on the entrepreneurial process from a behavioral perspective by defining and developing the skills and behaviors necessary to be entrepreneurial in both the start-up and in the established firm setting. From the readings, case material and from interviews, you will develop a definition of the skills and competencies of entrepreneurs. You will also focus on developing your own competencies through exercises and a personal assessment of your entrepreneurial strategy. Finally, you will acquire strategies that will promote innovative thinking, idea championing, and change in established firms. Cross-listed as ENTP 427.

PLCY 428. Small Enterprise Consulting (3)
Student teams will apply their expertise and experience to solve a strategic problem for a small enterprise selected by COSE (Council of Small Enterprises). Teams are expected to meet with their client, manage the project workload, and provide a case report with recommendations. Cross-listed as ENTP 428.

PLCY 429. New Venture Creation (3)
This course focuses on all aspects of creating a new venture from both an entrepreneurial as well as an intrapreneural perspective. The primary focus of the course will be understanding all the aspects of the business plan as well as understanding the feasibility of the venture. The course will also involve understanding the role of capital in the firm, the organization, and the production plans all within the context of the business plan framework. (Fall) Cross-listed as ENTP 429.

PLCY 440. Entrepreneurial Finance (3)
This course explores the financing of entrepreneurial new ventures. The primary focus of the course will be the various financing methods and mechanisms available to entrepreneurs. This will involve understanding the role of capital requirements, bootstrap financing, angel investors, venture capitalists, private placements, firm valuation and initial public offerings. Cross-listed as ENTP 440.

PLCY 441. Technology-Based Entrepreneurship (3)
This course seeks to equip students with the skills and factual information they need to create viable businesses in the face of such dynamism and uncertainty. We will develop skills to assess the viability of technology-based opportunities. We will also examine the elements of strategic analysis and positioning for competitive advantage in dynamic markets. Finally, we explore how entrepreneurs can create and structure the internal resources of the firm in order to exploit market opportunities and growth. While technology-based entrepreneurs often focus on technology and product-related issues, lack of attention to the creation, organization, and protection of internal resources can be a key inhibitor of growth. Cross-listed as ENTP 441.

PLCY 450. Challenges to U.S. Management from East Asia (3)
Examination of the Japanese, Chinese, and other East Asian business systems. Looks at how the business systems relate to broader social, economic, and political contexts. Compares the different systems with each other and with that of the United States. Inquires into the reasons for the past successes and recent problems of these systems.

PLCY 451. Development and Implementation of Global Strategy (3)
World events have radically altered the business environment as well as the structure and decision making of business throughout the world. Businesses today must increase their awareness of the influence of international events and activities on their future and establish and conduct transactions in other countries. While businesses become international for such reasons as a desire for continued growth, domestic market saturation, the opportunity to exploit some new technological advantage, the dominant reason relates to performance, as there is a correlation between improved performance and the degree of internationalization and the extent to which this internationalization is focused through a well-formulated global strategy, the substance of this course.

PLCY 471. Innovation and Intrapreneurship (3)
This course is designed to acquaint students with the ongoing innovation process in an organization. Through in-depth participation and observation of an innovation in an area organization, students develop an understanding of what leads to entrepreneurial activity and the analytical skills to evaluate and design managerial processes for innovation. Cross-listed as ENTP 471.

PLCY 472. Strategic and Organizational Issues in the Management of Technology (3)
This course addresses a wide variety of strategic and organizational issues that confront firms in technology-intensive environments. Although the emphasis is on firms in the private sector, public policy issues will be covered where appropriate. The course covers five broad themes: (1) managing firms in technology-intensive industries, (2) linking technology and business strategies, (3) using technology as a source of competitive advantage, (4) organizing the firm to achieve these goals, and (5) implementative technology in organizations. Case studies and participation in class discussions are stressed. In addition, students analyze actual situations in organizations and summarize their findings and recommendations in an in-depth term paper. Prereq: BAFI 402 and ECON 403 and MKMR 403.

PLCY 473. E-Business Strategies (3)
This course will develop a basic understanding of how e-commerce firms have developed a strategy for providing value to both consumers and businesses. The course will build on the basic strategy frameworks that the students have learned in their course strategy classes. The pedagogy will involve short lectures and case discussions. Prereq: MBAC 411 and MBAC 421.

PLCY 480. Management Policy and Strategic Planning I.E.M.B.A. (2)
This course places the functional areas covered in the first year in the Executive M.B.A. program in a context of corporate objectives and works on problems involving the interaction of functional areas. This course is limited to students in the Executive M.B.A. program.

PLCY 481. Strategic Planning-E.M.B.A. (2)
This course develops an understanding of the long-term strategic view of the firm. The ability to analyze types of business strategies and capabilities is emphasized. Readings and cases examine alternatives, including internal growth, acquisitions, divestitures, and other emerging forms of corporate development. This course is limited to students in the Executive M.B.A. program.

PLCY 488. Applied Problem Analysis-E.M.B.A. (2)
Participants are required to study an organization of corporate problems which reflects individual backgrounds and interests and which is of significance to their futures and to corporate objectives. This analysis is carried out with faculty supervision and may be conducted with a team of full-time M.B.A. students. This course is limited to students in the Executive M.B.A. program.

PLCY 490. Diversification and Merger Strategies (3)
This course explores the determinants of successful diversification strategies and a special case, acquisitions, to sustain growth and profitability. The course develops current frameworks of diversification based around the notion of synergy and/or capabilities transfer at the business strategy level. Using the fundamentals of competitive strategy, the course addresses types of entered markets (related or unrelated) and the mode of entry (direct, joint venture, acquisition, etc.). The course also develops advanced frameworks of diversification built around the concept of strategic intent, core competencies, leveraging of resources and dominant logic. Finally, the course develops the concepts that are useful in acquisitions. These concepts will address individual acquisitions as well as acquisition programs. The course content will be complemented by guest speakers from industry. Prereq or Coreq: PLCY 495 or PLCY 499. Prereq: BAFI 403.

PLCY 494. Consultation/Management of Professional Service Firms (3)
The course views consultancy as a role rather than career and conceptualizes consultancy as a process of optimizing an organization’s value creation potential. Students should be able to apply the concepts regardless of career choice. Unique aspects of consultancy to entrepreneurial firms will be emphasized. Exposure to senior practicing consultants is featured. Students will learn to match consulting methodologies with client needs. Projects include student consultancy to actual companies.
PLCY 495. Industry and Competitive Analysis for Strategic Planning (3)
This course introduces methods of industry and competitive analysis. Industry structure and firm competitive behavior are studied with a view to developing business strategies for securing and preserving competitive advantage. Emphasis is placed on understanding industry dynamics and the processes by which industries undergo change and evolution. Emphasis is also placed on firms' capabilities and core competencies and their capacity to implement major strategic changes in their industries. Readings and cases are the principal pedagogical tools utilized in this course. Students are required to analyze an industry of their choice in small project teams and present their analyses in class.

PLCY 496. Strategic Planning and Control Systems for Strategy Implementation (3)
This course introduces the principal tools of strategy implementation, namely the design of organization structures, the use of formal planning and control systems, and the design of measurement and reward systems. The importance of organizational context (small vs. large, for profit vs. not-for-profit, manufacturing vs. service, etc.) and the need to tailor systems to the context of the organization are emphasized. New and emergent organizational forms and their role in strategy development and implementation are reviewed. Cases and readings are the principal pedagogical methods utilized. Students work in small project teams, study the operation and effectiveness of systems for strategic control in organizations, and present the results of their analysis in class presentations.

PLCY 499. Management Policy (3)
This course focuses on the work of top managers in their roles as creator of value in organizations and society. The multiple skill requirements of top managers' roles are stressed, particularly their leadership ability and their ability to develop and implement strategies for the long term in the face of environmental changes and domestic and global competitive threats and opportunities. The integration of functional areas such as marketing, finance, manufacturing and human resource management into a coherent and comprehensive analysis of the total organization is emphasized. Course requirements vary, but exercises such as computer simulations of whole industries, field projects involving contact with local organizations, and strategic analysis of firms or industries using in-depth library research are frequently used. The course is taught through the case method, and learning by discussion, reading, debate and written analysis of cases is stressed. The course tends to be more varied and open-ended than functional area courses. Prereq: Completion of all other required M.B.A. courses.

PLCY 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest. Prereq: Consent of instructor.

PLCY 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

PLCY 701. Dissertation Ph.D. (1-18)

Division of Marketing
N. Mohan Reddy, Head
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Faculty
Stanton G. Cort, D.B.A. (Harvard University)
Associate Professor of Marketing
Market opportunity analysis, channel management, multinational market entry strategy and marketing and development
Ellen Garbino, Ph.D. (Duke University)
Assistant Professor of Marketing
Tripath Gill, M.B.A. (Indian Institute of Management)
Instructor of Marketing
Detelina Marinova, Ph.D. (University of Cincinnati)
Assistant Professor of Marketing
N. Mohan Reddy, Ph.D. (Case Western Reserve University)
Associate Professor of Marketing; Interim Associate Dean for Executive Education; Nancy and Joseph Keithley Professor in Technology Management
Management and marketing technology

Jose Antonio Rosa, Ph.D. (University of Michigan)
Assistant Professor of Marketing
Diptip Singh, Ph.D. (Texas Tech University)
Professor of Marketing
Marketing research, research methodology and measurement, consumer satisfaction/dissatisfaction and issues in boundary spanning roles
Deepak Sirdeshmukh, Ph.D. (Ohio State University)
Visiting Assistant Professor of Marketing
Consumer memory and persuasion processes underlying brand positioning, brand image and consumer satisfaction management

Secondary Appointment
Eric Youngstrom, Ph.D.
Assistant Professor of Psychology; Assistant Professor of Marketing and Policy Studies

Marketing (MKMR)

Undergraduate Courses

MKMR 301. Marketing Management (3)
This course covers key concepts and practices of marketing with emphasis on analysis and development of integrated marketing plans and programs that create customer value and competitive advantage in the world-wide marketplace. Prereq: ACCT 102.

MKMR 360. Independent Study (1-3)
This course is offered, with permission, to students undertaking reading and research in an area of their special interest.

Graduate Courses

MKMR 403. Managerial Marketing (3)
This course focuses on managing marketing as a process of creating value and mutually desirable exchanges of values. That is the foundation of a customer orientation and a central theme of market-driven management. Methods for strategic marketing planning, understanding buyer behavior, market analysis, segmentation and devising integrated marketing programs are introduced. Creating customer value and competitive advantage in worldwide markets is the central theme. Prereq: ACCT 401.

MKMR 405. Industrial/New Technologies Marketing (3)
This course focuses on concepts and practices of business-to-business marketing of products and services. It also examines how rapid technological change impacts industrial markets. Topics covered include: buyer-seller relationship building, competitive bidding, developing markets for new materials and value-based pricing strategies. Marketing to the government, marketing of intellectual property and marketing-R&D-manufacturing interface issues will also be explored. Prereq: MKMR 403 or MBAC 424.

MKMR 406. Sales Force Management (3)
The best laid plans of marketing managers must be implemented in the trenches by the field sales force. This course provides a conceptual framework and analytical tools to profitably manage a firm's field sales force. It first focuses on assessing key sales force outcomes: productivity of investment in the sales force, performance of individual salespeople, and turnover. Students then examine how to structure, deploy, motivate and compensate the sales force to maximize individual performance, manage turnover and provide a solid return on sales force investment. Specific issues covered include design and management of selling teams and independent agents, national account management, and managing the relationship between the marketing department and the sales force. Prereq: MKMR 403 or MBAC 424.

MKMR 407. Supply Chain Management (3)
If you're not on the shelf, you're not in business. This course addresses managing the processes of getting products and service to market. It focuses on strategic and tactical management of the supply chain and distribution channels as value-adding networks. Topics include assessing the value creation potential of network members (suppliers, producers, distributors, dealers, and retailers), which of them should make key decisions and how they relate to each other. Emphasis is on communication
throughout the marketing network to coordinate activity, to provide appropriate compensation, and to ensure the marketing program is implemented effectively at the customer level. Prereq: MKMR 403 or MBAC 424 or MIDS 456. Cross-listed as OPMT 407.

MKMR 410. Marketing Research for Decision Making (3)
This course stresses the generation and use of marketing information for a range of managerial decisions, including identifying and defining marketing performance and improving understanding of marketing as a process. This course discusses contemporary approaches for defining marketing information needs, designing methods for information collection and making sense of obtained results. The course utilizes lecture/discussion, case analysis, and a field project to develop skills in defining and solving marketing problems. Prereq: MKMR 403, MBAC 414, MBAC 424, QUMM 414. Coreq: MBAC 424.

MKMR 411. Consumer Behavior (3)
This course addresses micro and macro issues in consumer behavior which are essential for managers seeking to analyze and influence consumer decision making. The course focuses on how consumer behavior analysis can be used to develop effective marketing techniques and strategies. This involves developing an understanding of consumer behavior from a variety of perspectives, identifying the major factors that influence how consumers process and learn, marketing communications, managing consumer satisfaction, and developing an understanding of purchase decision making and its implications for marketing strategy. Emphasis is placed on designing persuasion strategies, enhancing brand memory, consumer profiling, analyzing consumer trends, and customer relationship management. Prereq: MKMR 403 or MBAC 424. Coreq: MBAC 424. MKMR 411K. Marketing (3)

MKMR 412. E-Marketing (3)
Using a combination of lectures, cases, and hands-on projects, the course examines how the Internet influences all the key aspects of marketing, including marketing strategy, pricing, advertising, segmentation, marketing research, retailing, distribution channels, and international marketing. Additionally, the course will cover more Internet specific topics such as privacy, wireless web, sales force automation, and emarketplace models. The course incorporates both business-to-business and business-to-consumer outlooks.

MKMR 413. Services Marketing (3)
The service sector contributes to greater than 50% of the U.S. GNP and total employment. By all accounts, global markets are experiencing a strong surge in demand for services and there is increasing competitive intensity among service organizations. In contrast to consumer and industrial products, managing and marketing services pose unique challenges to managers and the service organization. These include understanding service customer needs, managing internal service quality, creating effective organizational blue-prints for service delivery, and building organization and brand equity to create sustainable competitive advantages. These challenges are best overcome through a systematic and thoughtful study of services marketing and developing frameworks to guide strategy development and implementation. Prereq: MKMR 403 or MBAC 424.

MKMR 415. Managerial Marketing-E.M.B.A. (2)
This course focuses on the analysis, planning, and implementation of marketing strategies from middle and upper management perspectives. Key concepts and methods for the development of integrated marketing programs are introduced. This course is limited to students in the Executive M.B.A. program.

MKMR 420. Health Systems Marketing (3)
This course stresses the practical application of marketing technique to health care products and services. The major components of the industry and the interrelationships among health care customers, payers, providers and equipment suppliers are examined. Also addressed are ethical issues of health care marketing. Prereq: MKMR 403 or MBAC 424 or consent of instructor. Cross-listed as HSMC 422.

MKMR 421. Product and Brand Management (3)
Established products and brands typically provide the majority of firms’ earnings. If carefully managed, these products also are a significant source of growth and future earnings. This course focuses on the role of a Product/Brand Manager in profitably managing a firm’s existing offering. Students identify areas for growth (or decline) within a firm’s mature product lines, devise ideas to capitalize on growth potential or address decline, develop and assess concrete marketing initiatives, and determine the financial impact of alternative plans. The course uses a combination of case analysis, lecture/discussion and guest speakers, allowing students to develop their repertoire of quantitative and qualitative marketing decision skills. Prereq: MKMR 403 or MBAC 424.

MKMR 425. Global Marketing (3)
This course addresses the process of marketing across political and cultural boundaries, within trade groups like the EC, NAFTA and ASEAN and under global trade systems like the WTO or GATT. Emphasis is on planning, programming and managing profitable marketing strategies for exporting, importing or in-country production. Topics include: comparative opportunity analysis, identification of key points where value is added, market entry strategies, in-country competition after entry, and worldwide strategies for various stages of multinational marketing involvement. Prereq: MKMR 403 or MBAC 424.

MKMR 450A. Entrepreneurial Marketing-E.M.B.A. (2)
This course addresses the entrepreneurial/innopreneurial process of commercializing an idea for a market opportunity. Students select an opportunity and develop a deployable, one-year market entry program and a five-year strategic marketing program. Emphasis is on the entrepreneurial marketing decision process, including defining the business, defining the market, specifying customer perceived value, assessing competitive capability and advantage, identifying and properly using secondary and primary information, and deploying marketing programs throughout the organization and the supply chain. Prereq: Open to only E.M.B.A. students.

MKMR 450B. Entrepreneurial Marketing-M.B.A. (3)
This course addresses the entrepreneurial/innopreneurial process of commercializing an idea for a market opportunity. Students select an opportunity and develop a deployable, one-year market entry program and a five-year strategic marketing program. Emphasis is on the entrepreneurial marketing decision process, including defining the business, defining the market, specifying customer perceived value, assessing competitive capability and advantage, identifying and properly using secondary and primary information, and deploying marketing programs throughout the organization and the supply chain. Prereq: MKMR 403 or MBAC 424. Cross-listed as ENTP 450.

MKMR 460. Marketing Communications Management (3)
This course provides a sound understanding of management of an organization’s total marketing communications. The focus is on identifying appropriate strategies and tactics for effectively communicating with end consumers and other stakeholders/publics, in order to manage the firm’s brand equity and its market, industry and societal positioning. Students examine the roles of advertising, sales promotion, point-of-purchase efforts, and public relations, and emerging direct marketing technologies. They work with developing and managing these elements as part of an overall, synergistic communications strategy. Marketing communications for ongoing and crisis situations are developed. Multiple perspectives on evaluation of the effectiveness of marketing communications are introduced. Topics addressed include: integrated marketing communications, brand equity management, corporate communications strategies, public relations management, and crisis management. Prereq: MKMR 403 or MBAC 424.

MKMR 475. Logistics/Physical Distribution Management (3)
(See OPMT 475.) Prereq: OPMT 405. Cross-listed as OPMT 475.

MKMR 476. Purchasing/Materials Management (3)
(See OPMT 476.) Cross-listed as OPMT 476.

MKMR 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading or a project in a field of special interest.

MKMR 511. Advanced Marketing Problem Solving (3)
This course emphasizes a problem solving approach for key marketing decisions that relies on graphical, exploratory, and statistical analysis of market data. Utilizing case studies, online databases, and secondary data, the course facilitates learning of the power of multivariate analysis in providing insights into, and clarifying the underlying dynamics of marketing phenomenon. Marketing decisions discussed cover consumer and industrial marketing problems. Intended for advanced students who are interested in data-based-decision-making tools for marketing problems. Prereq: MKMR 410 or consent of instructor.
MKMR 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading or a project in a field of special interest.
MKMR 701. Dissertation Ph.D. (1-18)

Department of Information Systems
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Faculty
Michel Avital, Ph.D. (Case Western Reserve University)
Assistant Professor of Information Systems Application of appreciative inquiry to people-centered design
Richard J. Boland, Jr., Ph.D. (Case Western Reserve University)
Professor of Information Systems, Department of Information Systems; Professor of Accountancy
System design, problem formulation, organizational impact of information systems, interpretive studies of design and use of information systems
WooYoung Chung, D.B.A. (Boston University)
Assistant Professor of Information Systems
Fred Collopy, Ph.D. (The Wharton School, University of Pennsylvania)
Professor of Information Systems and Chair
Business and economic forecasting, value and organizational impacts of computing and software design
Jan Damsgaard, Ph.D. (Aalborg University)
Visiting Associate Professor of Information Systems
Matt Germonprez, Ph.D. (University of Colorado)
Assistant Professor of Information Systems
Social and cognitive issues dealing with the use of communication technology
Tanvir Goraya, Ph.D. (Case Western Reserve University)
Visiting Assistant Professor of Information Systems
Kalle Lyytinen, Ph.D. (University of Jyväskylä)
Professor of Information Systems
Julie Rennecker, Ph.D. (Massachusetts Institute of Technology)
Significance of extra-boundary contexts for anticipating and interpreting virtual work practices; Social and labor implications of virtual work arrangements
Paul P. Stork, M.B.A. (Case Western Reserve University)
Professor for the Practice of Information Systems
Betty Vandenbosch, Ph.D. (University of Western Ontario)
Associate Professor of Information Systems
Executive information systems, learning and information for decision-making
Youngjin Yoo, Ph.D. (University of Maryland)
Assistant Professor of Information Systems; Collaborative technology, the role of information technology in learning, virtual team management, information technology and organizational transformation

Adjunct Faculty
Alan F. Dowling, Jr., Ph.D. (Massachusetts Institute of Technology)
Adjunct Professor of Information Systems

Information Systems (MIDS)
Undergraduate Courses
MIDS 307. Computer Programming and Problem Solving (3)
The objective of this course is to help students gain proficiency in computer programming using a procedural language. Emphasis is placed on a modular, structured approach to developing programs; the use of workbench tools (dynamic debuggers, etc.) for increasing productivity in the development and testing of programs; the use of data structures such as lists, trees, hashtables, etc.; the use of a variety of file structures; and the design and analysis of efficient algorithms.

MIDS 308. Development of Information Systems (3)
The purpose of this course is to provide students with a basic understanding of human information exchange within an organizational context and how technology can be used to support various information exchange activities and gain competitive advantage. Topics include shortcomings of human decision making, decision support systems, information technology-enabled new organizational forms, strategic use of information technology, e-commerce, and ethical issues involved in the use of information technology. Through analysis of case studies and group projects, students explore the central management issues concerning the effective use of information technology in today’s globally competitive organizations. Prereq: Proficiency in Excel.

MIDS 309. Management of Information Systems (3)
This course is designed to familiarize students with some important issues in the design and development of information systems. Topics include: using information technology as a tool to redesign organizations, managing the information system development process, managing the implementation of new information systems, and designing databases. Students will develop the interpersonal, analytical and technical skills needed to analyze an organization as a system and to design and develop an information system. Working in teams, students deal with real-world organizations to analyze their information requirements and design systems that meet the requirements. Prereq: MIDS 308 and proficiency in Access.

MIDS 310. Technology of Information Systems (3)
Review of present day computing systems and function of modern computer technology. Computer systems architecture, file structures, operating systems, compilers and assemblers, and telecommunications. Prereq: MIDS 309.

MIDS 315. Multimedia Systems (3)
Current practices and future directions of multimedia systems are discussed. Special attention is given to management issues involved in specifying, designing, developing, and assessing multimedia systems and to design principles that can be used to improve the quality of multimedia. This is a project-based course in which students gain experience in developing websites, CD-ROMs, and films. Prereq: Not open to first-year students.

MIDS 326. Systems Analysis and Design (3)
This course investigates concepts and techniques for analyzing organizational systems in order to identify opportunities for redesigning the organization, its work practices and/or its information systems. It emphasizes creativity in diagnosing organizational problems and opportunities. You will learn consultation and intervention strategies for moving to a consensus on problem definition and a vision of desired changes. You will learn both soft and structured object-oriented methods for performing systems analysis. In addition you will learn the process of documenting new organizational and information system requirements in a form suitable for detailed system design and implementation. Prereq: MIDS 309.

MIDS 327. Database Management (3)
Technical and managerial issues of database management, especially the features of database management systems (D.B.M.S.) and the role of the database administrator (D.B.A.). D.B.M.S. using the three major data models are presented. Techniques for database designs at the logical and physical level are discussed. Students will have hands-on experience in using a D.B.M.S. Prereq: MIDS 309 and MIDS 310.

MIDS 329. Design of Object-Oriented Systems (3)
This course provides an opportunity to gain an understanding of the concepts and technology of object-oriented systems and learn system design techniques that take full advantage of this technology. Students also develop competence in programming in an object-oriented language. Prereq: Ability to program in Pascal or C, or consent of the instructor. MIDS 360. Independent Study (1-18)

Graduate Courses
MIDS 401. Leadership Dialogues: The CIO’s Perspective (1)
The purpose of this course is to engage M.B.A. students in issues facing today’s technology leaders. The course will be facilitated by Lev Gonick and will bring technology executives from industry into each session. The issues will focus on such things as technology vision and planning.
change management, assessing emerging technologies, economics of technologies, personnel and contractor issues, and the strategic use of information technology. The course is designed to prepare students to take a proactive role in managing information technology, to understand the importance of technology to the overall competitive positioning of the firm, and to understand how technology and systems permeate every aspect of the organization.

MIDS 403. Management of Information-E.M.B.A. (1)
This course is concerned with information as a resource in organizations. Students develop an appreciation of how information can support management decision making and control; an understanding of the factors influencing the individual and group processes of creating, distorting, communicating and using information; and the skills required to anticipate, recognize and diagnose those factors effectively. This course is limited to students in the Executive M.B.A. program.

MIDS 404. Management Information Systems-E.M.B.A. (2)
This course investigates the strategic and operational use and value of information technology in organizations. Its objectives are to enable students to assess both the opportunities and the challenges resulting from information technology and to become fluent with and comfortable addressing the issues relating to the management of the IT function and its resources. This course is limited to students in the Executive M.B.A. program.

MIDS 407. Computer Programming and Problem Solving Using Java (3)
The objective of this course is to help students gain proficiency in computer programming using an object-oriented programming language. Emphasis is placed on a modular, structured approach to developing programs: the use of workbench tools (IDE, dynamic debuggers, etc.) for increasing productivity in the development and testing of programs; and the use of the various packages in Java to facilitate rapid application development including JDBC and Swing. UML will be presented as a modeling tool and interfaces, thread management, and exception processing will be covered. Applications will be developed using classes, applets, servlets, and JavaBeans. Prior experience or course work with procedural programming is recommended.

MIDS 409. Introduction to Management Information Systems (3)
This course focuses on the effective, value creating deployment of information technology in organizations. Students develop a strong conceptual foundation as a basis for determining and evaluating information and decision support requirements, and for identifying opportunities to amplify individual and organizational intelligence through information technologies. The examination of actual systems being used in organizations serves to ground the concepts and issues explored in the course and make them as relevant as possible to the needs of modern organizations operating in a global environment.

MIDS 410. Information Technology Architectures (3)
Just as a crafts-person needs an intimate understanding of the tools of a trade, the information professional must understand the architecture of hardware, telecommunication facilities, operating systems, applications and networks. This course covers how prioritization, security, sharing and distribution can be improved by parallelism and how required synchronization can be safely and efficiently implemented across an essentially layered architecture that extends from the chip to the user-friendly application. Prereq: MIDS 409 or MBAC 425.

MIDS 411. Advances in Information Systems Technology (3)
This course examines advanced and emerging information technologies, and evaluates their potential uses. Topics include: advanced computer architectures, massively parallel computers, networking, graphics, machine learning, and new programming paradigms. Prereq: MIDS 409 or MBAC 423.

MIDS 415. Multimedia Systems (3)
As information becomes more abstract and therefore more difficult to perceive directly with one’s sense, sonic and visual presentation become more important than ever. Designing systems that take advantage of people’s aesthetic sensibilities is an area wide open to the enterprising and inventive entrepreneur. This course will interest those who think that artists have a say about how sound and graphics and words might be put together. The course examines aesthetic issues that arise in the development of multimedia. It focuses on creative integration of video, audio, and graphics particularly for the web, interactive CDs, and virtual reality. Prereq: Ability to program in any modern high-level language.

MIDS 418. Intelligent Support Systems (3)
Information systems should be active partners in the work group with responsibility for pattern recognition, task coordination and memory. This course provides students with an understanding of the factors influencing individual and group processes of creating, communicating, using and distributing information. Through case studies and hands-on use of data analysis, group decision and A1 tools, students learn how increased levels of intelligence can be built into both work flow systems and decision support systems. Prereq: Instructor approval required if student has already completed MIDS 414 and/or MIDS 422.

MIDS 426. Systems Analysis and Organizational Design (3)
This course emphasizes creativity in diagnosing organizational problems and opportunities. Students learn to generate high payoff (strategically significant) models for organizational and information system design. It covers consultation and intervention strategies for moving to a consensus on problem definition, a vision of desired changes and the preparation of functional specifications for the required information system to support that new organizational vision. Prereq: MIDS 409 or enrollment in M.S.M.-IS program. Preference given to M.S.M.-IS candidates.

MIDS 427. System Development and Data Management (3)
This course presents principles of system development using both relational and object-oriented databases. State-of-the-art tools are employed for developing both client and server system components. Object orientation is stressed as a design philosophy. Both prototyping and more conventional life-cycle methodologies are studied. Prereq: MIDS 429 or MBAC 425.

MIDS 429. Design of Object-Oriented Systems (3)
This course provides an opportunity to gain an understanding of the concepts and technology of object-oriented systems, and to learn system design techniques that take full advantage of this technology. Students develop competence in programming in an object-oriented language. Prereq: Ability to program in a procedural language (such as Pascal, C or Visual Basic), consent of the instructor, or enrollment in the M.S.M.-IS program. Preference is given to M.S.M.-IS candidates.

MIDS 432. Health Care Information Systems (3)
This course covers concepts, techniques and technologies for providing information systems to enhance the effectiveness and efficiency of health care organizations. Cross-listed as HSMC 432.

MIDS 433. Managing Electronic Teams in Global Economy (3)
This course covers technical, behavioral, and managerial bases that are necessary to build and manage high-performance global teams whose members are communicating primarily through electronic channels. Students will be working with students at other countries (or other schools) to learn various aspects of cross-functional “electronic” teams via various communication technologies, including electronic mail, groupware, and desktop videoconferencing. Fundamental group processes such as leadership, negotiation, communication, and decision-making will be revisited in the context of electronic teams.

MIDS 442. Management of Information Systems (3)
Examines information technology issues facing senior information management, including the role of information technology in supporting organization strategy: relationships with other senior managers and with end users; technology and applications architectures; funding information technology; managing in distributed technology environments; managing a global information technology activity; technology forecasting; and operational issues such as staffing and procurement. Prereq: MIDS 409 or MBAC 423 or enrollment in M.S.M.-IS program. Preference given to M.S.M.-IS candidates.

MIDS 444. Managing Scientific and Technical Knowledge as a Corporate Asset (3)
This course explores the role of technology in the successful enterprise. It examines the interaction of technical knowledge and systems with strategic enterprise management, with emphasis on managing scientific and technical capabilities as a strategic asset. Students will learn to analyze and assess the value of technical capabilities and to improve their written
and oral skills for communicating about technology management decisions. Prereq: MIDS 409.

MIDS 445. Technologies of E-Business (3)
Emerging concepts and principles in the practice of electronic commerce are presented in a hands-on, experience based approach. Topics covered include: the role of e-commerce in the global economy, key underlying technologies, business-to-business and business-to-consumers applications, knowledge management, security, electronic payments and privacy. Strategic and policy-level implications will be emphasized. Students will complete a team-based e-commerce design and development project. This course complements electives in Multimedia Management and E-Marketing. Prereq: MIDS 409 or MBAC 423.

MIDS 446. Managing E-Business Technologies (3)
The course covers managerial issues to the design, development, and implementation of electronic business sites. It emphasizes aspects of these technologies most important to managers and includes topics such as financial transaction and payment mechanisms, security and control issues, and the use of innovative technologies such as collaborative filtering. Prereq: MIDS 409 or MBAC 423 or permission, or enrollment in M.S.M.-IS program.

MIDS 446H. Managing E-Business Technologies (3)
(See MIDS 446.)

MIDS 450. Case Studies in Electronic Commerce (3)
This course will enable students to understand and evaluate the opportunities and limitations associated with e-commerce when viewed from a global perspective. Students will analyze case studies to identify the management action required to develop solutions in an e-commerce context that are both technologically and culturally feasible. Cases will cover e-commerce issues related to technology, strategy, enterprise resource planning, and computer-supported collaborative work. The course requires written reports synthesizing case analysis findings as well as oral presentation. Prereq: MIDS 409 or MBAC 423.

MIDS 454. Models of Management (6)
Case studies are used extensively in this course in order to strengthen a student’s ability to diagnose deficiencies and propose the redesign of core organizational processes. Students develop a working knowledge of process flow models, accounting models, and cycle models of the firm, as well as basic principles of quality management and financial analysis. Students will also develop an understanding of the structure and process of the firm and its industrial, national, and global markets. Economic and policy models of firms, industries, and markets are presented along with models of marketing as a value creating relationship with customer. Focus is on the competitive performance of the firm and its relation to marketing and strategy formulation and execution, including the financial analysis of technology strategy.

MIDS 456. Models of Management: Firm and Its Environment (3)
Students develop an understanding of the structure and process of the firm and its industrial, national and global markets. Economic and policy models of firms, industries and markets are presented along with models of marketing as a value creating relationship with customers. Focus is on the competitive performance of the firm and its relation to marketing and strategy formulation and execution, including the financial analysis of technology strategy. Preference given to M.S.M.-IS candidates.

MIDS 457. Models of Management: Dynamics of the Firm (3)
Mathematical representations add clarity and precision to the analysis of a firm and its information requirements. This course covers the important theory and methods of modeling an enterprise, emphasizing systems dynamics as the principle modeling technique. Practical managerial applications are studied and students develop and use a systems dynamics model to gain insight into the information and control needs of a firm’s business processes and strategies. Preference given to M.S.M.-IS candidates.

MIDS 458. Managing Corporate Knowledge (3)
Knowledge management has emerged as an important management practice in organizations and many firms use advanced information technology to support effective knowledge creation and sharing. This course covers technical, behavioral, and organizational bases for effective management of knowledge in organizations. Topics that are covered include: knowledge management systems, knowledge creation, knowledge transfer, communities of practice, managing mobilized knowledge, knowledge management and corporate strategy, and knowledge management in multinational corporations. Prereq: MIDS 409, MBAC 423 or enrollment in M.S.M.-IS program.

MIDS 459. Software Engineering (1.5)
This course presents process activities necessary for supporting highly effective software development. Software systems in organizations still fail at highly unacceptable rates. By attending to the details of risk evaluation, documentation, quality assurance, and version control, we can create high quality systems that will not fail. And by using robust methodologies that take advantage of the economics of reuse, we can do so on time and under budget. We also discuss issues of ethics and professionalism that systems professionals are likely to encounter as they progress in their careers. Prereq: Enrollment in M.S.M.-IS or MIDS 409 or MBAC 423.

MIDS 460A. Communication and Negotiation (1.5)
Through a combination of lectures, discussions, simulations and projects, students develop their communication and negotiation skills. Topics include: facilitation, interviewing, report writing and presentation, meeting management, negotiation, making demands and persuasion. This course is taken for one and a half credit hours per semester and is integrated with projects and materials being covered in the other courses. Prereq: MIDS 460A.

MIDS 460B. Communication and Negotiation (1.5)
Through a combination of lectures, discussions, simulations and projects, students develop their communication and negotiation skills. Topics include: facilitation, interviewing, report writing and presentation, meeting management, negotiation, making demands and persuasion. This course is taken for one and a half credit hours per semester and is integrated with projects and materials being covered in the other courses. Prereq: MIDS 460A.

MIDS 461. Change Management (1.5)
This course presents concepts and theories of change management as they are being used in organizations today. We will investigate organizational transformation, team-led process change, implementation strategies, IT readiness, and information sharing and then apply these concepts to business cases. We will also work to further our skills and capabilities as agents. By surfacing our own defenses and resistance to change we will learn techniques for encouraging others to embrace large scale change. Prereq: Enrollment in M.S.M.-IS or MIDS 409 or MBAC 423.

MIDS 470. Analyzing Mobility and Mobile E-Business (3)
Pervasive digital services and mobile computing applications, and intelligent and ubiquitous computing environments will change the landscape of organizational computing and business applications in the next decade. They will also change how we work and how business is conducted. There are technological, business, and regulatory challenges that must be addressed in shifting organizational approaches and technological solutions to this new environment. The goal of this course is to examine state-of-the-art solutions to this new arena, explore business opportunities and analyze research themes and issues that are emerging in this new arena. The course is meant for Ph.D. students studying pervasive computing, advanced M.S.M. students who are interested in this new area, technologically savvy M.B.A. students who want to explore and expand their knowledge in the leading edge technologies and for students in the engineering school who want to study business applications of telecommunication and agent-based technologies. Prereq: MIDS 446 or consent of instructor.

MIDS 485. Web Systems Integration (3)
Standards-based technology is used to help solve complex information system problems in modern organizations. This course brings together component-based development approaches in the context of doing business on the global Internet and on corporate intranets. Enabling technologies are based on published and de facto Internet standards including HTTP and HTML, CGI/API and Perl, CSS, JavaScript, ActiveX, XML, CORBA/DCOM, and SSL/SET. Students are encouraged to contribute to a team effort to design, implement, and integrate an appropriate solution to a selected business problem in electronic commerce or distance learning. They will also develop competency in the foundation technologies.

MIDS 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.
Department of Operations
330 Peter B. Lewis Building
Matthew J. Sobel, Chair
Phone 216-368-4141; Fax 216-368-6250

The Operations Department offers courses in operations research, operations management, and quantitative methods. The Department offers the M.S. in Management in Operations Research, and Supply Chain Management, a Ph.D. degree in operations research, and courses pertinent to the M.B.A. and undergraduate programs.

Faculty
Matthew J. Sobel, Ph.D. (Stanford University)
Professor of Operations and Chair; William E. Unстатtd Professor
Product design and technology change, coordination of operations, finance, and marketing; supply chain management, environmental and energy management; large-scale structured problems.

Apostolos N. Burnetas, Ph.D. (Rutgers University)
Professor of Operations
Markov decision processes

Ronald H. Ballou, Ph.D. (Ohio State University)
Professor of Operations
Planning, analysis, and control of supply chains, with particular emphasis on facility location, transportation, and inventory issues.

Roger A. Bielefeld, Ph.D. (Case Western Reserve University)
Professor for the Practice of Operations, and Director, Information Technology
Artificial neural network models, computer simulation, evolutionary computation, statistical computing, fuzzy representation of uncertainty

Apostolos N. Burnetas, Ph.D. (Rutgers University)
Associate Professor of Operations
Stochastic optimization and learning; adaptive Markov decision processes; models of supply chain management; real options and investment under uncertainty.

Hamilton Emmons, Ph.D. (The Johns Hopkins University)
Professor of Operations
Queueing control, workforce and jobshop scheduling

A. Dale Flowers, D.B.A. (Indiana University)
Associate Professor of Operations, and Codirector, Institute for the Integration of Management and Engineering
Enterprise resource planning, operational forecasting, quality control and management, manufacturing planning and control systems.

Lisa M. Maillart, Ph.D. (University of Michigan)
Assistant Professor of Operations
Stochastic processes, Markov decision processes, maintenance optimization and reliability.

Kamlesh Mathur, Ph.D. (Case Western Reserve University)
Associate Professor of Operations
Management science and statistical applications, mathematical programming.

Harvey M. Salkin, Ph.D. (Rensselaer Polytechnic Institute)
Professor of Operations
Analytical portfolio management, finance and investments, integer programming, linear programming.

Daniel Solow, Ph.D. (Stanford University)
Associate Professor of Operations
Use of models for studying complex systems, linear and nonlinear programming, combinatorial optimization, mathematics and computer science education.

George Vairaktarakis, Ph.D. (University of Florida)
Assistant Professor of Operations, Lewis-Progressive Assistant Professor of Management
Production and workforce planning, just-in-time scheduling, management of flexible manufacturing systems, management of virtual and traditional projects, product/process design, quality management, robust optimization.

Yunzeng Wang, Ph.D. (The Wharton School, University of Pennsylvania)
Assistant Professor of Operations
Service parts logistics, supply chain coordination, new product development, production and inventory models.

Secondary Appointments
Moren Lévesque, Ph.D. (University of British Columbia)
Assistant Professor of Management Policy and Entrepreneurship and Assistant Professor of Operations
Stochastic models for entrepreneurial processes, dynamic modeling of entrepreneurial behavior and decision making, effort allocation models for new venture creation, entry strategies of new ventures.

Thomas E. Love, Ph.D. (University of Pennsylvania)
Assistant Professor of Medicine, Epidemiology and Biostatistics and Assistant Professor of Operations
Data Analysis, diagnostics, experimental and observational study design, psychometrics, statistical process control.

Peter Ritchken, Ph.D. (Case Western Reserve University)
Professor of Banking and Finance; Professor of Operations; Kenneth Walter Haber Professor of Finance
Financial economics, fixed income and derivatives, applied stochastic processes and statistics.

Operations Research (OPRE)

Undergraduate Courses

OPRE 201. Introduction to Operations Research I (3)
This course covers philosophy, concepts, methods, and techniques of operations research, several classical problems and some contemporary case studies. Topics include linear programming, the transportation and assignment problems, integer programming, PERT/CPM, inventory models, simulation, and the use of analytical techniques in portfolio management. Prereq: Introductory statistics.

OPRE 300. Undergraduate Projects in Operations Research (1-18)
Individual operations research projects are carried out by qualified students. Prereq: Consent of instructor.

OPRE 345. Decision Theory (3)
(See OPRE 445.)

OPRE 348. Personal Investment Strategies (3)
This course is an introduction to the world of personal investing. In the framework of personal investment objectives and alternatives, topics included arc: stocks, bonds, convertibles, warrants, options and mutual funds. Discussions of contemporary factors driving stock and bond prices such as international currency and interest rate implications are also discussed. Practical money management programs to meet different investment objectives and levels of wealth are explored. Prereq: ACCT 102 or consent.

Graduate Courses

OPRE 402. Stochastic Models with Applications (1.5)
This course surveys fundamental methods and models in operations research and operations management that incorporate random elements. Topics discussed will include basic results from the theory of stochastic processes, especially Markov chains; an introduction to stochastic dynamic programming; and models in the control of queues and inventories. Prereq: OPRE 425A and OPRE 425B.
OPRE 404. Data Analysis (3)
This course presents selected topics in applied data analysis focusing on the fundamentals of time series analysis, categorical data analysis and experimental design. The course emphasizes what the statistical process is all about: how to conduct studies, what the results mean and what can be inferred about the whole from pieces of evidence. Modules include the analysis of data from designed experiments through the analysis of variance and covariance, fundamental models for the analysis of time series data, including smoothing techniques, classical decomposition, and Box-Jenkins ARIMA, and the analysis of categorical responses through measures of association, log-linear models, and logistic regression. Prereq: OPRE 405 or OPRE 428B or MBAC 414/QUMM 414 or consent of instructor.

OPRE 405. Regression Models in Management (1.5)
This course is for students interested in the problems of business and management. A wide variety of applications, drawn from the spectrum of business disciplines, drive our treatment of regression. The focus is on understanding and forecasting in a variety of data settings. Students will learn how to summarize relationships and measure how well these relationships fit data, and how to make meaningful statistical inferences when the usual assumptions do not hold. Students should achieve a working knowledge of multiple regression, and will be encouraged to become critical consumers of statistical information. OPRE 428B covers much of the same material, with a higher assumed knowledge of mathematical statistics. Prereq: MBAC 414 or consent of instructor.

OPRE 410. Math Foundations for Advanced Studies (1.5)
This course enhances the ability to use mathematics in advanced studies. In addition to learning such elementary ideas as the difference between closed-form and numerical-method solutions, a systematic approach is used to learn how to read, understand, think about, and do proofs. Specifically, it is shown how all proofs, regardless of subject area, can be explained as a sequence of individual proof techniques. The following mathematical skills are also taught: translating visual images to symbolic form using quantifiers; classifying mathematical objects into groups having similar properties; creating and working with mathematical definitions; unification; generalization. Prereq: Linear Algebra (equivalent of 1 semester undergraduate course) and Calculus (equivalent of 3 semesters of undergraduate studies) or consent of instructor.

OPRE 411A. Linear Programming (1.5)
The objective of this course is to enable the student to formulate deterministic (linear, nonlinear, integer and network) models. The simplex algorithm for solving linear programming problems is presented geometrically, algebraically and economically. The role of duality theory is also discussed. Case studies are used to teach the student how to interpret computer output obtained from the simplex algorithm and how to use that output to answer "What happens if..." questions. Prereq: One semester of undergraduate linear algebra or consent of instructor.

OPRE 411B. Deterministic Models with Applications (1.5)
Case studies are used to teach the student how to formulate, use computer packages, and prepare managerial reports for solving deterministic (linear, nonlinear, integer, network, and goal programming) problems that arise in business operations as well as project management problems (using PERT/CPM techniques). Conceptual and mathematical ideas of the various methods for solving such problems are presented. Prereq: OPRE 411A or MBAC 414/QUMM 414 or consent of instructor.

OPRE 412A. Theory of Linear Programming (1.5)
This course presents the theory of linear programming, including the formal development and proofs of (a) the geometry of linear programming problems (convex sets, extreme points and extreme rays), (b) the steps of the simplex algorithm and their relationship to the geometry, and (c) duality theory and its uses in sensitivity and post-optimality analysis. Prereq: OPRE 410 and OPRE 411A or consent of instructor.

OPRE 412B. The Theory of Nonlinear Programming (1.5)
This course presents the algorithms and theory for solving nonlinear programming problems. Problems that do not have constraints include: (a) solving nonlinear systems of equations with Newton's method, (b) finding fixed points of functions using the Brouwer and contractive fixed-point theorems, and (c) optimizing nonlinear functions of a finite number of variables using gradient and conjugate-gradient algorithms with line searches. Problems that have constraints include: (a) solving the linear complementarity problems, (b) solving optimization problems with methods of feasible directions that use the Karush-Kuhn-Tucker conditions and also with methods that use penalty functions. Throughout, the role of convexity in establishing convergence of algorithms is explained. Prereq: OPRE 412A or consent of instructor.

OPRE 413. Business Applications of Decision Models (1.5)
The objective of this course is to expose the students to situations from various business disciplines (e.g., Finance, Marketing, Information Systems, Supply Chain Management, etc.) where quantitative models effectively address the decision problems. This course will also integrate these business disciplines and will prepare students for action learning projects where quantitative models may be appropriate. The course will apply tools and techniques learned in MBAC 414. Other quantitative tools will be introduced "just-in-time" in context to particular application area. Prereq: MBAC 414 or QUMM 414. Coreq: MBAC 425 or OPMT 405.

OPRE 419. Game and Decision Theory (1.5)
Most of this course is an introduction to game theory; the remainder is a brief introduction to Bayesian analysis of decision problems including decision trees and conjugate pairs of distributions. The game theory portion consists of an axiomatic approach to utility theory, noncooperative solution concepts emphasizing equilibrium points, and cooperative solution concepts. Examples are drawn from economics, marketing, and operations research. Prereq: Linear Algebra and Calculus. Coreq: Linear Programming.

OPRE 424. Scheduling Theory (3)
Combinatorial and implicit search techniques are developed and applied to scheduling problems, including sequencing on a single and on parallel processors, scheduling in flow shops, open shops and general job shops, and resource-constrained project scheduling, to satisfy various objectives. Topics in the complexity of algorithms and worst-case analysis of heuristics are discussed. Stochastic extensions, manpower scheduling or other special topics may be considered. Prereq: OPRE 425A or equivalent or consent.

OPRE 425A. Probability Applications (1.5)
This course introduces the basic tools of probability. Topics include binomial analysis, basics of random variables and distributions, and correlation. Emphasis is placed on business applications in production and inventory planning, reliability and maintenance and finance. Prereq: A semester of calculus or consent of instructor.

OPRE 425B. Probability II (1.5)
This course introduces the fundamental concepts of probability theory. Topics include probability spaces and events, conditional probability and Bayes theorem, joint distributions of random variables, moment generating functions, laws of large numbers and the central limit theorem. Prereq: OPRE 425A or consent of instructor.

OPRE 426. Stochastic Processes (3)
This course develops probability models for systems that evolve dynamically over time and display uncertain behavior. The models studied include discrete and continuous time Markov processes, with several important special cases including the Poisson Process and other birth-and-death processes, branching processes, and Brownian motion. Other models include renewal, regenerative and semi-Markov processes. Applications include production and manufacturing, supply chain management, telecommunications, finance and economics. Prereq: OPRE 425A and OPRE 425B.

OPRE 427. Convexity and Optimization (3)
Introduction to the theory of convex sets and functions and to the extremes in problems in areas of mathematics where convexity plays a role. Among the topics discussed are basic properties of convex sets (extreme points, facial structure of polytopes), separation theorems, duality and polars, properties of convex functions, minima and maxima of convex functions over convex set, various optimization problems. Prereq: MATH 223 or consent. Cross-listed as MATH 427.

OPRE 428A. Statistics (1.5)
This course covers the basic foundations of statistical analysis, with an emphasis on applications of confidence intervals and hypothesis testing for a wide array of experimental designs. Topics include: descriptive statistics, sampling, comparison of means, medians and proportions through
interval estimation and hypothesis testing, and an introduction to the design of experiments. Prereq: OPRE 425B or MBAC 414/QUMM 414 or consent of instructor.

OPRE 428B. Regression and Experimental Design (1.5)
This course covers the fundamentals of regression analysis and generalized linear models, emphasizing understanding and forecasting relationships between variables in a variety of data settings. Heavy use of case studies is supplemented by more technical material, as students learn to summarize relationships and measure how well these relationships fit data, and how to make meaningful statistical inferences when the usual assumptions do not hold. Prereq: OPRE 428A or consent of instructor.

OPRE 429. Stochastic Processes and Optimization (1.5)
The course provides an introduction to various models and methods for optimization under uncertainty. Applications are considered from operations management (supply chain management, revenue and yield management, inventory control, queuing control), finance (portfolio optimization, option pricing, hedging policies), industrial organization (product development and pricing, research and development investment policies), and other areas. Topics covered include stochastic programming models and solution methodologies, extensions to sequential control of Markov Processes and a brief introduction to adaptive estimation and control. Prereq: OPRE 426 and OPRE 513A or consent.

OPRE 432A. Simulation Models with Applications (1.5)
This course covers the modeling and analysis of business systems using computer simulation. The focus of the course is the introduction of simulation as a modeling tool with emphasis on understanding the structure of a simulation model and how to build such models with the help of popular simulation software(s). Some fundamental statistical concepts behind simulation modeling will also be discussed. Coreq: A course in basic statistics (QUMM 414 or MBAC 414, or OPRE 428A and OPRE 428B) or consent of instructor.

OPRE 432B. Simulation Design (1.5)
This course covers the statistical design and analysis of simulation models. The topics include random number generation, input data analysis, statistical analysis of simulation outputs, variance reduction techniques, and design of simulation experiments. Prereq: OPRE 432A. Coreq: OPRE 428A and OPRE 428B or consent of instructor.

OPRE 435A. Computer Programming (1.5)
The objective of this course is to provide the student with the ability to write object-oriented computer code in C++ for solving problems that do not involve complex data structures. Topics include the use of variables and pointers, built-in functions, input and output, selection statements, loops, functions, and classes. Prereq: Knowledge of one of the following programming languages: Pascal, FORTRAN or C, or permission of the instructor.

OPRE 435B. Integrated Problem Solving in OR and OM (1.5)
This project-oriented course uses a variety of software to involve the student in the complete problem-solving process in OR and OM. This process includes problem definition and formulation, data collection, and storage in a database, connecting the database to the solution algorithm, designing and implementing an appropriate user interface, and presenting the final solution. Prereq or Coreq: OPRE 411B or consent of instructor.

OPRE 435C. Data Structures (1.5)
The objective of this course is to provide the student with the data structures (arrays, files, linked lists, trees, and so on) and the numerical methods (differentiation, integration, and solving linear equations) needed for implementing algorithms that solve operations research and operations management problems. These topics are illustrated with C++ and object-oriented programming. Emphasis is given to ensuring that the programs are robust and usable by nontechnical people. Prereq: OPRE 435A or consent of instructor.

OPRE 445. Decision Theory (3)
This course provides an understanding of the principles, basic concepts, and methodology of engineering economics. It develops proficiency with these methods and with the process for making rational decisions regarding situations likely to be encountered in professional practice.

OPRE 448. Personal and Institutional Money Management (3)
This course is an introduction to contemporary portfolio management. In addition to introductory material on securities, options and security markets, topics include contemporary equity and debt management models, hedging strategies, program trading, portfolio insurance, arbitrage programs, mergers and acquisitions, international investing and intermarket influences, and other contemporary factors driving stock and bond prices. Prereq: BAFI 402 or equivalent or consent.

OPRE 454. Analysis of Algorithms (3)
This course presents and analyzes a number of efficient algorithms. Problems are selected from such problem domains as sorting, searching, set manipulation, graph algorithms, matrix operations, polynomial manipulation, and fast Fourier transforms. Through specific examples and general techniques, the course covers the design of efficient algorithms as well as the analysis of the efficiency of particular algorithms. Certain important problems for which no efficient algorithms are known (NP-complete problems) are discussed in order to illustrate the intrinsic difficulty which can sometimes preclude efficient algorithmic solutions. Prereq: OPRE 435A, OPRE 435C and OPRE 410. Cross-listed as EECS 454.

OPRE 490. Independent Study in Operations Research (1-15)
This course is offered, with permission, to students undertaking reading in a field of special interest. Prereq: Consent of instructor.

OPRE 501. Special Problems and Topics (1-36)
This course is offered, with permission, to students undertaking reading in a field of special interest. Prereq: Consent of instructor.

OPRE 504A. Research in Mathematical Finance I (1.5)
The course introduces the basic principles of discrete time financial markets. The focal points are the method of no arbitrage asset pricing, its relationship with equilibrium investment strategies of individuals in a market of financial securities, and its applications in valuation of contingent claims. Specific topics include basic utility theory, single and multiple period investment models, complete and incomplete markets, risk neutral probability measures, pricing of European and American stock options, and introduction to bonds and interest rate derivative models. Prereq: OPRE 411A, OPRE 425A, and OPRE 425B.

OPRE 504B. Research in Mathematical Finance II (1.5)
The course introduces the mathematical models of financial analysis in continuous time. Topics include diffusion processes, stochastic differential equations and Itô’s lemma martingales, equivalent martingale measures for risk neutral valuation, Girsanov’s theorem, the Black-Scholes model of European option pricing, American options in continuous time, and introduction to the Heath-Jarrow-Morton model of interest rate claim valuation. Prereq: OPRE 504A.

OPRE 512. Large Scale Problems in Mathematical Programming (3)
This course deals with the computational theory of solving large problems in mathematical programming by exploiting the many special structures that arise in real-world problems. Prereq: OPRE 411A and OPRE 411B and OPRE 412A is recommended.

OPRE 513A. Dynamic Programming (1.5)
Dynamic programming consists of optimization models of sequences of decisions as time passes. The motivation and applications include all fields of management, engineering, and economics. This half-semester course includes the formulation of dynamic programming models and an introduction to the algorithms for analyzing the models. Deterministic and stochastic models (including Markov decision processes) are considered. Examples are drawn from many kinds of applications. Prereq: OPRE 411A and OPRE 425A, OPRE 425B, or equivalent.

OPRE 515A. Combinatorial Optimization (1.5)
This course provides the ability to recognize, formulate, and solve (or determine how difficult it is to solve) combinatorial optimization problems. Mathematical programming and network/graph-theory problems are used to illustrate the art of problem formulation. The individual components of combinatorial optimization are identified and presented in a unified framework. The two standard search strategies for finding an optimal solution—namely, the greedy approach and the finite-improvement approach—are illustrated with numerous examples. Conditions are presented under which these search strategies provide an optimal solution. Prereq or Coreq: OPRE 410 or consent.
OPRE 515B. Graph Theory (1.5)
This course provides the ability to use graph theory as a problem-solving tool. The student is taught to recognize, formulate, and solve graph theory problems. Numerous examples from Operations Research, Computer Science, and related areas are used to illustrate the art of problem formulation. Appropriate theory and algorithms are then developed for solving these problems using the two basic search strategies of the greedy algorithm and the finite-improvement algorithms. Prereq: OPRE 515A or consent.

OPRE 517. Networks (1.5)
This course is an introduction to Network Flow optimization with emphasis on applications, theory, and techniques. Applications include design of distribution systems, project scheduling, production planning, routing and scheduling, etc. The course also develops specialized techniques to solve key network problems, namely, Shortest Path, Maximal Flow, Minimum Cost Flow, and Traveling Salesperson problems. Computational complexity issues of these algorithms are also emphasized. Prereq: OPRE 411A.

OPRE 518. Integer Programming (1.5)
This course provides foundations to Integer Programming with emphasis on applications, theory, and techniques. Applications include problem in scheduling, location, sequencing, capital budgeting, loading, and frequency management. Basic ideas and results are discussed for cutting plane, enumerative, and partitioning algorithms. Prereq: OPRE 411A and OPRE 412A.

OPRE 521. Queueing Theory (3)
This course covers basic theorems in stochastic processes pertaining to queueing theory; analysis of descriptive models for queues with exponential, Erlang and general distributions for interarrival times and service times; distributions of the queue size and the waiting time; and optimization analysis for control and design of queueing systems. Prereq: OPRE 425A or OPRE 425B.

OPRE 523. Multiobjective and Hierarchical Systems (3)
This course covers basic concepts of hierarchical, multi-level systems. Lagrangian decompositions, and coordination principles. Fundamentals and recent advances in theory, methodology and applications of multiple criteria decision making (MCDM) with single and multiple decision makers are included as arc: interactive MCDM methods; multiple objectives for discrete and continuous models; multi-objective programming methods, hierarchical overlapping coordination with single and multiple objectives; multi-objective multi-stage impact analysis; and applications to large-scale systems and to decision support systems. Prereq: OPRE 411A and OPRE 411B or consent of instructor; OPRE 422A recommended. Cross-listed as EECS 523.

OPRE 601. Advanced Readings in Operations Research (1-18)
Students report on recent literature and review selected topics in the various areas of operations research. Students also perform detailed studies of special topics in operations research under the guidance of a faculty member. M.B.A. students should enroll in OPRE 501. Prereq: Consent of instructor.

OPRE 602A. Predissertation Research (1.5)
The objective of this course is to study a potential Ph.D. thesis area in detail. Under the guidance of a committee headed by a faculty member in the Department of Operations, students perform a thorough literature review of the chosen area with the objective of summarizing the recent major results obtained in the area and identifying open problems that might be suitable for research. Prereq: Consent of instructor.

OPRE 602B. Predissertation Research (1.5)
As a continuation of OPRE 602A, students complete study of a potential Ph.D. thesis area in detail. Under the guidance of a committee headed by a faculty member in the Department of Operations, students finish a thorough literature review of the chosen area and write a 10-page report summarizing the recent major results obtained and identifying open problems that might be suitable for research. Students also make a one-hour oral presentation to their committee and other interested students and faculty. Prereq: Consent of instructor.

OPRE 701. Dissertation Ph.D. (1-18)
This course is limited to candidates for the Ph.D. degree who are preparing dissertations in some field of operations research. Prereq: Consent of instructor.

OPRE 702. Appointed Dissertation Fellow (9)

Operations Management (OPMT)

Undergraduate Courses

OPMT 350. Operations Management (3)
This course presents an overview of the management of operations in business and service firms. The nature of operations problems through the use of case studies is introduced. Emphasis is placed on problems of production, purchasing, product movement and storage, and the attendant information required to achieve desired levels of consumer satisfaction and company profitability. Not recommended for freshmen and sophomores. Prereq: Introductory course in Statistics or consent of instructor.

OPMT 360. Independent Study (1-18)

OPMT 390. Special Problems and Topics in Operations Management (1-18)
Undergraduate student pursues a special topic or problem, with agreement of operations management instructor. Prereq: Consent of instructor.

Graduate Courses

OPMT 405. Operations Management (3)
Operations management deals with the design of products and processes, the acquisition of resources, the conversion of inputs to outputs, and the distribution of goods and services. It is central to a firm’s ability to compete effectively. As global competition in both goods and services increases, the management of operations is becoming more and more important. This course provides a broad overview of the managerial issues associated with production and delivery of goods and services. It includes the use of quantitative modeling using computers as a central methodology. Prereq: QUMM 414 or MBAC 414.

OPMT 407. Supply Chain Management (3)
If you’re not on the shelf, you’re not in business. This course addresses managing the processes of getting products and service to market. It focuses on strategic and tactical management of the supply chain and distribution channels as value-adding networks. Topics include assessing the value creation potential of network members (suppliers, producers, distributors, dealers, and retailers), which of them should make key decisions and how they relate to each other. Emphasis is on communication throughout the marketing network to coordinate activity, to provide appropriate compensation, and to ensure the marketing program is implemented effectively at the customer level. Prereq: MKMR 405 or MBAC 424 or MIDS 456. Cross-listed as MKMR 407.

OPMT 420. Managing Quality in Organizations (3)
This course provides an introduction to managing quality in both manufacturing and service settings. It begins with the development of a customer centered approach through the concepts of quality function deployment. Representative programs which may be covered are: the Juran trilogy, Deming’s approach, Crosby’s approach, Kaizen or continuous process improvement, quality teams and vendor relationships and certification. Broad managerial considerations in managing quality, such as education and training of organizational personnel, commitment to quality, and administration of the quality function are also covered. Students may work in teams on cases or real world projects in order to apply the concepts introduced in the course. Prereq: OPMT 405 or MBAC 425.

OPMT 422. Service Operations Management with E-Commerce (3)
This course concerns the management of operations in e-commerce and other kinds of services. E-commerce absorbs more course time than any other type of service, but we also examine other settings such as financial services, health care, information systems, and transportation. There are modules on the similarities and differences of operations in e-com-
mercer versus other service industries, structures of service industries, design of services, profitably utilizing service capacity, enhancing the quality of services, and managing service projects. Topics in capacity management include revenue management, queueing models, and simulation. A recurring theme is the integration of service operations with marketing, finance, and information systems. Prereq: OPMT 405 or OPMT 425 or equivalent.

OPMT 423. Operations Management-E.M.B.A. (2)
Participants study the processes by which goods and services are supplied, produced and distributed in organizations, with emphasis on systems for analyzing design and operational problems in the production/operations function. This course is limited to students in the Executive M.B.A. program.

OPMT 475. Logistics/Physical Distribution Management (3)
Effective management of the distribution of goods and services as they flow from plants/ports/vendors to customers is the focus of this course. Concepts and methods, some computerized, are presented that can lead to improved physical distribution customer service and/or to lower costs in a variety of manufacturing and service company settings. Key topics include transportation, inventories, warehousing, materials handling, order processing, packaging, pricing, customer service standards, and warehouse and retail location. (A companion course to OPMT/MKMR 474.) Prereq: OPMT 405 or MBAC 425. Cross-listed as MKMR 475.

OPMT 476. Purchasing/Materials Management (3)
Effective management of the physical supply of goods and services to manufacturing and service companies is the focus of this course. The course is designed to provide an overview of the management problems associated with acquiring and maintaining the flow of material supplies to a firm, and to sharpen decision-making skills as related to materials supply within the broader scope of logistics and the firm as a whole. Topics include purchasing, inventory control and supply scheduling. (A companion course to OPMT/MKMR 475.) Prereq: OPMT 405 or MBAC 425. Cross-listed as MKMR 476.

OPMT 477. Enterprise Resource Planning (3)
Enterprise resource planning (ERP) includes the application of various concepts to plan proper resource utilization for an enterprise. Concepts including forecasting, material requirements planning, operations scheduling (aggregate and detailed), capacity planning, and activity control are central to ERP. Both quantitative modeling and managerial analysis for these subjects are included in this course. The quantitative analysis will be performed on a microcomputer using software available in the Weatherhead Computer Lab. Prereq: MBAC 125, OPMT 405, OPMT 425 or consent of instructor.

OPMT 478. Operations Design and Quality Control (3)
The primary thrust of this course is statistical applications in manufacturing. The areas of acceptance sampling, process control, total quality control and an introduction to industrial research are included in the course. Methods engineering is introduced as an important underpinning of the quality control system. Prereq: OPMT 405 or MBAC 425 or consent.

OPMT 479. International Operations Management (3)
The main objective of this case-based course is to help prospective operations managers to overcome national and cultural myopia, identify cultural and contextual differences in operations management practice, describe successful operations management approaches in other countries and examine reasons for their success as well as the viability of transferring them to significantly different operating environments, and finally address the impact of the global scope of operations on the usual operating decisions (production planning, quality control, etc.). Topics to be covered include organization of global operations, production strategies in entering foreign markets, development of a global manufacturing strategy, international facilities location, offshore manufacturing, global sourcing and logistics, global transfer of technology, risk management on global operations, cultural and national comparisons of operations management practices, and successful global service operations. Prereq: OPMT 405 or MBAC 425.

OPMT 480. Operations Strategy and Technology (3)
This course discusses the process of developing an operations strategy for competitive advantage. A number of strategic issues are studied from a manufacturing perspective, including product development, introduction of new technologies, managing multiple plant operations, flexibility, and financial control systems. Coreq: OPMT 405 or MBAC 425.

OPMT 490. Independent Study in Operations Management (1-15)
This course is offered, with permission, to students undertaking reading in a field of special interest. Prereq: Consent of instructor.

OPMT 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest. Prereq: Consent of instructor.

OPMT 504A. Research in Operations Management I (1.5)
The material in this introduction to the research literature in operations management consists of several research papers on supply chains for goods and services. Although specific topics and papers vary from year to year, representative topics include manufacturing, logistics, design of service networks, and revenue management. Prereq: OPRE 412A, OPRE 419, OPRE 426, OPRE 513A or consent.

OPMT 504B. Research in Operations Management II (1.5)
Seminar continuation OPM 504A's introduction to the research literature in supply chains for goods and services. Specific topics and papers vary from year to year, but representative topics include manufacturing, logistics, service networks, and revenue management. Prereq: OPMT 504A or consent.

OPMT 601. Special Problems and Topics (1-18)
This is a course of flexible design in which a student, with the agreement of an instructor in operations management, may pursue a special topic or problem. M.B.A. students should enroll in OPMT 501. Prereq: Consent of instructor.

OPMT 602A. Predissertation Research (1.5)
The objective of this course is to study a potential Ph.D. thesis area in detail. Under the guidance of a committee headed by a faculty member in the Department of Operations, students perform a thorough literature review of the chosen area with the objective of summarizing the recent major results obtained in the area and identifying open problems that might be suitable for research. Prereq: Consent of instructor.

OPMT 602B. Predissertation Research (1.5)
As a continuation of OPMT 602A, students complete study of a potential Ph.D. thesis area in detail. Under the guidance of a committee headed by a faculty member in the Department of Operations, students finish a thorough literature review of the chosen area and write a 10-page report summarizing the recent major results obtained and identifying open problems that might be suitable for research. Students also make a one-hour presentation to their committee and other interested students and faculty. Prereq: Consent of instructor.

Quantitative Methods in Management (QUMM)

QUMM 414. Statistics and Decision Modeling (3)
This course provides the foundations of statistical and operations research methodologies for managerial decision-making. Business statistics focuses on statistical thinking as one of the fundamentals of effective management. Topics covered include sampling and the normal distribution, making inferences from data via confidence intervals and hypothesis tests, and analyzing relationships between samples. Decision modeling of organizational systems uses mathematical and computer models to provide a quantitative perspective on identifying, analyzing and solving complex decision problems. This course includes an introduction to linear programming models and applications, simulation techniques in decision-making, and project management.

QUMM 415. Quantitative Methods for Management-E.M.B.A. (2)
This course examines the use of modern quantitative methods to support the executive decision-making process. Particular models examined include those which assist in describing and analyzing problems and those devoted to suggesting possible managerial actions. This course is limited to students in the Executive M.B.A. program.

QUMM 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest. Prereq: Consent of instructor.
QUMM 501H. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest. Prereq: Consent of instructor.

QUMM 601. Special Problems and Topics (1-18)
This is a course of flexible design in which a student, with the agreement of an instructor in quantitative methods, may pursue a special topic or problem. M.B.A. students should enroll in QUMM 501. Prereq: Consent of instructor.

Department of Organizational Behavior
Peter B. Lewis Building
Richard E. Boyatzis, Chair
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The Organizational Behavior Department offers programs leading to the Master of Science in Organization Development and Analysis degree and the Ph.D. degree, as well as providing courses pertinent to the M.B.A. program.

Faculty
Richard E. Boyatzis, Ph.D. (Harvard University)
Chair, Department of Organizational Behavior; Professor of Organizational Behavior
Leadership and developing emotional intelligence, lifelong learning, competency and outcome assessment, values development
Diana Bilimoria, Ph.D. (University of Michigan)
Associate Professor of Organizational Behavior
Corporate governance and leadership, women directors, leaders and entrepreneurs, management education
Hilary Bradbury, Ph.D. (Boston College)
Assistant Professor of Organizational Behavior
Organizations in the natural environment, negotiation, change and transformation
Susan S. Case, Ph.D. (State University of New York at Buffalo)
Associate Professor of Organizational Behavior
Organizational communication, management of diversity, multicultural work environments and teams, gender and organizations, career assessment and development
David L. Cooperrider, Ph.D. (Case Western Reserve University)
Associate Professor of Organizational Behavior
Social innovations corporate governance and policy, management of professional organizations, organization analysis, appreciative inquiry
Vanessa U. Druskat, Ph.D. (Boston University)
Assistant Professor of Organizational Behavior
Effectiveness in self-managed teams; gender and leadership style; group facilitation.
Ronald E. Fry, Ph.D. (Massachusetts Institute of Technology)
Associate Professor of Organizational Behavior, Faculty Director, EMBA Program
Team development, functioning of the executive, design of learning environments, effecting system-wide change, appreciative inquiry
David A. Kolb, Ph.D. (Harvard University)
Professor of Organizational Behavior;
Individual and social change, experiential learning, career development, organization development
William K. Laidlaw, E.D.M. (Case Western Reserve University)
Professor for the Practice of Management
Poppy McLeod, Ph.D. (Harvard University)
Associate Professor of Organizational Behavior
Group decision making, technology effect on interpersonal communication, interpersonal and group dynamics, social and organizational issues in MIS
Eric H. Neilson, Ph.D. (Harvard University)
Professor of Organizational Behavior
Organizational change and development, team building, executive education, history and sociology of industrial development
Sandy Kristin Piderit, Ph.D. (University of Michigan)
Assistant Professor of Organizational Behavior
Change agents, ambivalence and resistance to change, networking and relationships among co-workers, influence and persuasion
Melvin L. Smith, M.B.A. (Clark Atlanta University)
Instructor of Organizational Behavior
Human resource and strategic management
Suresh Srivastva, Ph.D. (University of Michigan)
Professor of Organizational Behavior
Management of work, management of power, organizational analysis and development, administrative strategy and planning

Secondary Appointments
Duncan V.B. Neuhauser, Ph.D. (University of Chicago)
Professor of Epidemiology and Biostatistics, School of Medicine;
Professor of Organizational Behavior; CoDirector: Health Systems Management Center
Peter J. Whitehouse, M.D., Ph.D. (The Johns Hopkins University)
Professor of Neurology, School of Medicine; Professor of Organization Behavior

Organizational Behavior (ORBH)

Undergraduate Courses
ORBH 250. Introduction to Organizational Behavior and Management (3)
This course challenges students to analyze and manage organizations as complex systems, and to enhance their individual and interpersonal effectiveness.

ORBH 303. Leadership and Personal Development (3)
This is an experience-based course designed for increased integration of cognitive and emotional processes, greater awareness of one’s behavior and impact on others, and greater opportunity for behavioral choice in interpersonal relations. Several Saturday classes.

ORBH 304. Advanced Workshops in Personal Development (3)
This is an experience-study course offered for groups of interested and qualified individuals. This course concentrates on an affective theme: conflict and power, intimacy, aggression, etc. There is an effort to combine experience-based learning with conceptual understanding. Prereq: ORBH 303.

ORBH 390. Special Topics (1-18)
This course is offered for candidates undertaking reading in a field of special interest.

Graduate Courses
ORBH 403. Developing Interpersonal Skills for Managers (3)
This course is intended to sharpen students’ skills in the art of relating successfully to other individuals and groups. The course uses an intensive group experience to make students more aware of how their actions affect others, more capable of giving and receiving interpersonal feedback, and more cognizant of processes through which groups work. Several Saturday classes.

ORBH 412. Organizational Analysis (3)
This course studies organizational analysis through appreciative inquiry. It explores multiple frame works for understanding the complexity of organizational life. Students form teams and conduct appreciative studies across industries. This course also addresses questions of organizational change (how to move from theory/ideal to practice). Learning is experiential in nature.

ORBH 415. Residency Periods-E.M.B.A. (2)
The primary objective of the residency periods is to create and maintain relationships among the E.M.B.A. participants and faculty that enable and accelerate learning throughout the program. This includes the formation, maintenance and development of effective Study Groups. Another primary objective is to develop behavioral management skills in leadership, teamwork, conflict negotiation, decision making and problem management that are best studied through sustained periods of experiential
and developmental needs, and with the opportunities, strategic needs analysis projects that are consistent with their current skills, career plans workshops; and (2) to plan and execute organizational change and/or organizational development projects in their organizations. Each project is supervised by appropriate faculty and organization members. This course is limited to candidates for the MSODA program.

ORBH 444. Organizational Analysis and Development-E.M.B.A. (2) This course is an introduction to concepts for understanding the organization as a complex social system, with emphasis on the behavioral aspects of strategy and structure, including recruitment, reward systems, staffing and social and technical aspects of special arrangements. This course is limited to students in the Executive M.B.A. degree program.

ORBH 450. Executive Leadership (3) This course explores answers to questions such as: Who are leaders? Are they different than managers, heroes and heroines? How do the effective ones think and act? What situations create leaders, foster their emergence or provide opportunities? What makes us want to follow them? What are the personal pits of being a leader (i.e., sex, drugs, alcohol, insomnia, ulcers, etc.)? How are leaders developed? Case studies, self-study and at-work projects will be the primary methods used in the course.

ORBH 460. Women in Organizations (3) This course addresses important leadership and management issues concerning women in organizations. The course provides complex understandings of issues pertinent to professional women and work such as sex role typing, sex-based discrimination, equal pay, sexual harassment, work-family balance, women’s leadership and women’s career issues and development. The course helps students increase self-knowledge about their own values and practices as well as enhance their capabilities as leaders and managers. We will examine the opportunities, challenges, trade-offs, and organizational dynamics experienced by women in work settings, as well as the interpersonal, organizational, and societal structures and processes impacting women in organizations. Through a variety of course methods, students gain greater awareness of the gendered nature of work and organizations and learn effective strategies for women’s career progress and effective participation in organizations.

ORBH 478. Organization and the Environment (3) This course focuses on ways of looking at the interface between organizations and their environments that have important implications for organizational development activities and the people who design and implement them. The first part of the course reviews several conceptual approaches to assessing this interface. The second part involves the application of these approaches to a series of organizational/environmental problems that members of the class perceive their organizations as currently experiencing. Limited to MSODA candidates.

ORBH 488. Leadership and the Global Agenda (3) This course addresses workforce diversity issues from individual, group, and organizational perspectives. The focus is on innovative ways of utilizing today’s culturally expanding workforce. Emphasis is on the “what and how” for managers in developing a corporate culture that embraces diversity, helping them in learning to work with, supervise and tap the talent of diverse employees within their organizations. Included are methods for modifying systems to attract, retain, develop, and capitalize on benefits of the new workforce demographics. A retreat experience is part of this course and is required of all participants.
ORBH 496. Leadership, Executive Assessment, and Development-EM.B.A. (3)
The purpose of this course is to learn a method for assessing a participant's knowledge, abilities, values and interests relevant to leadership and executive management so that the person will be able to develop and implement a plan for enhancing leadership and executive capability throughout career and life. The enabling objectives are: (a) to construct a view of current and desired capability (i.e., knowledge, abilities, values, and interests); (b) to develop an individualized learning agenda and plan for the next 3-5 years; and (c) to explore techniques to assist others in doing the same. This course is limited to students in the Executive M.B.A. program.

ORBH 497. Development of Executive Leadership Skills (3)
The objective of this course is the development of skills in effective human interaction, with emphasis on the pragmatics of working with people in organizations. The focus is on learning by doing through the use of applied behavioral science methods of simulation, role plays and structured exercise. Leadership topics covered include decision management, problem management, motivation, planned change, teamwork, and the language of leaders. Designed for MSODA students. M.B.A. students admitted upon consent of instructor.

ORBH 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

ORBH 510. Foundations of Organizational Thought (3)
Learning some of the foundations of organizational thought can stimulate a vision for creating organizations for the twenty-first century. This course is intended to prepare future scholars for understanding, creating and intervening in future organizational life. Preparation will include study of the classics in organizational literature, contemporary writings and historical analyses of seminal thought in organizational behavior. Preparation will include the process of historical and appreciative inquiry, roots in organizational thought, contemporary roots of organizational thought and some organizing principles. Prereq: Consent of instructor.

ORBH 520. Group and Interpersonal Analysis (3)
This course is a review of major concepts and research in group dynamics and interpersonal interaction such as communication patterns, power, hierarchy, leadership, norms, goals, productivity, social theories of personality, and personal change through group methods. The course combines cognitive emphasis and personal experience-based learning. Prereq: Consent of instructor.

ORBH 525. Developing Emotional Intelligence (3)
This course will examine the process by which individuals change and the methods often used to facilitate this change. How and what a person chooses to change (i.e., select their change goals) will be explored, as well as factors affecting the extent to which he or she changes. The efficacy and ethics of various approaches to individual change as part of human resources and organization development efforts will be discussed.

ORBH 530. Social Analysis (3)
This course is an introduction to major themes and concepts in sociology that influence the field and to sociological analysis as it relates to the careers of behavioral science practitioners. Students are exposed to major theoretical orientations as well as to summaries of current thinking in several major topic areas in sociology. The studies of sociology, sociologists and the self are combined to help students develop a sociological perspective of their own potential roles in the applied behavioral sciences. Prereq: Consent of instructor.

ORBH 541. Organizational Systems (3)
This course covers the use of general systems theory as a conceptual base for examining organizations from the macro-perspective. The course examines organizational structure and technology, organizations and interorganizational networks in interaction with their societal environments, and large-scale problems of organizational and social power, conflict and change. It is designed to present a large-scale perspective on organization theory and behavior that is complementary to the micro-perspective of organizational behavior. Prereq: Consent of instructor.

ORBH 561. Research Methods II: Theory Building (3)
This course is designed as a methodological practicum in theory building through qualitative methods. The process of good theory construction is portrayed as the discovery of theory from data, resulting in the construction of knowledge of consequence. The course asserts, in Lewinian fashion, that "there is nothing so practical as good theory." It then focuses on the methods, personal disciplines, and perspectives needed to bring this dictum alive. Individual research proposals are developed throughout the semester.

ORBH 565. Research in Gender and Diversity in Organizations (3)
Examination of full range of feminist research methods exploring relationship between feminism and methodology involving a plurality of perspectives for conducting research and creating knowledge with an emphasis on collecting and interpreting qualitative materials. Particular attention is paid to understanding gender- and diversity-related phenomenon that occur in the workplace. Classic feminist research from a variety of historical, societal, economic, interpersonal, and organizational paradigms are incorporated.

ORBH 570. Learning and Development (3)
This course provides an exploration of the learning and development paradigm underlying the human potential development approach to human resource development. The origins of this approach in the naturalist epistemologies John Dewey's pragmatism, Kurt Lewin's gestalt psychology, the work of James, Follett, Emerson, Piaget, Maslow, Rogers, and others and current research in adult development, biology and brain/mind research, artificial intelligence, epistemology, moral philosophy and adult learning will be considered. The course will focus on applications of these ideas to current issues in human resource development such as adult learning in higher education, advanced professional development, and large system learning and development. Prereq: Consent of instructor.

ORBH 572. Thematic Analysis (3)
This course will help students develop the abilities to sense themes or patterns, to apply coding systems in a reliable manner, to develop a coding system, and to design research studies for developing or using codes. Participants will develop and practice three abilities on four types of data: conscious and unconscious thought; an individual's behavior; interaction among people; and historical documents such as speeches, myths, ballads, etc. Assignments will involve reading, practice coding of material provided, developing preliminary code from materials selected, and completing a research project in which the development and/or use of a code is required. This course is appropriate for doctoral students in the behavioral or social sciences. Prereq: Consent of instructor.

ORBH 575. Theory and Research in Small Groups (3)
The course is designed to provide doctoral students with broad exposure to the theoretical foundations of research in the area of groups and teams in organizations, and to current and emerging trends in the research within this area. The ultimate objective is to enable students to conduct independent research on topics relevant to groups and teams within organizations. The primary focus will be on task-oriented groups and teams, and in the organizational context. It will draw from basic research in social psychology and sociology in addition to organizational behavior.

ORBH 601. Special Problems and Topics (1-18)
This course is offered, with permission, to candidates undertaking reading in a field of special interest.

ORBH 660. Methods of Applied Behavioral Science (3)
This course includes laboratory methods of learning, techniques of design and operation in human relations training, and trainer behavior in group settings. The course is aimed at conceptualizing learning and influencing processes in training laboratory settings as well as providing opportunities for the practice of design and operating skills. Prereq: Consent of instructor.

ORBH 701. Dissertation Ph.D. (1-18)
ORBH 702. Appointed Dissertation Fellow (9)
ORBH 706. Advanced Behavioral Science Theory I: Integrative Seminar (3)
These seminars are advanced courses which various faculty offer depending on current research interests. Content topics and convening faculty
change from semester to semester. These advanced seminars may lead into new intervention activities and/or dissertation research.

ORBH 707. Advanced Behavioral Science Theory II: Integrative Seminar (3)
(See ORBH 706.)

Other Course Offerings

M.B.A. Core Courses (MBAC)

MBAC 404. Executive Dialogues (1)
Credit/pass/fail option only. Students will engage in dialogues with leaders of regional organizations on issues related to leadership, organizational development and success, and community activism/social responsibility. Each class will begin with remarks from the invited guest on a topic related to the course, and the remainder of the class time will consist of a dialogue among the students and the speaker. Students are expected to prepare for each session by reading materials about the speaker’s organization and articles related to the topic to be discussed in class. The pass/fail grade will be based on individual class attendance and participation, as well as on the performance of each team in preparing for its assigned speaker.

MBAC 410. Leadership Assessment and Development (2)
The Leadership Assessment and Development course is the cornerstone of the Weatherhead M.B.A. program that offers students an opportunity to take an active role in shaping their learning experience in the program. The objective of the course is to help students learn a method for assessing and developing the knowledge and abilities relevant to management throughout their careers. This is accomplished through helping students develop an individualized learning plan to enhance their abilities and knowledge areas as well as to help achieve their career objectives. Students engage in a number of assessment activities, then receive feedback and interpret it. These activities take place in the context of an Executive Action Team where students collaboratively help each other assess their current capability and future development needs.

MBAC 410A. Leadership Assessment and Development (2)
The Leadership Assessment and Development course is the cornerstone of the Weatherhead M.B.A. program that offers students an opportunity to take an active role in shaping their learning experience in the program. The objective of the course is to help students learn a method for assessing and developing the knowledge and abilities relevant to management throughout their careers. This is accomplished through helping students develop an individualized learning plan to enhance their abilities and knowledge areas as well as to help achieve their career objectives. Students engage in a number of assessment activities, then receive feedback and interpret it. These activities take place in the context of an Executive Action Team where students collaboratively help each other assess their current capability and future development needs.

MBAC 410L. Management Skill Building Lab (.5)
The course helps develop interpersonal and team management skills. The course is interactive and has recommended readings and extensive in-class participation in groups.

MBAC 411. Strategic Issues and Applications I (2.5)
The first two weeks of this course are an initial introduction to the full range of issues managers confront in the process of creating value in organizations and to the multiple skills required to deal effectively with them. This course also addresses in detail the issues and skills involved in strategic thinking and management, including analyzing industry and competitive environments, developing organizational objectives and strategies for the long term, integrating functional activities into implementable action programs, and structuring and leading the organization. Other managerial issues and skills introduced in the first two weeks of the course will be addressed in detail throughout the first year in the M.B.A. functional core courses.

MBAC 411A. Strategic Issues and Applications (3)
Student EAT teams are introduced to a comprehensive case study to discover the broad range and integrative aspects of management issues confronting organizations today. Functional teachers in the accelerated core courses will provide “just-in-time” coaching as students break down the complexities of the case.

MBAC 412. Managing Your Career and Action Learning Preparation (.5)
This course is designed to build the skills necessary for a successful job search, personal career development, and business etiquette. The course sessions are interactive and require extensive classroom participation.

MBAC 412A. Management and Career Skills (1)
Course explores communication skills, team building, and negotiations; classes are interactive. There will be recommended readings and extensive in-class participation in groups.

MBAC 412L. Career Development Skills (1)
This is a seminar course designed to build skills necessary for a successful job search and future career development. The course sessions are interactive and require extensive classroom participation.

MBAC 413. Human Value in Organizations (2.5)
Examines the behavioral sciences relevant to the effective management of people and the effective design of human resources system, structure, and policies. Topics include leadership, change management, motivation and pay systems, team dynamics, staffing, decision making, organizational communications, employee participation, performance appraisal, conflict management, negotiation, work design, organizational design, and organizational culture. A variety of methods, including experiential and interactive learning methods, are used to study these topics.

MBAC 413A. Human Values in Organizations (1)
Classes will explore research in the fields of organizational behavior and human resource management and apply this knowledge in actual situations and cases. They will learn about how to learn from experiences they have in class and in their EATs. Students will be able to directly apply skills learned in class to leadership, project management, task force management, team development, staff meetings, decision making, problem solving, interpersonal relations, environmental analysis, job redesign, organizational change, and labor and human resource policy.

MBAC 413L. HVO Laboratory: Negotiation Skills (.5)
This course is designed to build negotiation skills with recommended readings and extensive in-class participation. Available only to full-time M.B.A. candidates.

MBAC 414. Statistics and Decision Modeling (2.5)
This course provides quantitative foundations for modern business decision making. It begins with an introduction to managerial statistics and data analysis, covering such topics as the use of graphical tools for data description, methods for estimation, comparison and hypothesis testing, and regression models. The second part of the course introduces management science techniques, including mathematical programming models, simulation and project management. Computer software is heavily used throughout.

MBAC 414A. Statistics and Decision Modeling (1)
This class provides a brief look at management science and selected key tools and applications. Topics include modeling, linear programming, simulation and linear regression. Students should have a background in statistics and college-level algebra. Just-in-time statistics review workshops will be available at the beginning of the semester.

MBAC 415. Financial Reporting and Control (2.5)
This course examines the framework that underlies financial and managerial accountancy, and how the information produced by these functions can be used by (1) parties external to the firm, i.e., stockholders, creditors, and government, to evaluate the financial performance of an organization; and (2) internal management to fulfill planning and control requirements.

MBAC 415A. Financial Reporting and Control (1)
The accounting component will cover the use and application of basic financial statements, the basic cost structures in a firm, and decision making using accounting information. We will discuss usage and analysis of information from the annual report, focusing on the balance sheet, income statement, cash flow statement, and related notes. The course will also cover internally generated accounting information about the cost structure of the firm. We will discuss use of this information in decision making. You are expected to be comfortable with definitions of basic ac-
counting terms, and you should be familiar with the accounting structure and the financial statements.

MBAC 416. Managerial Finance I (2.5)
Finance is the study of the allocation of resources under uncertainty, especially as it involves contracts with the providers of funding. This first course develops finance reasoning and tools valuable to both financial and non-financial managers. Central topics include the use of accounting information to evaluate the sources of value, the techniques for valuing prospective cash flows in risky situations (including valuation of projects, and securities like stocks and bonds), capital budgeting, and the measurement of risk for asset pricing in capital markets. Teaching methods include lectures, discussions, cases, and extensive exercises.

MBAC 416A. Managerial Finance (1)
This module reviews knowledge and refreshes core skills in managerial finance, especially those related to financial statement analysis, discounted cash flow valuation, and risk and return in the capital markets. Teaching methods include lectures, discussions, cases, and extensive exercises. (Summer).

MBAC 421. Strategic Issues and Applications II (2)
This course wraps up the M.B.A. core by providing an integrative experience of applying the full range of managerial skills addressed throughout the core in a comprehensive case exercise. Students develop, document and present comprehensive, implementable strategic and tactical actions programs in groups. Prereq: MBAC 411.

MBAC 422. Management and Career Skills II (1)
This course explores communication skills, team building and negotiations. These are interactive classes. There will be recommended reading and extensive in class participation in groups. Prereq: MBAC 412.

MBAC 423. Information Design and Management (2.5)
Organizations are technology- and knowledge-intensive systems. All their functions are driven by the flow and use of information. This course will enable students to develop the models, analytic techniques, and critical attitudes needed to design effective, adaptable organizations. Student will learn to employ information technologies and new organizational forms to improve a firm’s functions and strategies.

MBAC 423A. Information Design and Management (1)
This course will cover systems thinking and the systems approach to structuring and solving problems. Topics include principles of the management of information systems, the biases and heuristics of decision making, linear models and decision support, the human aspect of information systems and the economics of IS. We will assume that students are aware of the range of application of IS to business problems, and that they have an appreciation of their potential administrative and strategic importance.

MBAC 424. Marketing (2.5)
This course focuses on managing marketing as a process of creating value and mutually desirable exchanges of values. That is the foundation of a customer orientation and a central theme of market-driven management. Methods for strategic marketing planning, understanding buyer behavior, market analysis, segmentation, and devising integrated marketing programs are introduced. Creating customer value and competitive advantage in worldwide markets is the central theme. Prereq: ACCT 401.

MBAC 424A. Marketing (1)
The marketing management course will focus on the process of identifying and developing strategies that capitalize on the firm’s unique capabilities and deliver superior customer value. That is the foundation of customer orientation and central theme of market driven management. Students will apply a broad range of marketing principles and techniques to marketing decision making in domestic and global settings. Knowledge of basic marketing concepts and models will be assumed.

MBAC 425. Operations Management (2.5)
Operations Management deals with the design of products and processes, the acquisition of resources, the conversion of inputs to outputs, and the distribution of goods and services. As global competition in both goods and services increases, the management of operations is becoming more and more important. This course provides a broad overview of the managerial issues associated with production and delivery of goods and services. It includes the use of quantitative modeling using computers as a central methodology. Prereq: QUMM 414 or MBAC 414.

MBAC 425A. Operations Management (1)
In recent years, a changing competitive landscape has highlighted the critical role of the operations function in ensuring business success. In this course, we treat business as a value-added chain of processes that supply and convert disparate inputs into products and services and distribute these outputs. We examine how to best design, run and improve these processes. A variety of manufacturing and service sector settings will be used as examples to illustrate the concepts. It is assumed that the student is familiar with the material covered in a basic undergraduate course in operations management. Specifically, a vocabulary of operations management terminology and proficiency in basic tools and techniques of operations management are expected.

MBAC 426. Economics for Management (2.5)
This course surveys the basic principles of micro- and macroeconomics. The focus is on how these principles help managers to better understand the effect of the economic environment on their organization, so as to make more effective decisions. Topics covered include supply and demand, foreign trade and the foreign exchange market, market structures, and fiscal and monetary policies. Special emphasis is given to recent innovations in the study of strategic interactions between firms.

MBAC 426A. Economics (1)
This course serves as a review of economic principles and an introduction to the use of economics in the management setting. Basic economic concepts will be demonstrated by analyzing economic issues and policies relating to the environment in which organizations function. Economic analysis will be demonstrated with reference to particular decisions confronted by firms, including game theory.

MBAC 440. Leadership Assessment and Development (1)
In the outcome assessment M.B.A. students reassess their management abilities and knowledge areas and measure the progress they have made during their learning experience at the Weatherhead School. This documentation of individual strengths is applied to students’ job search strategies and/or their postgraduate learning plans.

MBAC 498. Action Learning (6)
This course allows teams of students to integrate functional core knowledge from the first year of the M.B.A. program and apply analysis and strategic management skills in a real-world setting. Students will be evaluated by the instructor and the project managers at the client organizations. Prereq: Second year full-time M.B.A. status.

Management Courses (MGMT)

Undergraduate Courses

MGBT 001. Supervised Professional Practicum - Semester 1 (0)
A professional practicum is a workplace experience, the primary goal of which is the intellectual, personal and professional growth of the student. It occurs under the sponsorship or supervision of a mentor in the workplace who is committed to seeing that it is an educational as well as a work venture. It requires skills appropriate to the student’s year in college and provides students with new skills, insights and experiences that are transferable back to the academic setting and/or to a future position in the workplace. (Only available to declared Weatherhead Accounting or Management majors.) Prereq: Junior standing.

MGBT 002. Supervised Professional Practicum - Semester 2 (0)
A professional practicum is a workplace experience, the primary goal of which is the intellectual, personal and professional growth of the student. It occurs under the sponsorship or supervision of a mentor in the workplace who is committed to seeing that it is an educational as well as a work venture. It requires skills appropriate to the student’s year in college and provides students with new skills, insights and experiences that are transferable back to the academic setting and/or to a future position in the workplace. (Only available to declared Weatherhead Accounting or Management majors.) Prereq: Junior standing.

MGBT 360. Special Topics and Issues in Management (1-9)
This course option is available to qualified students who are undertaking special projects in a management related field.
Graduate Courses

MGMT 403. Leadership Assessment and Development (3)
This course is designed to increase competitive attractiveness in the marketplace and maximize the added value of the M.B.A. program. The objective of the course is to have students learn a method for assessing and developing in themselves the knowledge and abilities relevant to management throughout their careers. This is accomplished by helping students develop an individualized learning plan to enhance their level of knowledge in 11 fields and 22 abilities. Students engage in a number of assessment activities, then receive feedback and interpret it. This occurs in the context of an Executive Action Team (i.e., students and a facilitator) in which students help each other assess their current capability and future development needs. This course is limited to students in the M.B.A. program.

MGMT 413. Human Value in Organizations (3)
Examines the behavioral sciences relevant to the effective management of people and the effective design of human resources system, structure and policies. Topics include leadership, change management, motivation and pay systems, team dynamics, staffing, decision making, organizational communications, employee participation, performance appraisal, conflict management, negotiation, work design, organizational design, and organizations culture. A variety of methods, including experiential and interactive learning methods, are used to study these topics.

MGMT 419. Corporate Field Research (1)
This course is intended for the graduate business student who wishes to gain applied/practical business experience based on his/her intended career path and/or with an organization. This course will assist building required skills and bridge the gap between the classroom and real world application. Prereq: Permission of the instructor.

MGMT 421. Business for Engineers (3)
This course is designed to assist practicing engineers to interface with the management of their organization. The focus of such interaction is with marketing, from whom the voice of the customer is relayed to engineering design, and with manufacturing, to whom the engineering function provides product and process designs. In addition, there are some integrative and contextual topics to round out the course. No M.B.A. credit. Prereq: Admission to Practice Oriented Master’s program.

MGMT 441. Planning for Personal Learning (3)
This course is designed for mid-life, mid-career professionals (health care, law, science and technology, management and the like) who may be moving toward new levels of leadership in their fields or organizations or who may be undergoing significant life or career transitions. Two three-day workshops (in August and January) plus three all day Saturday sessions in between are planned, along with individual follow-up in February or March. No M.B.A. credit.

MGMT 442. Seminar: Contemporary Management Issues I (3)
This is a two course sequence where a variety of current topics on leadership and management issues are presented in a seminar format. Specific topics for the year are selected in consultation with the participants. Previous topics have included re-engineering the corporation, marketing opportunity analysis, reinventing government, quality management, leadership and governance structures, and conflict management in organizations. In addition, each participant selects a subject for research. Proposals are prepared and reviewed by the faculty and class. Faculty guidance is offered. No M.B.A. credit.

MGMT 443. Planning for Personal Learning II (3)
This course is the second of a two-part sequence on personal and professional assessment, learning, and development. Part II includes a three-day residential retreat in January, a two-day retreat in May, and six half-day weekend sessions (February, March, April) for goal setting and action planning. Executive coaching is provided. An individualized development plan and an organizational project are completed. Prereq: MGMT 441.

MGMT 452. Japanese for Managers II (3)
Japanese for Managers II continues the introduction of fundamental Japanese grammar, pronunciation, and vocabulary essential for everyday business in Japan. In addition to language skills needed for specific situations (such as visiting, making appointments, extending invitations, business luncheons, etc.), the course will present, through discussion, video, and guest lecture, elements of Japanese society and culture relevant to conducting business in Japan. As the course emphasizes the development of productive oral and aural Japanese language skills, a major portion of each class meeting is devoted to the performance of dialogues and applied situational conversation. Prereq: Permission of instructor.

MGMT 453A. Working Spanish I (3)
Instruction in Spanish language and culture for managers with intensive study in Mexico.

MGMT 453B. Working Spanish for Managers II (3)
Continuation of MGMT 453A.

MGMT 455. Issues in Public Policy (3)
This course will introduce students to the primary frameworks and tools of public policy analysis. Such skills have become essential to business managers, who are increasingly called upon to perform quasi-public functions, especially at the CEO and vice-presidential levels. The course will begin by presenting analytical frameworks, drawn mostly from political science and economics. It will proceed to illustrate these frameworks using three public policy cases. Current plans are to discuss telecommunication regulation, urban development policy, and conflicts in the arts. This course is required for students enrolled in the M.B.A. certificate in public policy. It will also be open to graduate students from throughout the university, on the theory that a classroom with diverse professional backgrounds will better simulate the public arenas in which managers must increasingly operate.

MGMT 460. Managing in a Global Economy (3)
Managers need new skills to enable them to manage effectively in what is increasingly a global economy. They need a deeper understanding of cultural differences and how these differences may influence communications with foreign employers, employees, customers, suppliers or partners. They need a better understanding of the economic and political mechanisms of the world business system. They need to learn how to find out more about potential opportunities and threats that lie outside the United States. This course is designed to address these needs.

MGMT 460A. Managing in a Global Economy (3)
Managers need new skills to enable them to manage effectively in what is increasingly a global economy. They need a deeper understanding of cultural differences and how these differences may influence communications with foreign employers, employees, customers, suppliers or partners. They need a better understanding of the economic and political mechanisms of the world business system. They need to learn how to find out more about potential opportunities and threats that lie outside the United States. This course is designed to address these needs.

MGMT 460E. Managing in a Global Economy-E.M.B.A. (3)
This course is open for enrollment by E.M.B.A. students only. The course is designed to present first-hand issues in international management. It accomplishes this by means of readings, a written assignment and, most importantly, an international trip designed to witness different management cultures, styles and environments for business in the international community. The course is offered during the Spring semester of the second year (referred to as Semester V in the program). Faculty responsibility rests with the Faculty Director of the E.M.B.A. Program as well as a “Resident-Faculty” specific to each field trip. Such faculty are drawn from the Weatherhead community and vary by the design and destination of the trip. In addition, the course is staffed by an administrative assistant from the complement of Dively CMDR staff. Occasionally and where appropriate, there is also “in-tourist” assistance in some of our foreign locations. This course is part of our overall management offerings and is designated as MGMT 460; Section E.

MGMT 460K. Managing in a Global Economy (3)
Managers need new skills to enable them to manage effectively in what is increasingly a global economy. They need a deeper understanding of cultural differences and how these differences may influence communications with foreign employers, employees, customers, suppliers or partners. They need a better understanding of the economic and political mechanisms of the world business system. They need to learn how to find out more about potential opportunities and threats that lie outside the United States. This course is designed to address these needs.
MGMT 461. Development of American Business (3)
The major theme of this course traces the development of concepts relating to business structures and capital markets and workplace values in the United States and other countries. Attention is given to the emergence of the professional manager and the exploration of current business issues from a societal and historical perspective.

MGMT 462. Technology and Society: Progress and Problems (3)
Rapid technological change has markedly transformed business and society. Managers operate in an environment where consequences of new technologies need to be understood from an economic and social perspective. Given the broad context within which technologies emerge and evolve, this course seeks to create an awareness of how technology is a driving (but sometimes subtle) force that (1) shapes nearly all aspects of our experiences, opportunities, satisfactions, and problems; (2) influences and is influenced by the network of increasingly governmental and private sector organizations and interests; (3) drives the emergence of social and ethical issues and, in dealing with these issues, shows the strengths and limitations of political and economic institutions; and (4) is a significant determinant of corporate strategy in a world where economic, political, and social considerations coexist.

MGMT 462A. Technology and Society: Progress and Problems (1.5)
Summer offering.

MGMT 462B. Technology and Society: Progress and Problems (1.5)
Fall offering. Prereq: MGMT 462A.

MGMT 464. Business Ethics (3)
This course is built around two core learning tracks. The first is an extended analysis of case studies, which identifies ethical problems, diagnoses import, and develops strategic programs to address them. The second learning track uses short pieces of fiction to explore issues of ethical character, leadership, and organizational responsibility. Each student keeps an ethics journal over the course of the semester to reflect on ethical issues, both inside and outside the classroom. In addition, small student groups are formed to write case studies focusing on a business ethics problem.

MGMT 465. Perspectives in European Management (3)
The European Summer Institute provides an introduction to international business through a unique combination of class meetings on campus and a two-week excursion to central Europe. While in Europe, students meet with local business people, consult officials, and university professors to learn the prerequisites for doing business in the region. The trip features a number of site visits to local companies. (This course may be used for perspective course credit.) Prereq: Permission of instructor.

MGMT 466. Seminar in International Business (3)
This course is a continuation of MGMT 465 and includes an independent study component. (Approval for course credit in the student's area of concentration may be approved by the instructor at the time of registration.) (Summer only.) Prereq: Permission of instructor.

MGMT 498. Process Improvement Consulting (3-6)
This course is highly recommended to students who are planning to pursue post-M.B.A. careers in consulting firms or as an in-company process improvement or quality management consultant. At the start of the course, students will be organized as five-member consulting teams and will be assigned a consulting project and a project manager from a major Cleveland organization. Students will be expected to spend at least one day a week at the organization facility. The student consulting teams will be taught to use several tools for process improvement, project management, and communication with clients. Faculty member will act as a “consulting partner” during the course to provide guidelines and advice during challenging periods of the projects and to keep the progress of the projects on schedule. Student consulting groups will be evaluated on the quality of their analysis, reports and presentations and on the significance of the cost-savings or profits which they have identified for the firm through their analysis. Prereq: Second-year status.

MGMT 499. Strategic Issues and Applications (3)
This course wraps up the M.B.A. core by providing an integrative experience of applying the full range of managerial skills addressed throughout the core in a comprehensive case exercise. Students develop, document, and present comprehensive, implementable strategic and tactical actions programs in groups. Prereq: ACCT 401 and BAFI 402.

MGMT 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

MGMT 560. Theoretical Perspectives in Management (3)
The aim of this seminar is to expose the students to the theoretical underpinnings and empirical research associated with emerging ideas and theories in management. The end goal would be to challenge the students to utilize the perspective offered by one or more of these ideas to analyze a critical research issue in their field and develop a proposal for future research. Prereq: Ph.D. level course; otherwise instructor permission required.

MGMT 563. Qualitative Research Methods (3)
This course emphasizes qualitative methods for organizational diagnosis. The major portion of the course will involve presentations and discussions of fieldwork experience. (Fall, alternate years)

MGMT 570. Research Theory and Method (3)
A range of traditions in the social science are introduced, highlighting different positions from the philosophy of science and epistemology that are drawn upon to guide contemporary research methods. Issues of research design and statistical analysis in laboratory and field settings are explored. Ph.D. standing is required.

MGMT 571. Measurement Theory and Method (3)
This course provides a broad understanding of the theoretical and methodological issues in social science measurement, emphasizes scale development and assessment procedure, and involves extensive use of multivariate statistics (e.g., via SAS or SPSSx) and structural equations modeling (e.g., via LISREL or EQS).

MGMT 573. Application of Multivariate Data Analysis (3)
This course provides an understanding of the assumptions, principles and applications of a diverse range of multivariate data analytic techniques, including Principal Component/Factor Analysis, Canonical Correlation Analysis, Multiple Discriminant Analysis, Cluster Analysis, Path Analysis and Latent Variable Structural Equations modeling. This course involves extensive use of statistical packages (e.g., SAS/SPSSx). Students also will use LISREL/EQS.

MGMT 575. Doctoral Research Project (5)

MGMT 586. Research Project (3)

MGMT 601. Special Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

MGMT 602. Advanced Topics (1-18)
This is a course of flexible design to meet advanced theoretical and/or methodological needs of doctoral students. Approval is needed from the instructor, and it requires a letter grade.

MGMT 650. Leadership in a Changing World: Culture, Politics, Economics (4)
Study of the interaction of cultural, political, and economic factors in the international environment, explaining the implications of these issues for organizations and their leaders. The course emphasizes the development of frameworks for managerial thinking with respect to complex global issues. A team-teaching approach stresses the interdisciplinary quality of complex problems facing organizational leaders.

Health Systems Management Courses (HSMC)

HSMC 420. Health Finance (3)
(See BAFI 420.) Prereq: ACCT 401 or permission of instructor. Cross-listed as BAFI 420.

HSMC 421. Health Economics and Strategy (3)
(See ECON 421.) Cross-listed as ECON 421 and MHPH 421.

HSMC 422. Health Systems Marketing (3)
(See MKMR 420.) Prereq: MKMR 403 or MBAC 424 or consent of instructor. Cross-listed as MKMR 420.

HSMC 427. Health Law (3)
(See LAWS 227.) Cross-listed as LAWS 227.
HSMC 432. Health Care Information Systems (3)
(See MIDS 432.) Prereq. MIDS 409 or MBAC 423 or consent of instructor. Cross-listed as MIDS 432.

HSMC 456. Health Policy and Management Decisions (3)
This seminar course combines broad health care policy issue analysis with study of the implications for specific management decisions in organizations. This course is intended as an applied, practical course where the policy context is made relevant to the individual manager. Cross-listed as MHPH 456 and NURS 456.

HSMC 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

HSMC 501G. Medical School Electives (1-3)
Students complete requirements for three six-week electives offered by the Medical School and complete a paper to receive 3 hours of credit. For detailed information about this course, contact the Health Systems Management Center advisor in 570 Enterprise Hall (368-6403).

HSMC 502. Health Care Executive Education Series (1-3)
Students may choose six out of eight all day Friday seminars in the Health Care Executive Education Series, plus completion of a paper covering an aspect of the management of health care systems. Registration is 1 credit for Fall semester and 2 credits for the Spring Semester as seminars begin in the Fall and continue through the Spring semester. Limited to students admitted to the Health Systems Management Certificate program and those with approval from Barbara Bolek (bxp@po.cwru.edu; 216-368-6403).

HSMC 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

Executive Doctor of Management (EDMP)

EDMP 610. Culture and World Politics (3)
Religion, ethnicity and nationalism are assuming increasing significance as defining factors in the post cold war period. These developments call for analysis of how culture affects domestic, regional and international integration and disintegration. They raise questions about how culture and social structure are interrelated with economic development. The seminar will examine ideas of political democracy and economic liberalism in relation to different cultural and religious ideas and explore relationships among social values, political structures and economics.

EDMP 611. Theory and Practice of Collective Action (3)
The dominant model of business behavior assumes that organizational actions are solely individualistic, autonomous and competitive. Recently, the importance of collective action, within and across industries and communities, has been recognized. This seminar will address the theory and practice of collective action in the business environment and examine problems and solutions in local, national and global contexts. Case studies of collective action problems, such as waste recycling, technology development and community revitalization, will be discussed.

EDMP 612. Participant Observation and Ethnographic Methods/Project 1 (3)
Exposure to methodological issues of modern empiricism, qualitative study, and postmodern inquiry. Beginning development of participant observation skills, placing oneself in a context relevant to one’s research issue, observing, recording, and analyzing behavior. Exploring academic and practitioner literatures to inform data interpretation. By the end of the semester, production of a written miniethnography/participant observation and proposal for an expansion of the ethnography to be completed in the second semester. Part of the proposal will be the identification of a faculty advisor who can provide substantive advice in the chosen research area.

EDMP 613. Leadership to Create Human Value (3)
This seminar will promote reflection on the meaning and responsibilities of leadership in modern society. The role of sense-making—constructing the world of the organization in ways that make collective action possible—will be examined and discussed, using classical and modern literature that addresses the need for leadership. These discussions and participants’ own experiences in leading will form the basis for exploring three executive issues: the valuing of multiple beliefs and ideas that shape human intentions; the translation of that intention into possibilities for action; and the personal enactment of aspirations and visions that attracts others toward collective efforts in a global society. Assignments will include individual dialogue between participants and contemporary leaders to inquire about the experience of leadership and the current and future roles of the leader.

EDMP 614. Business as a Dynamic System (3)
This seminar examines the evolution of large-scale business firms as a result of technological and organizational change. It deals with the role of history, culture and finance in generating business organizations in different countries. The seminar also studies technological and regional systems as well as innovation and industry structure.

EDMP 615. Participant Observation and Ethnographic Methods/Project 2 (3)
Major emphasis on goals and methods of ethnography, reading texts of exemplary ethnographic works. Implementation of an ethnographic field project including observations, analytic induction, and theoretic interpretation. Expectation of completion of an ethnographic project, in publishable form, by the end of the semester.

EDMP 616. Global Economic Systems and Issues (3)
This seminar examines recent structural changes occurring in the world economy and how countries and international institutions are responding. Evolving patterns of global investment and trade are analyzed, especially the emergence of regional trade and investment blocs, and the changing roles of international economic institutions such as the World Bank, the International Monetary Fund, and the World Trade Organization.

EDMP 617. Technology and Social System Design (3)
Intensification of electronic technology, especially communication and computing technology, generates issues of technology assessment and social system design. Technology assessment concerns broad questions of how managers can anticipate and evaluate the potential consequences of existing and emerging technology, including social, economic, and political implications. As technologies intensify, questions of social system design will replace parochial concerns with organization design. Interorganizational networks, citizen action networks and financial government structures will become primary management concerns. This seminar will draw on historical studies of communication technologies and their impact on society.

EDMP 622. Thematic Elective I (1-3)
Participants in the E.D.M. Program take a selected sequence of two coordinated elective courses that provide opportunities for advanced study in topical or sector-specific areas. Sequences will be designed according to the shared interests of participant groups. For example, a sequence for participants with special interest in Nonprofit Management may consist of courses in Constitutional Issues, Nonprofit Organizations in the Marketplace, or The International Nonprofit Sector. A sequence designed for participants interested in Technology Management may include Foundations for Technology Management Leadership plus an additional course that integrates topics in Information Systems, Management Policy, Operations Management, and Organizational Behavior.

EDMP 623. Thematic Elective II (1-3)
(See EDMP 622.)

EDMP 624. Applied Research II (1-4)
(See EDMP 621.)

EDMP 625. Thematic Elective III (1-6)
(See EDMP 622.)

EDMP 626. Applied Research III (1-9)
(See EDMP 621.)

EDMP 627. Applied Research IV (3-9)
(See EDMP 621.)

EDMP 637. Formulation and Analysis of Social Policy (3)
This seminar examines the institutions and processes involved in assessing social needs, designing policies to address those needs, and evaluating policy effectiveness. Using health care as a primary example, seminar themes include the complexity of democratic decision making, dilemmas
associated with problem definition, difficulties in monitoring implementation, and differences in the functioning of the policy cycle across sectors, nations, and cultures. Students apply seminar concepts and analytical tools to social issues of interest to them.

EDMP 638. Qualitative Research Methods I (3)
This introductory seminar will build upon students’ experience with ethnography. Emphasis is placed on designing a structured and rigorous approach to qualitative inquiry. Students will craft research questions that attend to the larger pragmatic and theoretical contexts that shape them. Through readings, class discussions, expert consultations, and design of a personal (or group) research project, participants are introduced to the differences between inductive and deductive qualitative research while exploring major qualitative methods such as grounded theory, archival study, case studies, and action research. Emphasis is placed on developing clear conceptual frameworks that inform and bound the research work. Research practices concerned with review of appropriate literature, site selection, sampling, development of semi-structured interview protocols, interview techniques, and methods for triangulating data will be covered.

EDMP 640. Social Ethics: Contemporary Issues (3)
While drawing upon intellectual ancestors in philosophy and ethics, a primary focus on current issues and points of view. Analysis of social and ethical questions pertaining to the definition and purpose of contemporary life, the need for moral coherence, and the meaning of living in a global society. Particular emphasis on the ethical questions and dilemmas, opportunities and threats, posed by technological advances. Objectives are to expand capacity to address the ethical implications of these issues and to come closer to framing the right questions.

EDMP 641. Qualitative Research Methods II (3)
The continuing seminar emphasizes both systematic data analysis and theory building. We will seek to apply coding approaches in a rigorous manner and to pursue quantification of data and its statistical manipulation where appropriate. Research practices to be covered include: issues of validity and reliability, enfoldling appropriate theory to ensure a contribution to the problem or issue with which one is working, and structuring the written work so as to make it first presentable and then publishable. Completed projects will be reviewed and assessed for their contribution by a faculty review committee.

EDMP 642. Directed Studies Seminar (3-9)
A course in the third program year dedicated to student-identified directed study. Individually, in pairs, or in trios, students develop objectives and plans of study to deepen their understanding in particular topics, either through initiating a new writing project, extending a previous project, engaging in a directed reading program, or undertaking new field research. Faculty are invited to advise projects in their areas of interest. Sharing of interest and learning among students in a dedicated seminar.

EDMP 643. Foundations for Quantitative Inquiry (3)
This seminar will focus on basic foundations for designing generalizable (quantitative) studies. The participants will be able to use these skills in framing and designing their own research work. Basic foundations will be covered including survey, experimental/longitudinal, and secondary research design issues, sampling, control over confounding variables, selection/survey error and generalizability issues. Also covers scaling and measurement of social science phenomenon with emphasis on reliability and validity of constructs.

EDMP 644. Univariate Statistics II (2)
This is a follow-up seminar to the work in univariate statistics done in year two. This seminar will cover the assumptions, principles, and application of additional univariate statistics including covariance, test for mean difference, multiple comparisons, and regression/anova. This seminar covers the use of SPSS and EQS software for implementing statistical analysis.

EDMP 645. Critical Application and Research Project Issues (4)
This seminar will focus on common application issues that arise during the participants’ execution of individual research projects. By critically analyzing selected pieces of published applied research, participants will develop an appreciation of critical application issues that have wider applicability and relevance. Application to the participant’s own research stream will be encouraged and supported by sharing and discussing of common themes and problems.

EDMP 646. Advanced Analytical Methods for Generalizable Studies (3)
This seminar will focus on building the methodological skill base for rigorous analysis of quantitative data. This covers the assumptions, principles, and application of multivariate statistics including multiple regression analysis, moderator-mediator analysis, factor analysis, and path analysis. Also includes implementation of multivariate procedures using SPSS/EQS.

EDMP 699. Applied Research Project Continuation (1-9)
Program participants who have not successfully completed their Applied Research Projects before the start of the fall semester following their third year of enrollment in the E.D.M. Program will have until April 30th of the next year to complete the Applied Research Project. Students will be required to take sufficient additional hours to satisfy 54 semester credit hours required to receive the E.D.M. degree. In each case, the major advisor for the Applied Research Project will be responsible for supervising additional hours of independent work.

Entrepreneurial Studies (ENTP)
Undergraduate Courses

ENTP 295. Entrepreneurial Strategy (3)
This course is designed to show students how to identify potential business opportunities, determine what constitutes a good business model, and to strategically implement a business proposal. Topics of focus include an overview of the entrepreneurial process, determinants of venture success in high tech and other business environments, and strategies for industry entry and venture growth.

ENTP 310. Entrepreneurial Finance - Undergraduate (3)
This course explores the financing and financial management of entrepreneurial new ventures. The course will focus on issues of financial management of new ventures (forecasting cash flows, cash flow management, capital budgeting, valuation, capital structure) and the various financial methods and mechanisms available to entrepreneurs (bootstrapping, angel investors, venture capitalists, IPOs). Prereq or Coreq: ACCT 101 or ACCT 303 or consent of instructor.

ENTP 311. New Venture Creation (3)
This course explores all aspects of the creation of a new venture from idea through startup, growth, and beyond. Students will learn how to evaluate opportunities, develop strategies, create a business plan and acquire financing for a new venture. In this course students will develop a business plan for a new venture.

Graduate Courses

ENTP 418. New Enterprise Development (3)
This entrepreneurship course teaches how to start, acquire and manage one’s own business. Valuation, capital acquisition, turnarounds and growth strategies are featured, utilizing successful entrepreneurs and their companies to assure a real world learning experience. Cross-listed as PLCY 418.

ENTP 419. Entrepreneurship (3)
Utilizing active entrepreneurs, class exercises and original case studies, this course will explore the roles of the chief executive in smaller enterprises as negotiator, manager, leader and strategist. Cross-listed as PLCY 419.

ENTP 420. Managing the Family Firm (3)
The vast majority of U.S. firms are family controlled and present special problems in strategic management including the interaction of family and firm objectives, executive succession, management development and motivation, finance, estate planning, etc. This course explores solutions to these problems in the context of guiding the firm’s growth through the threshold between personal and professional management. The course pedagogy is participative and experiential. Cross-listed as PLCY 420.

ENTP 422. Managing an Emerging Growth Enterprise (3)
Students are exposed to what it is like to work in an emerging growth company with sales under $100 million. Prospective students might be
individuals who are considering employment with middle market company, entrepreneurs who may start a company, or business persons who may buy a middle market company. The learning experience will stem from participating in an actual semester-long project. In-class discussions include: business planning, selling, managing technology transfer, and creativity/innovation, and guest presentations by CEOs from middle market companies. Prereq: ACCT 401 and BAFI 402 and MKMR 403 and MIDS 409 and consent of instructor. Cross-listed as PLCY 422.

**ENTP 424. Advanced Principles of Entrepreneurship (3)**
This course will provide students with in-depth information on the entrepreneurial process by cross-cutting the stages of venture development with key functional business areas including marketing, operations, strategic planning, finance, and human resources. Each student will complete a practicum with a host company that consists of a weekly time commitment (work schedules will be set and agreed to by the course instructor, the host company and the student). Prereq: Approval of Ellen Blahut, EDI. Cross-listed as PLCY 424.

**ENTP 425. Managing Human Resource Issues in Entrepreneurial Firms (3)**
(See LHRP 425.) Cross-listed as LHRP 425.

**ENTP 426. International Entrepreneurship (3)**
This course introduces the area of international entrepreneurship by focusing on various aspects of this area. Topics to be covered include: conditions making small, medium-sized, and new ventures increasingly important in international business; information sources relevant to international entrepreneurship; critical steps in deciding on doing international entrepreneurship, strategic planning and methods in conducting international entrepreneurship; and benefits and problems of going international as a new venture. Cross-listed as PLCY 426.

**ENTP 427. Entrepreneurial Strategy (3)**
(See PLCY 427.) Cross-listed as PLCY 427.

**ENTP 428. Small Enterprise Consulting (3)**
Student teams will apply their expertise and experience to solve a strategic problem for a small enterprise selected by COSE (Council of Small Enterprises). Teams are expected to meet with their client, manage the project workload, and provide a case report with recommendations. Cross-listed as PLCY 428.

**ENTP 429. New Venture Creation (3)**
This course focuses on all aspects of creating a new venture from both an entrepreneurial as well as an intrapreneurial perspective. The primary focus of the course will be understanding all the aspects of the business plan both at start-up as well as growing the venture. This will involve understanding: sources of capital, the financial plan, the marketing plan, the organization plan, and the production plan all within the business plan framework. (Fall) Cross-listed as PLCY 429.

**ENTP 434. Business and Nonprofit Entrepreneurship (3)**
This course examines the power of entrepreneurship in the nonprofit sector. It will cover large scale policy initiatives, new services and for-profit activities. Course elements include vision, staffing, leadership, and funding. Cross-listed as ECON 434 and MAND 434.

**ENTP 440. Entrepreneurial Finance (3)**
This course explores the financing of entrepreneurial new ventures. The primary focus of the course will be the various financing methods and mechanisms available to entrepreneurs. This will involve understanding: estimation of capital requirements, bootstrap financing, angel investors, venture capitalists, private placements, firm valuation and initial public offerings. Cross-listed as PLCY 440.

**ENTP 441. Technology-Based Entrepreneurship (3)**
(See PLCY 441.) Cross-listed as PLCY 441.

**ENTP 450. Entrepreneurial Marketing (3)**
(See MKMR 450B.) Cross-listed as MKMR 450B.

**ENTP 471. Innovation and Intrapreneurship (3)**
(See PLCY 471.) Cross-listed as PLCY 471.

**ENTP 501. Special Problems and Topics (1-36)**
School of Medicine
The mission of the School of Medicine is to advance the health of humankind through three interrelated components:

1) Education: To provide the highest-quality humanistic and scientific education for students pursuing the doctor of medicine degree, advanced degrees in the biomedical sciences, and graduate and continuing medical education.

2) Research: To lead in the development of new knowledge in the biomedical sciences, the clinical disciplines, and areas that examine the organization and provision of health care services.

3) Service: To act to improve the health and health care of the community.

Since its founding in 1843, the Case Western Reserve University School of Medicine has been at the forefront of training tomorrow’s doctors and discovering tomorrow’s cures.

Before the turn of the century, the school was one of the first medical schools in the country to employ instructors devoted to full-time teaching and research. Six of the first seven women to receive medical degrees from accredited American medical schools graduated from Western Reserve University (as it was called then) between 1850 and 1856.

Already a leading educational institution for more than a century, in 1952 the School of Medicine initiated the most advanced medical curriculum in the country, pioneering integrated education, a focus on organ systems and team teaching in the preclinical curriculum. This curriculum instituted a pass/fail grading system for the first two years of medical school to promote cooperation among students instead of competitiveness, introduced students to clinical work and patients almost as soon as they arrived on campus, and provided free, unscheduled time in an era when doing so seemed unthinkable. Many other medical schools followed suit, and these components remain at the core of the medical school’s curriculum today.

The medical school counts eight Nobel Prize holders among its alumni and current or former faculty:

- John J.R. Macleod, M.B., Ch.B., D.P.H., physiology professor from 1903 to 1918, shared the 1923 Nobel Prize in Physiology or Medicine for the discovery of insulin. Dr. Macleod completed a considerable amount of the groundwork that furthered his understanding of diabetes in Cleveland.

- Corneille J.F. Heymans, M.D., who was a visiting scientist in the Department of Physiology in 1927 and 1928, received the Nobel Prize in Physiology or Medicine in 1938 for work on carotid sinus reflexes.

- Frederick C. Robbins, M.D., now medical school dean emeritus, university professor emeritus, and emeritus director of the Center for Adolescent Health, shared the 1954 Nobel Prize in Physiology or Medicine for his work on the polio virus, which led to the development of polio vaccines. He received the award two years after joining the medical school.

- Earl W. Sutherland, Jr., M.D., who had been professor and director of pharmacology from 1953 to 1963, won the 1971 Nobel Prize in Physiology or Medicine for establishing the identity and importance of cyclic adenosine monophosphate (AMP) in the regulation of cell metabolism.

- Paul Berg, Ph.D., who earned his biochemistry degree at the University in 1952, received the 1980 Nobel Prize in Chemistry for pioneering research in recombinant DNA technology.

- George H. Hitchings, Ph.D., who had been a biochemistry instructor from 1959 to 1942, shared the 1988 Nobel Prize in Physiology or Medicine for research leading to the development of drugs to treat leukemia, organ transplant rejection, gout, the herpes virus and AIDS-related bacterial and pulmonary infections.

- Alfred G. Gilman, M.D., Ph.D., a 1969 graduate of the medical school, shared the 1994 Nobel Prize for Physiology or Medicine for identifying the role of G proteins in cell communication. (Now he is professor and chair of the Department of Pharmacology at the University of Texas Southwestern Medical Center, Dallas.)

- Ferid Murad, M.D., Ph.D., a 1965 graduate of the medical school, shared the 1998 Nobel Prize in Physiology or Medicine for discoveries concerning nitric oxide as a signaling molecule in the cardiovascular system. (Now he’s chair of the Department of Integrative Biology, Pharmacology and Physiology at the University of Texas-Houston Medical School.)

Two other distinguished alumni have served as U.S. surgeon general: Jesse Steinfeld, M.D., a 1949 graduate, was surgeon general from 1969 to 1973, and David Satcher, M.D., Ph.D., graduated in 1970 and was surgeon general from 1998 to 2002.

The school is very proud of the contributions made by its educators and graduates but doesn’t rest on its laurels. Today, the Case Western Reserve University School of Medicine is among the top medical schools in the enrollment of minority students, and each class contains a high percentage of women. The curriculum responds to the latest findings in education and medicine and sets the pace for other schools.

The School of Medicine is the largest biomedical research institution in Ohio, as measured by funding received from the National Institutes of Health, the world’s largest funding agency of biomedical research. The medical school receives more NIH funding than all the other Ohio medical schools combined and is in the top tier of medical schools nationally.

U.S. News and World Report repeatedly has ranked the Case Western Reserve School of Medicine as one of the top overall medical schools in the country and specifically has singled out the family medicine, primary care and biomedical engineering programs as being exemplary.

The Case Western Reserve University School of Medicine was the first medical school to provide laptop computers to all its students. Today, students use their laptops to access the entire syllabus as well as numerous electronic resources deemed essential by faculty. Also, a multimedia classroom and extensive fiber optic wiring bring the latest technological resources to the fingertips of faculty during classroom time and facilitate interactive education through video conferencing between many learning sites. But technology is used to enhance, not replace, the faculty-student interaction that occurs in the classroom, the laboratory and small group discussions.

History

Founded in 1843 as Cleveland Medical College, the school moved into its first building, in downtown Cleveland, in 1846. In 1915, a 20-acre site was secured for a medical center in University Circle, the current home of Case Western Reserve University, its School of Medicine, and two of the school’s affiliated hospitals, University Hospitals of Cleveland and the Louis Stokes Cleveland Department of Veterans Affairs Medical Center. University Circle also is home to many of the country’s outstanding cultural and educational institutions.
In 1924, the School of Medicine moved into the most modern and best-equipped preclinical science building in the country at that time. That building, donated by Cleveland industrialist Samuel Mather, remains an integral part of the medical school complex. In 1995, it was named the Harland Goff Wood Building in honor of the late chair and professor of biochemistry and former provost of the university. In 2001, the School of Medicine broke ground for a new addition to the Wood Building expected to be completed in 2002. The new, eight-story wing will add more than 50,000 square feet to the medical school, primarily for research laboratories. Also as part of the project, 30,000 square feet of existing laboratory space in the Wood Building will be renovated.

In 1971, the Health Sciences Center was completed to house the University's medical, dental and nursing schools, as well as the Health Center Library. In 1994, the health sciences complex was named for now-retired U.S. Congressman Louis Stokes. The proximity of these excellent research and educational centers to other prestigious University departments, including science, engineering and social sciences, stimulates uniquely creative interaction among researchers and educators.

Another giant leap in research capabilities came in the early 1990s, when the Richard F. Celeste Biomedical Research Building, named for the former Ohio governor, was opened. The $70 million building, attached to the original School of Medicine, added 154,000 square feet of research space and includes conference spaces, a lecture hall, public spaces and a cafeteria.

**Faculty**

The University's medical school educators have received four Abraham Flexner Awards for Distinguished Service to Medical Education, more than have educators at any other medical school in the country, from the Association of American Medical Colleges.

The School of Medicine has 1,601 full-time and 2,121 part-time faculty members who teach in classroom, laboratory, small group and clinical settings. These faculty members work in the medical school's 13 preclinical departments, 16 clinical departments and dozens of centers.

**Research**

As a research institution, the School of Medicine also has a tradition of national leadership. The National Institutes of Health is the country's largest funding source for biomedical research, and the School of Medicine consistently has ranked in the top tier of the nation's medical schools for federal research funding from the NIH. In fact, fiscal year 2001 (at press time the latest year for which figures were available) marked the 15th consecutive year that NIH funding to the medical school had increased.

For fiscal year 2001, the school received $174 million in grants from the NIH. The school ranked first among Ohio's six medical schools, receiving more NIH funding than all the other Ohio schools combined. Seven departments placed in the top 10 for NIH funding in their fields: Pediatrics, first; Orthopaedic Surgery, second; Dermatology, fourth; Epidemiology and Biostatistics, seventh; Neurosciences, seventh; Psychology, eighth; and Public Health and Preventive Medicine, ninth. Sixteen other departments ranked in the top 50.

More than 40 of the school's professors each receive $1 million or more in funding from the NIH and other sources.

**Community Involvement**

The School of Medicine also serves the northern Ohio community in many ways. Primarily, it is a critical link between scientific discovery and the delivery of health care to the community. The school's faculty provide 90 percent of the indigent health care in Cuyahoga County and a majority of the care for indigent patients in Ohio.

The School of Medicine's commitment to the community is illustrated by a number of programs that link researchers and medical students to the community. These include the Center for Urban Health Care, the Center for Adolescent Health, the Center for Health Promotion Research, the Primary Care Track, and the Institute for Public Health Sciences, involving the MetroHealth System and the School of Medicine. This latter program includes research into the prevention, diagnosis and treatment of health problems in groups and communities, as well as educational programs for medical and graduate students, physicians and other health care personnel.

Current community-based programs, including the Urban Area Health Education Center (AHEC) and the award-winning Cleveland Health Education Program, offer opportunities for students from several of the University's undergraduate and professional schools, especially the medical school, to interact with students in the Cleveland public schools and with the community at large. Also, through the master of public health degree program, students complete a public health field practicum in which they work on a project for a public agency and produce a report for the agency. M.P.H. graduates are qualified to work in local and state health departments, universities and colleges, hospitals, ambulatory medical centers, non-profit organizations, and the insurance and pharmaceutical industries.

A major economic influence on the northern Ohio area, the School of Medicine and its affiliated hospitals are among the largest employers of personnel in the area and further stimulate the economy by providing concepts for technology transfer to the business sector.

On the global level, the School of Medicine has an international health program focusing on AIDS, parasitic diseases, tuberculosis, malaria and other diseases that directly threaten world health.

**Administration**

The dean of the School of Medicine also is vice president for medical affairs at Case Western Reserve University and is responsible for the administration of the school and for the university's relationships with affiliated hospitals; medical health-related agencies and institutions; and community health care, education and research programs involving the faculty of the School of Medicine. The person holding this position reports to the president of the university.

The chairpersons of university departments are delegated administrative responsibility in their respective areas and report to the dean.

The faculty of the School of Medicine, through the Faculty Council, plan and implement educational programs and formulate general policies and those regarding student affairs.

**Administration**

Jerald S. Goldberg, D.D.S.
Interim Dean

Linsey C. Henson, M.D., Ph.D.
Vice Dean for Medical Education and Academic Affairs

C. Kent Smith, M.D.
Vice Dean for Student Affairs

Albert C. Kirby, Ph.D.
Associate Dean for Admissions and Student Affairs

Thomas M. Nosek, Ph.D.
Associate Dean for Biomedical Information Technologies

Russell F. Catanese
Interim Associate Dean for Development and Alumni Affairs
Daniel E. Anker, Ph.D., J.D.
Associate Dean for Faculty and Institutional Affairs
Jerome Kowal, M.D.
Associate Dean for Geriatric Medicine
Richard D. Aach, M.D.
Associate Dean and Director of Residency and Career Planning
Robert Haynie, M.D., Ph.D.
Associate Dean for Student Affairs
Ben Brouhard, M.D.
Associate Dean for the MetroHealth System
Robert B. Daroff, M.D.
Associate Dean for University Hospitals of Cleveland
Murray D. Altose, M.D.
Associate Dean for Veterans Affairs Medical Center
Joseph Corrao, M.Ed.
Registrar

Academic Department Chairs

Preclinical Departments

Anatomy
Joseph LaManna, Ph.D. (Acting)
Biochemistry
Michael A. Weiss, M.D., Ph.D.
Biomedical Engineering
Patrick Crago, Ph.D.
Environmental Health Sciences
G. David McCoy, Ph.D. (Acting)
Epidemiology and Biostatistics
Alfred A. Rimm, Ph.D.

General Medical Sciences
Nathan A. Berger, M.D.

Center for Adolescent Health
Barbara Cromer, M.D., Director

Center for Bioarchitectonics
Raymond J. Laske, Ph.D., Director

Center for Biomedical Ethics
Stuart Youngner, M.D., Director

Center for International Health
James W. Kazura, M.D., Director

Center for Physical and Rehabilitation Medicine
Patrick Murray, M.D. (Acting Director)

Center for RNA Molecular Biology
Timothy W. Nilsen, Ph.D., Director

Comprehensive Cancer Center
James K. V. Wilson, M.D., Director

Genetics
Terry J. Hassold, Ph.D., Patricia A. Hunt, Ph.D., Joseph H. Nadeau, Ph.D. (Acting)

Molecular Biology and Microbiology
Jonathan Karm, Ph.D.

Neurosciences
Lynn Landmesser, Ph.D.

Nutrition
Henri Brunengraber, M.D., Ph.D.

Pathology
George Perry, Ph.D. (Acting)

Pharmacology
John H. Nilson, Ph.D.

Physiology & Biophysics
Antonio Scarpa, M.D., Ph.D.

Clinical Departments

Henry Ford Health System

Department Chairs

Anesthesiology
Morris Brown, M.D.

Biostatistics
Edward Peterson, Ph.D. (Interim)

Dermatology
Gary W. Lim, M.D.

Emergency Medicine
Michael Tomlanovich, M.D.

Family Practice
Susan Schooley, M.D.

Internal Medicine
John Popovich, M.D.

Medical Genetics
Daniel VanDyke, M.D.

Neurology
Ivo Drury, M.D.

Neurosurgery
Mark Rosenblum, M.D.

Obstetrics and Gynecology
Ronald Strickler, M.D.

Ophthalmology
Paul A. Edwards, M.D. (Interim)

Orthopaedics (Bone and Joint Center)
David J. Collon, M.D.

Otolaryngology
Michael Benninger, M.D.

Pathology
Richard Zarbo, M.D. (Interim)

Pediatrics
Charles Barone, M.D.

Psychiatry
C. Edward Coffey, M.D.

Radiology
Jae Ho Kim, M.D.

Radiation Oncology
Amy B. Ron, M.D.

Surgery
Frank Lewis, M.D.

University Hospitals of Cleveland

Department Chairs

Anesthesiology
Howard Nearman, M.D.

Dermatology
Kevin D. Cooper, M.D.

Family Medicine
George Kikano, M.D.

Medicine
Richard A. Walsh, M.D.

Neurological Surgery
Robert A. Ratcheson, M.D.

Obstetrics and Gynecology
Laszlo Sogor, M.D., Ph.D. (Acting)

Ophthalmology
Jonathan H. Lass, M.D.

Orthopaedics
Vctor M. Goldberg, M.D.

Otolaryngology-Head and Neck Surgery
James Arnold, M.D.

Pediatrics
Ellis D. Ayner, M.D.

Pathology
John Anhalt, M.D., Ph.D.

Psychiatry
Pedro Delgado, M.D.

MetroHealth Medical Center

Department Chairs

Anesthesiology
Tejbir Sidhu, M.D.

Dentistry
Edward R. Hills, D.D.S. (Interim)

Dermatology
Marlene Willen, M.D. (Interim)

Emergency Medicine
Charles L. Emerman, M.D.

Family Medicine
James Campbell, M.D.

Medicine
Alfred Connors, M.D.

Neurology
Joseph P. Hanna, M.D. (Interim)

Obstetrics and Gynecology
Patrick Catalanoto, M.D.

Otolaryngology - Head and Neck Surgery
Joseph Carter, M.D.

Orthopaedics
Brendan Patterson, M.D.

Pathology
Joseph F. Tomashewski, M.D.

Pediatrics
Robert Cohn, M.D. (Interim)

Physical Medicine and Rehabilitation
Gary Clark, M.D.

Psychiatry
R. Taylor Segraves, M.D., Ph.D.

Radiology
Anthony Minotti, M.D. (Interim)

Surgery
Mark A. Malangoni, M.D.

Louis B. Stokes Veterans Affairs Medical Center

Department Chairs

Anesthesiology
Howard Nearman, M.D.

Dermatology
Kevin D. Cooper, M.D.

Family Medicine
George Kikano, M.D.

Medicine
Richard A. Walsh, M.D.

Neurological Surgery
Robert A. Ratcheson, M.D.

Obstetrics and Gynecology
Laszlo Sogor, M.D., Ph.D. (Acting)

Ophthalmology
Jonathan H. Lass, M.D.

Orthopaedics
Victor M. Goldberg, M.D.

Otolaryngology-Head and Neck Surgery
James Arnold, M.D.

Pediatrics
Ellis D. Ayner, M.D.

Pathology
John Anhalt, M.D., Ph.D.

Psychiatry
Pedro Delgado, M.D.
Department of Biomedical Engineering

Chair
Patrick E. Crago, Ph.D. (A & C Ford Professor)

Professors
Dominique Durand, Ph.D.
J. Lawrence Katz, Ph.D.
Roger E. Marchant, Ph.D.

John Thomas Mortimer, Ph.D.
P. Hunter Peckham, Ph.D.
Yoram Rudy, Ph.D.
Gerald M. Saidel, Ph.D.

Associate Professors
Ravi Bellamkonda
Igor Efimov, Ph.D. (Elmer L. Lindseth Associate Professor)

Miklos Gratzi, Ph.D.
Joseph Izatt, Ph.D.
W. Sanford Topham, Ph.D.

Adjunct Associate Professors
Hiroaki Harasaki, M.D., Ph.D.
Ivan Vesely

Assistant Professors
Jiannin Cui, Ph.D.
Steven J. Eppell
Jinming Gao, Ph.D.
Warren M. Grill, Ph.D.

Adjunct Assistant Professors
Brian Davis, Ph.D.
Mark D. Graber, Ph.D.

Kandice Kottke Marchant, M.D., Ph.D.

Todor Mazgalev
Marc S. Penn, M.D., Ph.D.
Jean A. Tkach, Ph.D.

D. Geoffrey Vince, Ph.D.
Michael Wendt, Ph.D.
Guang Yue, Ph.D.

Maciej Zborowski, Ph.D.

Secondary Appointments

Professors
Nathan A. Berger, M.D.
Henri Brunengraber, M.D., Ph.D.
Dorr G. Dearborn, M.D., Ph.D.
Helen H. Evans, Ph.D.
Douglas S. Kerr, M.D., Ph.D.

Vincent M. Monnier, M.D.
Nancy L. Oleinick, Ph.D.
Ganes Chandra Sen, Ph.D.
John E. Stuehr, Ph.D.
James R. Zull, Ph.D.

Associate Professors
Richard L. Eckert, Ph.D.
Thomas A. Gerken, Ph.D.

Karl A. Koehler, Ph.D.
David W. Lundgren, Ph.D.
Lucynda R. Marino, M.D.
W. David Sedwick, Ph.D.

Marie Varnes, Ph.D.
Martina Veigl, Ph.D.

Siomma Berger, Ph.D.

Adjunct Assistant Professors
Jun Qin, Ph.D.

Vivian Yee, Ph.D.

Department of Dermatology

Chair - MetroHealth Medical Center
Marlene Willen, M.D.

Chair - University Hospitals
Kevin D. Cooper, M.D.

Professors
Bryan R. Davis, M.D.
Mahmoud A. Ghannoum, Ph.D.

Department of Dermatology

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Chair - University Hospitals
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Department of Dermatology

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Chair - University Hospitals
Kevin D. Cooper, M.D.

Professors
Bryan R. Davis, M.D.
Mahmoud A. Ghannoum, Ph.D.
Eliot N. Mostow, M.D.
Lauren S Nagashima-Whalen, M.D.
Dale Pokorney, M.D.
Elizabeth W. Rauschkolb, M.D.
Joseph J. Ross, M.D.
Vernon Sackman, M.D.
John G. Secrist, M.D.
Carol Collins Slover, M.D.
Janet N. Sullivan, M.D.
Steven J. Taub, M.D.
Karen J. Turgeon, M.D.
Judith J. Walker, M.D.
Janet S. Wieseltier, M.D.

**Adjunct Assistant Professors**

Rajesh Agarwal, Ph.D.
Marnita E. Sandifer, Ph.D.

**Senior Clinical Instructors**

Louis S. Kish, M.D.
Joyce Ann Lender, M.D.
Michael G. Mancuso, M.D.
Rodion Palazij, M.D.
Nina Petroff, M.D.
Richard Edward Ranchoff, M.D.

**Instructors**

Frances Florentino, M.D.
Sanjay Gupta, Ph.D.
Guadalupe Reyes, Ph.D.

**Clinical Instructors**

Judith M. Andreano, M.D.
Jennifer R. Lloyd, O.D.
Lydia Parker, M.D.
Constance D. Sutter, M.D.
Lynn Ryan Williams, M.D.

**Adjunct Instructor**

Alice M. Jeromin, D.V.M.

**Secondary Appointments**

**Profiessors**

Richard L. Eckert, Ph.D.
M-Jan-Sun Sy, Ph.D.

**Associate Professor**

Tariq M Haqqi, Ph.D.

**Department of Environmental Health Sciences**

**Acting Chair**

G. David McCoy, Ph.D.

**Clinical Professor**

Dale H. Cowan, M.D.

**Adjunct Professor**

Herbert S. Rosenkranz, Ph.D.

**Adjunct Associate Professors**

Paul C. Howard, Ph.D.
Robert Mermelstein, Ph.D.
Robert W. Naismith, Ph.D.

**Assistant Professor**

Ellen A. Rorke, Ph.D.

**Secondary Appointments**

**Professors**

Helen H. Evans, Ph.D.
Stanton L. Gerson, M.D.
Gilis Klopman, Ph.D.
John J. Mieyal, Ph.D.
Hasan Mukhtar, Ph.D.
Nancy L. Oleinick, Ph.D.
Thomas G. Pretlow II, M.D.
Norman Robbins, M.D., Ph.D.

**Associate Professors**

Lawrence M. Sayre, Ph.D.

**Department of Epidemiology & Biostatistics**

**Chair**

Alfred A. Rimm, Ph.D.

**Professors**

Robert H. Binstock, Ph.D.
Sara M. Debanne, Ph.D.
Robert C. Elston, Ph.D.
Sylvan B. Green, M.D.
Duncan B. Neuhauser, Ph.D. (C.E. Blanchard Professor)

**Associate Professors**

Paul K. Jones, Ph.D.
Sana Loue, Ph.D.
David R. Nerenz, Ph.D.
Jane M. Olson, Ph.D.
Nicholas J. Schork, Ph.D.
Christopher Curtis Whalen, M.D.
John S. Witte, Ph.D.

**Adjunct Associate Professor**

Gerald J. Beck, Ph.D.

**Assistant Professors**

Jeffrey Albert, Ph.D.
Elaine Borawski, Ph.D.
Marcella Elizabeth Ford, Ph.D.
Katrina B. Goddard, Ph.D.
Kathryn Hirst, Ph.D.
Sudha Iyengar, Ph.D.
Christine L.M. Joseph, Ph.D.
Kevin Keen, Ph.D.
Tommas Radiovoyetch, Ph.D.
J. Sunil Rao, Ph.D.
Benjamin A. Rybicki, Ph.D.
Ethan L. Mendel Singer, Ph.D.
Hope H. Snider, M.D.
Hemant K. Tiwari, Ph.D.
Kimberlydawn Wisdom, M.D.

**Adjunct Assistant Professors**

Steven J. Bowlin, O.D.
David Chou, M.D.
Karin M. Fagan, M.D.
Tom Greene, Ph.D.
Robin B. Lake, Ph.D.
Richard N. Matzen, M.D.
Lyle Palmer, Ph.D.
George D. Weiner, Ph.D.

**Senior Instructors**

Pingfu Fu, Ph.D.
Sarun Koroukian, Ph.D.
Mei Lu, Ph.D.
Wilmack Mackay, M.S.

**Adjunct Instructors**

Richard W. Pine, M.D.

**Secondary Appointments**

**Professors**

David C. Aron, M.D.
Randall D. Cebul, M.D.
Neal V. Dawson, M.D.
Norman Robbins, M.D., Ph.D.
Mark D. Schluchter, Ph.D.
J.B. Silvers, Ph.D.
Kurt C. Stange, M.D., Ph.D.
Stephen Wotman, D.D.S.
Stephen J. Zyzanski, Ph.D.

**Associate Professors**

Avi Dor, Ph.D.
Scott H. Frank, M.D.
Charles H. King, M.D.
C. Kent Kwoh, M.D.
Susan Redline, M.D.
Norman R. Rushforth, Ph.D.

**Assistant Professors**

Gregory S. Cooper, M.D.
Douglas Einstadter, M.D.
Susan A. Flocke, Ph.D.
Li Li, Ph.D.
Suchitra Nelson, Ph.D.
Ashwini Sehgal, M.D.

**Instructor**

Henry Lester Kirchner, Ph.D.

**Department of Family Medicine**

**Chair - MetroHealth Medical Center**

James Wiley Campbell, M.D.

**Chair - University Hospitals**

George Kikano, M.D.

**Professors**

Raymond Y. Demers
Antonnette V. Graham, Ph.D.
C. Kent Smith, M.D. (D.J. Weatherhead Professor)
Kurt C. Stange, M.D., Ph.D.
Stephen J. Zyzanski, Ph.D.

**Associate Professors**

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Jason Chao, M.D.
Kathy Cole-Kelly, M.S.W.
Scott H. Frank, M.D.
Robert B. Kelly, M.D.
Patricia Hughes Moore, M.D.

**Associate Clinical Professors**

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Fred M. Jorgensen, M.D.
Thomas M. Mettee, M.D.
Edward C. White, M.D.

**Assistant Professors**

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Christine M. Anderson, M.D.
Christine A. Alexander, M.D.
Christine M. Anderson, M.D.
Christine Antenucci, M.D.
Alan S. Cadesky, M.D.
Mary V. Corrigan, M.D.
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Tanya L. Edwards, M.D.
Lee K. Erickson, M.D.
Alan R. Fischler, O.D.
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Kenneth B. Frisof, M.D.
Darrell T. Hulisz, Pharm.D.
Jean T. Stevenson, M.D.
Timothy P. Spiro, M.B.B.S.
Hope H. Snider, M.D.
Bernard J. Silver, M.D.
Donald C. Shina, M.D.
Abdelwahab Shalodi, M.B.B.Ch.
Ashwini Sehgal, M.D.
P. Sridhar Rao, Ph.D.
Isabel M. Parraga, Ph.D.
Beth Overmoyer, M.D.
Michael Oefelein, M.D.
Elizabeth O'Toole, M.D.
Louis J. Novak, M.D.
Masahiro Morikawa, M.D.
David S McPheeters, Ph.D.
Janet W. McGrath, Ph.D.
Susan R. Marengo, Ph.D.
Rina Lazebnik, M.D.
Mary Joan Laughlin, M.D.
Bruce T. Lamb, Ph.D.
Omer Koc, M.D.
Bruce T. Lamb, Ph.D.
Mary Joan Laughlin, M.D.
Rina Lazebnik, M.D.
Guangbin Luo, Ph.D.
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Samantha Rose, Ph.D.
Janet W. McGrath, Ph.D.
David S McPheeters, Ph.D.
Anna-Lisa Nieminen, Ph.D.
Louis J. Novak, M.D.
Elizabeth O'Toole, M.D.
Beth Overmoyer, M.D.
Isabel M. Farraga, Ph.D.
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Timothy P. Spiro, M.B.B.S.
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Hakon Torjesen, B.A.
Scott B. Vande Pol, M.D., Ph.D.
Bingcheng Wang, Ph.D.
Anita H Weiss, M.D.
Susan Wentz, M.D.
Christopher Curtis Whalen, M.D.
Cathy White-Owen, M.D.
Georgia L Wiesner, M.D.
Amy L Wilson, Ph.D.
M. Linda Workman, Ph.D.
Assistant Clinical Professors
Daniel Brustein, M.D.
Mary Ellen S. Davis, M.D.
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Janet Schriner, M.S.N.
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Peter S. Ecklund, Ph.D.
Douglas Henry, M.D.
Judith P. Lipton, J.D.
Hua Lou, Ph.D.
Carly P. Yanda, M.S.
Clinical Instructors
Elizabeth R. Imrie, M.B.B.S.
Joan Jackson, M.D.
Elizabeth R. Imrie, M.B.B.S.
Ilan Schmitt, M.D.
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Co-Chairs
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Patricia Ann Hunt, Ph.D.
Joseph H. Nadeau, Ph.D. (James H. Jewell Professor)
Professors
Marcelo Jacobs-Lorena, Ph.D.
Stuart Schwartz, Ph.D.
George R. Stark, Ph.D.
Daniel Van Dyke, Ph.D.
Huntington F. Willard, Ph.D.
Bryan R.G. Williams, Ph.D.
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Aravinda Chakravarti, Ph.D.
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Robert D Nicholls, D. Phil.
Assistant Professors
Ronald A. Conlon, Ph.D.
Peter J. Harre, Ph.D.
A. Gregory Matera, Ph.D.
Anne Matthews, Ph.D.
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Helen K. Salz, Ph.D.
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Georgia L Wiesner, M.D.
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Assistant Professors
Christine Curtis, Ph.D.
Evan Eichler, Ph.D.
Bruce T. Lamb, Ph.D.
Hua Lou, Ph.D.
Guangbin Luo, Ph.D.
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Instructors
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Feng Tie, Ph.D.
Nancy G. Wolf, M.D.
Clinical Instructors
Jennifer Facher, M.S.
Michael D. Graf, M.S.
Shauna Heeger, M.S.
Katherine Lynch, M.S.
Rebecca J. Nagy, M.S.
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Secondary Appointments
Assistant Professors
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Mitchell L. Drumm, Ph.D.
James W. Jacobberger, Ph.D.
Philip G. Morgan, M.D.
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Michiko Watanabe, Ph.D.
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Richard Allen Walsh, M.D. (John H. Hord Professor)
Vice Chair
E. R. McFadden Jr., M.D. (A. J. Beams Professor)
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Richard D. Aach, M.D.
Murray D. Altosc, M.D.
Baha H. Arafa, M.D.
David C. Aron, M.D.
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Robert C. Bahler, M.D.
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Nathan A. Berger, M.D.
W. Henry Henry Boom, M.D.
Mark D. Carlson, M.D.
Oscar Carretero, M.D.
Susan G. Carter, M.D.
Randall D. Cebul, M.D.
Neal V. Dawson, M.D.
Clark W. Distelhorst, M.D. (C.S. Britton II Professor)
Janice G. Douglas, M.D.
Michel G. Farah, M.D.
Claudio Fiocchi, M.D.
Jeffrey Garvin, Ph.D.
Saul M. Genuith, M.D.
Stanton L. Gerson, M.D. (Shiverick Professor)
Sidney Goldstein, M.D.
Richard C. Graham Jr., M.D.
Linda A. Headrick, M.D.
John D. Hines, M.D.
Brian Hoyt, M.D.
Lansing C. Hoskins, M.D.
Donald E. Hricik, M.D.
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Brian Hoyt, M.D.
Lansing C. Hoskins, M.D.
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Timothy Scott Kern, Ph.D.
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Musa Haxhiu, M.D., Ph.D.
Charles L. Hoppel, M.D.
Lawrence Kass, M.D.
M. Edward Medof, M.D., Ph.D.
Duncan B. Neuhauser, Ph.D.
Timothy W. Nilsen, Ph.D.
Fritz M. Rottman, Ph.D.
Yoram Rudy, Ph.D.
Antonio Scarpa, M.D., Ph.D.
Huntington F. Willard, Ph.D.
Stuart Youngner, M.D.

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Thomas H. Murray, Ph.D.

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Thomas M. Hering, Ph.D.
Michael R. Jacobs, M.B.B.S.
Joel Peerless, M.D.

Assistant Professors
Donald D. Anthony, M.D.
Sarah C. Aronson, M.D.
Barbara J. Daly, Ph.D.
Parvin C. Dorostkar, M.D.
David Effron, M.D.
Michael D. Infeld, M.D.
Kanagaraj G. Kumar, M.D.
John Lane, M.D.
Grace McComsey, M.D.
Sudhir K. Mehta, M.D.
Michael L. Nieder, M.D.
Marsha A. Pyle, D.D.S.
Donald C. Shina, M.D.
Nora G. Singer, M.D.
John E. Stork, M.D.
Magdalena Tary-Lehmann, M.D.

Assistant Clinical Professors
Lois S. Freedman, M.D.
Richard J. Koletsky, M.D.
Donald Mann, M.D.
Daniel F. Reynolds, M.D.
Carl A. Robson, M.D.
Seth M. Seltzakian, M.D.
Theodore H. Sher, M.D.
Joel S. Steinberg, M.D.

Senior Instructors
Thomas Lukens, M.D., Ph.D.
Ronald C. Reed, Pharm.D.
Ethan L. Mendel Singer, Ph.D.

Senior Clinical Instructors
Phillip C. DeMio, M.D.
Peter Laufer, M.D.
Edward C. White, M.D.

Adjunct Senior Instructor
Mary Margaret Chren, M.D.

Instructors
R. Scott Krugman, M.D.
Kathleen Smyth, Ph.D.

Clinical Instructors
David Alan Bowe, M.D.
Jon J. Floriano, M.D.
Ernest H. Friedman, M.D.
James E. Gibbs, M.D.
Bruce A. Oppenheim, M.D.
Beth Brandt Sersig, M.D.
Heather W. Vays, M.D.

Department of Molecular Biology & Microbiology

Chair
Jonathan Karn, Ph.D. (R & W Reinberger Professor)

Professors
Lloyd Culp, Ph.D.
Robert W. Hogg, Ph.D.
Fritz M. Rottman, Ph.D.

Adjunct Professor
Hsing-Jien Kung, Ph.D.

Associate Professors
Petrus Anton Jacobus de Boer, Ph.D.
Sandi K. Lemmon, Ph.D.
David R. Setzer, Ph.D.
Jo Ann Wise, Ph.D.

Adjunct Associate Professor
Russell A. Maurer, Ph.D.

Assistant Professor
Susan Burden-Gulley, Ph.D.

Instructors
Tim S. Whittingham, Ph.D.

Secondly Appointments

Professors
Pamela B. Davis, M.D., Ph.D.
Faramarz Ismail-Beigi, M.D., Ph.D.
Timothy W. Nilsen, Ph.D.

Associate Professor
Jonatha M. Gott, Ph.D.

Assistant Professors
Joseph Bokar, Ph.D.
James P. Bruzik, Ph.D.
Mark G. Caprara, Ph.D.
Michael E. Harris, Ph.D.
Sanford Markowitz, Ph.D.
Phillip Rather, Ph.D.
Rolf Renne, Ph.D.
Thomas E. Evans, Ph.D.

Instructors
Patricia Maroney, B.S.

Department of Neurological Surgery

Chair - University Hospitals
Robert A. Ratcheson, M.D. (Harvey H. Brown, Jr. Professor)

Professors
Alan R. Cohen, M.D.
Russell W. Hardy Jr., M.D.
W. David Lust, Ph.D.

Robert J. Maciunas, M.D.
Mark Rosenblum, M.D.
Warren R. Selman, M.D.
Yoshiro Takaoka, M.D.
Robert J. White, M.D., Ph.D.

Associate Professors
Kost Eliseyevich, M.D., Ph.D.
Matt J. Likavec, M.D.
Irvin G. Mc quarrie, M.D., Ph.D.

Associate Clinical Professors
Benedict J. Colombi, M.D.
Melvin Shafron, M.D.
Assistant Professors
James S. Anderson, M.D.
David Dean, Ph.D.
Roseanna Marie Lechner, M.D.
Sandra Rempel, Ph.D.

Department of Neurology

Chair - MetroHealth Medical Center
Joseph P. Hanna, M.D.

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Dennis M. Landis, M.D. (Gilbert W. Humphrey Professor)

Professors
Robert Barry Daroff, M.D.
Louis F. Dell’Osso, Ph.D.
Michael Deveraux, M.D.
Ivo Drury, M.D.
Robert P. Friedland, M.D.
M. Bashar Katirji, M.D.
Joseph C. LaManna, Ph.D.
Richard John Leigh, M.D. (D. Blair/R. Daroff Professor)
Robert L. Ruff, M.D., Ph.D.
Stephen M. Sagar, M.D.
Peter J. Whitehouse, M.D., Ph.D.

Associate Professors
Asa Wilbourn, M.D.
John P. Conomy, M.D.

Clinical Professors
Robert J. White, M.D., Ph.D.

Clinical Professors
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Michael Deveraux, M.D.
Ivo Drury, M.D.
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Stephen M. Sagar, M.D.
Peter J. Whitehouse, M.D., Ph.D.

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Asa Wilbourn, M.D.

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Clinical Professors
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Louis F. Dell’Osso, Ph.D.
Michael Deveraux, M.D.
Ivo Drury, M.D.
Robert P. Friedland, M.D.
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Stephen M. Sagar, M.D.
Peter J. Whitehouse, M.D., Ph.D.

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Asa Wilbourn, M.D.
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Vice Chair  
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Mark Hatzoglou, Ph.D.  
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Kou-Yi Tseng, Ph.D.  

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Diane Foreman Peck, M.S.  
Sandra Pichette, M.A.  
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Patricia K. Schultz, M.S.  
Sharon Schwartz, M.S.  
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Jay Yawman, M.D.
Clinical Instructors
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Pamela T. Conover, M.D.
Curtiss Lee Jones, M.S.
Daniel Katz, M.D.
David J. Keep, M.D.
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Kay A. May, B.S.
Brian J. Peck, M.S.
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Sunetree Sapatnekar, Ph.D.
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James T. Wentzel
Secondary Appointments
Professors
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Claire Doerschuk, M.D.
Claudio Fiocchi, M.D.
James Kazura, M.D.
Mary L. Kumar, M.D.
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Neal S. Rote, Ph.D.
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John R. Schreiber, M.D.
Gary S. Wood, M.D.
Associate Professors
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Alfred D. Heggie, M.D.
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Paul G. Smith, O.D.
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Philip Toltsis, M.D.
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Michele C. Walsh, M.D.
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Susan R. Wiersma, M.D.
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Martha S. Wright, M.D.
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Lee J. Brooks, M.D.
Bill D. Clem, M.D.
Harold W. Ford, M.D.
Marilee L. Gallagher, M.D.
Mary F. Hellerstein, M.D.
Daniel A. Kramer, M.D.
Jan Kwiwinsky, M.D.
Morris W. Levinsohn, M.D.
Sudhir K. Mehta, M.D.
Michael A. Michael, M.D.
William Michener, M.D.
Harry Nudelman, M.D.
Amy C. Richardson, M.D.
Michael G. Saalouke, M.D.
James B. Sauers, M.D.
Mark Sivakoff, M.D.
Richard C. Wamsley, M.D.
Peter Cooper White, M.D.
Hue-Lee C. Kaung, Ph.D.
Mace J. Landau, M.D., Ph.D.
Gail S. Murray, Ph.D.
Stephanie Sadlon, M.D.
Mark I. Singer, Ph.D.
Philip C. Smith, M.D., Ph.D.
Robert C. Sprecher, M.D.
Anthony Stallion, M.D.
John E. Stork, M.D.
Thomas P. Swales, Ph.D.
Paul Alan Tripi, M.D.
Matthew L. Warman, M.D.
Dayna M. Weinert, M.D.
Richard Paul Woychik, Ph.D.
W. David Lust, Ph.D.
Timothy Scott Kern, Ph.D.
Janice G. Douglas, M.D.
Leona Cuttler, M.D.
Jeffrey L. Blumer, M.D., Ph.D.

Secondary Appointments

Professors
Jeffrey L. Blumer, M.D., Ph.D.
Leona Cuttler, M.D.
Clark W. Distelhorst, M.D.
Janice G. Douglas, M.D.
Timothy Scott Kern, Ph.D.
W. David Lust, Ph.D.
Richard Paul Woychik, Ph.D.

Adjunct Professor
Marc Thibonniere, M.D.

Associate Professors
David Allen Boothman, Ph.D.
David Danielpour, Ph.D.
George Dubyak, Ph.D.
Alan D. Levine, Ph.D.
Ram H. Nagaraj, Ph.D.

Assistant Professors
Eric J. Arts, Ph.D.
Robert Bonomo, M.D.
Paul Roos Ernsberger, Ph.D.
Alison K. Hall, Ph.D.
Michael F. Romero, Ph.D.
Bingcheng Wang, Ph.D.

Department of Pharmacology

Chair
John H. Nilson, Ph.D. (J.H. Hord Professor)

Professors
Charles L. Hoppel, M.D.
Michael E. Maguire, Ph.D.
John J. Mieyal, Ph.D.
Ruth E. Siegel, Ph.D.

Instructors
Anjali P. Adur, M.B.B.S.
Mark M. Goldfinger, M.D.

Adjunct Instructors
Thomas D. Ginley, O.D.
Todd G. Gottschalk, O.D.
Louise A. Sieben, M.D.

Department of Physiology and Biophysics

Chair
Antonio Scarpa, M.D., Ph.D. (D. I. Meyer/Scarpa Professor)

Professors
Arthur M. Brown, M.D., Ph.D.
Paul E. DiCorleto, Ph.D.
Anthony F. DiMarco, M.D.
George Dubyak, Ph.D.
Richard L. Eckert, Ph.D.
Joan E.B. Fox, Ph.D.
Ulrich Hopfer, M.D., Ph.D.
Masao Ikeda-Saito, Ph.D.
Paul J. Martin, Ph.D.
D. Thomas M. Nosek, Ph.D.
Nanduri R. Prabhakar, D.Sc.
Ganes Chandra Sen, Ph.D.
Witold K. Surewicz, Ph.D.

Adjunct Professor
Robert Graham, M.D.

Associate Professors
Meredith Bond, Ph.D.
Cathleen R. Carlin, Ph.D.
Thomas Talbot Egelhoff, Ph.D.
Robert D. Harvey, Ph.D.
Philip Howe, Ph.D.
Stephen W. Jones, Ph.D.
Albert C. Kirby, Ph.D.
Jianjie Ma, Ph.D.
Charles R. Sanders, Ph.D.
William P. Schilling, Ph.D.

Assistant Professors
Jian-Ping Jin, Ph.D.
Christine Schomisch Moravec, Ph.D.
Jeffrey L. Overholt, Ph.D.
Andrea Romani, M.D., Ph.D.
Michael R. Romero, Ph.D.
Ki-Joon Shon, Ph.D.
Corey B. Smith, Ph.D.
Frank D. Sonnichsen, Ph.D.
William C. Stanley, Ph.D.
Mark E. Szweida, Ph.D.

Assistant Associate Professors
Antonio Guadalberto, Ph.D.
Antonio E. Lacerda, Ph.D.

Instructors
Marco A. Brotto, Ph.D.
Margaret P. Chandler, Ph.D.
Carlos Arturo Obejero-Paz, M.D., Ph.D.
Karen Parker, Ph.D.

Department of Psychiatry

Chair - MetroHealth Medical Center
R. Taylor Segraves, M.D., Ph.D.
Chair - University Hospitals
Pedro L. Delgado, M.D. (Douglas D. Bond Professor)

Vice Chair
Robert Frymier, M.D.

Professors
David Agle, M.D. (Sihler Family Professor)
Naomi Breslau, Ph.D.
Peter Buckley, M.B.B.S.
Joseph R. Calabrese, M.D.
C. Edwards Coffey
Glenn C. Davis, M.D.
Claire Ernhart, Ph.D.
Javad H. Kashani, M.D.
Matig Mavissakalian, M.D.
Phillip Resnick, M.D.
Daniel S. Schubert, M.D., Ph.D.
Katherine L. Wisner, M.D.

Clinical Professors
Norman Clemens, M.D.
Stephen B. Levine, M.D.
Sylvia B. Rimm, Ph.D.
Ellen Rothchild, M.D.
Michael A. Schwartz, M.D.

Adjunct Professors
Herbert Y. Meltzer, M.D.
Joseph C. LaManna, Ph.D.
Carole M. Liedtke, Ph.D.
Michael E. Maguire, Ph.D.
Richard J. Martin, M.B.B.S.
Hasan Mukhtar, Ph.D.
Yoram Rudy, Ph.D.
John R. Sedor, M.D.
Richard Allen Walsh, M.D.

Associate Professors
David R. Bickers, M.D.
Neil S. Cherniack, M.D.

Department of Psychology

Chair
John H. Nilson, Ph.D. (J.H. Hord Professor)

Professors
Charles L. Hoppel, M.D.
Michael E. Maguire, Ph.D.
John J. Mieyal, Ph.D.
Ruth E. Siegel, Ph.D.

Instructors
Anjali P. Adur, M.B.B.S.
Mark M. Goldfinger, M.D.

Adjunct Instructors
Thomas D. Ginley, O.D.
Todd G. Gottschalk, O.D.
Louise A. Sieben, M.D.

Adjunct Professor
Vickie Zurcher, M.D.
Joseph P. Martin, M.D.
Sangithan Moodley, M.B.B.S.
Kevin L. Muiue, M.D.
Vibha K. Parikh, M.D.
Barry Peskin, M.D.
Julian Peskin, M.B.B.S.
Alfida J. Ramahi, M.D.
Yogesh G. Shah, M.D.
Sohila Zarandy, M.D.

Adjunct Assistant Professor
Ellen S. Lazarus, Ph.D.

Senior Clinical Investigators
John H. Sanders, M.D.
Irwin T. Wason, M.D.
Kimberly Ann White, M.D.

Instructors
May Hsich Blanchard, M.D.
Ndubueze Okereke, M.D.
Jay Pinkerton, M.D.
Carlyn P. Yanda, M.S.

Clinical Investigators
Benito Alvarez, M.D.
Natalina Andreani, M.D.
Jose S. Arias, M.D.
Katherine Austinson, M.S.N.
Timothy S. Barrett, M.D.
Sandra L. Bellin, M.D.
Mary G. Blank, M.D.
Diane E. Brown-Young, M.D.

Adjunct Investigators
Michael Anderson, M.D.
Mark Binstock, M.D.
Michael Bloomfield, M.D.
Stephen P. Emery, M.D.
Gretchen Fisher, M.D.
Charlotte Fries, M.S.N.
John P. Iafelice, M.D.
I.W. Kim, M.D.
Elliot Philipson, M.D.
Elisa K. Ross, M.D.
Robert Schwarz, M.D.
David Vogel, M.D.

Secondary Appointments
Professors
Avroy A. Fanaroff, M.D.
Maureen Hack, M.D.
Satish C. Kalhan, M.B.B.S.
Richard J. Martin, M.B.B.S.
Howard S. Nearman, M.D.

Associate Professors
Miriam Rosenthal, M.D.
Allen D. Seftel, M.D.

Assistants Professors
Louise S. Acheson, M.D.
Jill E. Bailey, M.D.
Richard L. Eckert, Ph.D.
John J. Moore, M.D.
Raymond W. Redline, M.D.
Nathaniel H. Robin, M.D.
Katherine L. Wisner, M.D.

Department of Surgery
Chair - MetroHealth Medical Center
Mark A. Malangoni, M.D.

Chair - University Hospitals
James A. Schulak, M.D.

Professors
Louis Stewart Binder, M.D.
Richard B. Fratianne, M.D.
Jerry Goldstone, M.D.
Thomas J. Kirby, M.D.
Frank Russell Lewis
Edward A. Luce, M.D. (Kiehn/Desprez Professor)
Edward G. Mansour, M.D.
David Nathanson, M.B.B.S.
Jerry M. Shuck, M.D. (Oliver H. Payne Professor)
Norman Silverman, M.D.
Thomas A. Stellato, M.D.
Robert M. Zollinger Jr., M.D.

Clinical Professors
Jerald S. Brodkey, M.D.
Bahman Guyuron, M.D.
Robert Hermann, M.D.
Jeffrey L. Ponsky, M.D.

Associate Professors
John Jeffrey Alexander, M.D.
Ami Azzodi, M.D.
Jon Bradrick, D.D.S.
Christopher P. Brandt, M.D.
Julie Clayman, M.D.
Rita Kay Cudykula, M.D.
Charles L. Emerman, M.D.
William F. Fallon, M.D.
Jeffrey A. Goldstein, M.D.
Nicholas J. Jouriles, M.D.
Terry A. King, M.D.
Christopher R. McHenry, M.D.
Joel Peerless, M.D.
Marjie L. Persons, M.D.
Paul P. Priebe, M.D.
Robert R. Shenk, M.D.
Michael L. Spector, M.D.

Associate Clinical Professors
Melvyn Dinner, M.B.B.S.
Lu-Jean Feng, M.D.
Stanley Jaffe, M.D.
Fred Plecha, M.D.
James E. Sampliner, M.D.
Helmut Schreiber, M.D.
Ezra Steiger, M.D.
Mark D. Wells, M.D.

Assistant Professors
Marwan S. Aboujound, M.D.
Bruce J. Averbook, M.D.
Henry R. Baie, M.D.
David C. Baringer, M.D.
Steven L. Bernard, M.D.
Steven J. Busuttil, M.D.
Brian L. Cmolik, M.D.
Thomas E. Collins, M.D.
Robert Samuel Decosta Higgins, M.D.
Lynn C. Dezelon, M.D.
David Effron, M.D.
Ray J. Gagliardi, M.D.
Daniel P. Goldberg, M.D.
Steven Goldman, M.D.
Debra Graham, M.D.
Max C. Hutton, M.D.
Roderick B. Jordan, M.D.
Randall Jotte, M.D.
Bram R. Kaufman, M.D.
Jai H. Lee, M.D.
Rosemary Leeming, M.D.
Thomas Lukens, M.D., Ph.D.
David Magnuson, M.D.
Bernardo Martinez, M.D.
Stephen W Meldon, M.D.
Sandra Najarian, M.D.
Timothy J. Nypaver, M.D.
Raymond P. Onders, M.D.
Gilles Pinault, M.D.
Janet M. Poponick, M.D.
Harry L. Reynolds, M.D.
David S. Seaman, M.D.
Christopher Thomas Siegel, M.D., Ph.D.
Philip C. Smith, M.D., Ph.D.
Anthony Stallion, M.D.
Maria Stephan, M.D.
Jean T. Stevenson, M.D.
Mary Hancock Stewart, M.D.
Nicholas Stowe, Ph.D.
Assistant Clinical Professors
Frederick Alexander, M.D.
J. Sheldon Artz, M.D.
Michael P. Binder, M.D.
Mark J. Botham, M.D.
Altagracia M. Chavez, M.D.
John W. DiFiore, M.D.
Richard V. Dowden, M.D.
Henry Eisenberg, M.D.
Haysam El-Dalati, M.B.B.S.
Caldwell B. Esselstyn, M.D.
John P. Ferron, M.D.
Anthony Forde, D.D.S.
Robert A. Jones, O.D.
Donald W. Lenzhart, M.D.
Dale R. Levy, M.D.
Isadore Lidsky, M.D.
James A. Malgieri, M.D.
E. Terry MaMounas, M.D.
Alan H. Markowitz, M.D.
Jeffrey M. Marks, M.D.
Bryan J. Michelow, M.B.B.S.
Margaret M. Olsen, M.D.
Joan C. Palomaki, M.D.
Elmer Perse, M.D.
James M. Persky, M.D.
Roland S. Philip, M.D.
George John Picha Jr., M.D., Ph.D.
James D. Polk, O.D.
E. Louis Priem, M.D.
Timothy J. Pritchard, M.D.
Melvin M. Reydenman, M.D.
Victor Scharf, M.D.
Ahmad H. Shattila, M.D.
George V. Smith Jr., M.D.
Clifford J. Vogt Jr., M.D.
Senior Instructors
Peter T. Hallowell, M.D.
John Jasper, M.D.
Katherine Manzon, M.D.
Jeffrey Eugene Pennington, M.D.
Jonathan Siff, M.D.
Senior Clinical Instructors
E. S. Brown, M.D.
Robin Dhillon, M.D.
Arthur C. Hill, M.D.
Robert L. Hood, M.D., Ph.D.
Charles B. Hurst, M.D.
Joseph A. Lahoolla, M.D.
Derrick D. McElroy, M.D.
Robert W. Stewart, M.D.
Ivan P. Tewarson, M.B.B.S.
Anthony Udekwu, M.B.B.S.
Instructors
John E. Duldiner, M.D.
Edward J. Hartwig, O.D.
Clinical Instructors
Dominick C. Adornato, D.D.S.
Kenneth L. Arsham, M.D.
Stanley A. Berman, D.D.S.
Trudi Jo Brown, M.D.
Leonard L. Brzozowski, M.D.
Christian Caldeira, M.D.
Vedantum R. Chari, M.D.
Ihor John Danko, D.D.S.
Howard L. Darvin, M.D.
John T. Davis, M.D.
John Dorsky, M.D.
Seth W. Eisengart, M.D.
William A. Evan, D.D.S.
Vincent Ferrini, M.D.
Claudio Gallo, M.D.
Amitabh Goel, M.D.
Eric R. Hahn, M.D.
Frederic M. Hustey, M.D.
Jessie Jean-Claude, M.D.
Jeffrey W. Kosman, D.D.S.
Mine Kuray, M.D.
Edward A. Levy, M.D.
Thomas P. Noeller, M.D.
William J. Petseloulo, M.D.
John L. Prathee, D.D.S.
Debra A. Pratt, M.D.
Kenneth A. Spano, M.D.
Thomas A. Waters, M.D.
Samuel Weinstein, M.D.
Secondary Appointments
Professors
Jerold Goldberg, D.D.S.
Howard S. Nearman, M.D.
Clinical Professor
John F. Distefano, D.D.S.
Associate Professors
Nabida H. Gordon, Ph.D.
Joseph P. Li Puma, M.D.
Assistant Professor
Michael Powers, D.D.S.
Department of Urology
Chair - University Hospitals
Martin I. Resnick, M.D. (L. Persky Professor)
Professors
Donald R. Bodner, M.D.
Jack S. Elder, M.D.
Mani Menon, M.D.
John P. Spinnak, M.D.
Clinical Professor
Ralph Sprafon, M.D.
Associate Professors
Stanley Althof, Ph.D.
Nehemia Hampel, M.D.
Susan R. Marengo, Ph.D.
Allen D. Seftel, M.D.
Associate Clinical Professor
Bayton Kest, M.D.
Assistant Professors
Kurt Dinchman, M.D.
Howard B. Goldman, M.D.
Christopher Haas, M.D.
Michael Oefelein, M.D.
Jeffrey S. Palmer, M.D.
Mark D. Stovskys, M.D.
Assistant Clinical Professors
Michael Barkoukis, M.D.
Arturo S. Basa, M.D.
Michael T. Bote, M.D.
Sidney M. Cohen, M.D.
Joan T. Davis, M.D.
Gerard A. DeOroco, M.D.
J. P. Fegen, M.D.
Lawrence A. Gervasi, M.D.
Julia A. Gordon, M.D.
Gregory F. Kondray, M.D.
John T. Leininger, M.D.
Fredric J. Levine, M.D.
Sanford S. Luria, M.D.
S. Mahone III, M.D.
Thomas M. Picklow, M.D.
Arthur Porter, M.D.
Melissa D. Reigle, M.D.
Robert F. Seymour, M.D.
Robert A. Shapiro, M.D.
Tim A. Sidor, M.D.
David Turk, M.D.
Lawrence W. Wolkoff, M.D.
Secondary Appointments
Assistant Professors
Cindy Connell, M.D., Ph.D.
Gregory T. MacLennan, M.D.
Affiliated Hospitals

University Hospitals Health System

The tertiary hub of University Hospitals Health System (UHHS) is University Hospitals of Cleveland (UHC). Founded in 1866, UHC is a 947-bed academic medical center serving northern Ohio and the nation through patient care, research and teaching, with a historic commitment to the health care needs of the community. UHC’s main campus includes the Alfred and Norma Lerner Tower, Samuel Mather Pavilion, and Lakeside Hospital for adult medical/surgical care; the nationally renown Rainbow Babies & Children’s Hospital; University MacDonal Women’s Hospital, Ohio’s only women’s hospital; University Ireland Cancer Center, a partnership with the university designated by the National Cancer Institute as a comprehensive cancer center (and the only NCI-designated cancer center in northern Ohio); University Psychiatric Center (Hanna Pavilion); skilled nursing and rehabilitation services; and The Research Institute of UHC. The primary affiliate of Case Western Reserve University, UHC and the university form the largest biomedical research center in Ohio. UHC enjoys some of the most prestigious centers of excellence in the country and the world. These include not only those most familiar to the public — cancer, pediatrics and women’s health — but also areas such as orthopaedics and spine, radiology and radiation oncology, neurosurgery and neurosience, organ transplantation, infectious diseases, cardiology and cardiothoracic surgery, ophthalmology, dermatology, behavioral health, and the fast-emerging field of human genetics and genomics. UHC, along with its partner hospitals in UHHS, serves patients and families at more than 150 locations in northern Ohio. The system is the region’s broadest network of physicians, outpatient centers and hospitals; wellness programs, occupational health, behavioral health, skilled nursing, elder health, assisted living, rehabilitation services and home care; and managed care and insurance.

The MetroHealth System

The MetroHealth System has been serving the medical needs of the Cleveland community for more than 160 years. Today the hospital system is one of the largest, most comprehensive health care providers in Northeast Ohio.

The MetroHealth System includes: MetroHealth Medical Center, MetroHealth Center for Rehabilitation, MetroHealth Centers for Skilled Nursing Care - East and West, MetroHealth Clement Center for Family Care, and a dozen urban and suburban primary care sites. In addition, in 2000, MetroHealth opened an outpatient surgery center on Cleveland’s west side. Together, these units provide a complete spectrum of health care services.

As Cleveland’s first hospital and the largest on the city’s west side, the 728-bed MetroHealth Medical Center is the flagship unit of The MetroHealth System. The medical center provides a full range of general and tertiary services for the acutely ill; rehabilitation services are provided through MetroHealth Center for Rehabilitation.

MetroHealth is nationally recognized for its advanced techniques in treating complex medical problems. Special interests include emergency and trauma care, surgical specialties, family health, senior health, internal medicine, oncology, dentistry, women’s and children’s services, psychiatry, rehabilitation, and subacute and long-term care.

As a principal teaching center of the School of Medicine, MetroHealth maintains a fine tradition of academics and research. All active staff physicians are full-time faculty of the School of Medicine and actively participate in undergraduate and graduate medical education. Intensive training for physicians and medical professionals is offered in more than 25 medical specialties.

MetroHealth Medical Center provides care to more than 27,000 inpatients, including more than 3,500 newborns, annually. More than 600,000 visits are recorded each year in the medical center’s 100 outpatient clinics. In addition, patient visits to the emergency room exceed 70,000.

The Louis Stokes Cleveland Veterans Affairs Medical Center

The Louis Stokes Cleveland Department of Veterans Affairs Medical Center is a major teaching hospital of the School of Medicine and is an important site for the education of medical students. The Cleveland VAMC also supports more than 100 residency and fellowship training positions in medicine, surgery, and psychiatry and their subspecialties. Most VAMC physicians hold faculty appointments within the School of Medicine. The affiliation is overseen by the Dean’s Committee, consisting of the dean, department chairpersons from the School of Medicine, and key VAMC officials.

The Cleveland VAMC is a part of the VA Healthcare System of Ohio, linking VA health care facilities in Ohio in an integrated service network. Inpatient care is provided at the Wade Park and Brecksville divisions and includes medicine, surgery, psychiatry, spinal cord injury, neurology and rehabilitation medicine as well as a nursing home and a domiciliary. Outpatient care is delivered in primary and specialty care clinics located at Wade Park, Brecksville, Akron, Canton, Cleveland, East Liverpool, Lorain, Mansfield, New Philadelphia, Painesville, Ravenna, Sandusky, Warren and Youngstown. The medical center serves more than 60,000 individual veterans annually through approximately 9,000 hospital admissions and 500,000 outpatient visits.

An active research program includes activities funded through the Department of Veterans Affairs and other governmental and private funding sources. Total funding of approximately $11 million annually (from all sources) supports more than 50 principal investigators in a broad range of research endeavors.

The Henry Ford Health System

The academic and research programs of the Henry Ford Health Sciences Center are supported by the Henry Ford Health System (HFHS), a major integrated health services network in Southeastern Michigan and a recognized leader in patient care, research and education.

HFHS includes Henry Ford Hospital, a 903-bed tertiary care hospital, education and research complex in Detroit’s New Center area; Henry Ford Medical Group (HFMG), one of the nation’s largest group practices, with 900 physicians in 40 specialties who staff Henry Ford Hospital; and 25 Henry Ford medical centers. Other hospitals: Henry Ford Wyandotte, serving the western Wayne and Downriver communities; Bi-County Community, a 203-bed osteopathic teaching facility in Warren, Mich.; and Riverside Osteopathic, a 162-bed osteopathic teaching facility in Trenton, Mich.

Henry Ford Health System’s multidisciplinary approach to medical care attracts patients from more than 27 states and abroad.

Henry Ford Health Sciences Center has helped keep HFHS in the forefront of developments in many areas of medicine: heart and vascular disease; disorders of the brain and spinal cord, including stroke and migraines; organ transplantation; bone and metabolic disorders; cancer; sleep disorders; genetics and birth defects; and chemical dependency.
These advanced patient care programs are backed by strong education and research efforts. As a University teaching affiliate, Henry Ford Hospital provides training to third- and fourth-year medical students. The affiliation also includes cooperative research efforts, with an ongoing exchange of scientists and a combining of National Institutes of Health funding.

The Henry Ford Health Sciences Center combines teaching, research, and advanced patient care. The center provides innovative physician-training programs and collaborates in leading-edge medical research. The Health Sciences Center consists of the Research Institute and the School for Health Sciences.

The School for Health Sciences offers more than 70 physician, nursing and allied health, and continuing medical education programs that benefit more than 1,000 individuals annually. These include graduate and undergraduate medical education programs that attract some 850 physicians-in-training in 22 specialties and 39 subspecialties. Henry Ford and Case Western Reserve are collaborating on a Robert Wood Johnson Foundation grant to train generalist physicians. The school provides students with experiences in urban, suburban, tertiary and primary care settings.

Amenities

Cleveland Health Sciences Library

The Cleveland Health Sciences Library began operating in 1966 with an agreement between the Cleveland Medical Library Association and the University. CHSL operates in two locations, the Allen Memorial Medical Library, at the corner of Euclid Avenue and Adelbert Road, and the Health Center Library, in the east wing of the School of Medicine.

The CHSL collection consists of books, journals, theses, government documents, audio-visual items and electronic resources. The Dittrick Medical History Center collection, located at the Allen Memorial Medical Library, also contains archives, rare books and artifacts for research in the history of medical technology. The CHSL’s total collection numbers more than 390,000 volumes. CHSL receives more than 2,000 print subscriptions and has access to approximately 7,000 electronic journals and research databases. These resources are included in the campus-wide online catalog, EuclidPLUS (http://catalog.cwru.edu), which also includes materials held by the University Library branches, the Law Library, the Harris Library of the Mandel School of Applied Social Sciences, the Cleveland Institute of Music Library, and the Cleveland College of Jewish Studies.

Complete information about the CHSL can be found at the library’s homepage on the Web: http://www.cwru.edu/chsl/homepage.htm.

Health Sciences Bookstore

The Health Sciences Bookstore, located in the basement of the west wing of the School of Medicine, is operated for medical, dental and health science students, health professionals and hospitals in northeastern Ohio.

Customers may choose from a selection of all required texts, as well as many basic science and clinical books of special interest. Also offered is a selection of office supplies, medical equipment and clinic wear.

Order services exist for books and equipment not carried in stock. Store hours: Mondays, Wednesdays, Thursdays and Fridays, 9:30 a.m. to 5 p.m.; Tuesdays, 9:30 a.m. to 6 p.m.; and Saturdays, 10 a.m. to 1 p.m. Phone orders are welcome at (216) 368-3464. The store’s Website address is http://www.bkstore.com/cwru-med/.

Endowed Lectures

THE NIKAAN B. ANDERSON LECTURE
Established in 1974 by friends of the late professor of anesthesia (from 1969 until his death in 1974), this annual lecture is presented by teachers of the science of anesthesia.

THE CLAUDE S. BECK SCHOLARSHIP VISITING LECTURESHIP
This lecture, about cardiovascular surgery, was established in 1989. At what is now known as the Case Western Reserve University School of Medicine, Claude S. Beck, M.D., was demonstrator of surgery in 1924 to 1925; professor of neurosurgery in 1940; and the first professor of cardiovascular surgery in the United States from 1952 until 1965.

THE RICHARD E. BEHRMAN, M.D., LECTURE IN CHILD DEVELOPMENT
Established in 2001 with contributions from friends of colleagues of this former School of Medicine dean (1980 to 1989), this annual lecture is delivered by distinguished scholars in child development.

THE JACK H. BERMAN, M.D., LECTURE
Established in 1999 by family, friends and colleagues of this alumnus and associate clinical professor, guest lecturers discuss the basic science behind disease and its application to patient care through this program.

THE LOUIS A. BLOOMFIELD MEMORIAL LECTURE
Established in 1955 in memory of the Cleveland attorney Theodore R. Bloomfield by his widow and his son, this lecture brings outstanding members of the medical profession from around this country and abroad to discuss new concepts and developments in medicine with the medical community and allied professions.

THE COURTNEY BURTON FRONTIERS OF MEDICINE LECTURE
This annual lecture is presented by an outstanding individual who has achieved or helped achieve a significant advance in medicine or a closely related field and whose presentation would be of great interest to members of the medical profession. It is supported by a fund established in 1993. Courtney Burton, Jr., was chair of the board of Oglebay Norton Co. from 1957 until shortly before his death in 1992.

THE ALFRED CAHEN MEMORIAL LECTURE
This lecture series in gastroenterology has been supported by a fund established in 1965 by Lottie Cahen, widow of the founder and former president of World Publishing Co., in memory of her late husband.

THE FROHRING PRESIDENTIAL LECTURESHIP IN MEDICINE AND ENGINEERING
Lecturers in medicine and engineering deliver this lectureship at the discretion of the University president thanks to a fund begun in 1993 by Paul R. Frohring.

NATHAN S. GREENFIELD FAMILY VISITING LECTURERS IN PHARMACOLOGY
Through an endowment, Rosalee Greenfield Weiss, Ph.D., and Raymond A. Weiss, Ph.D., established this annual lecture in 1997 to honor her father, Nathan S. Greenfield, a pharmacist who owned Wade Park Pharmacy in Cleveland from 1914 to 1956; her mother, Corinne Sternheimer Greenfield; and Lynn Stuart Weiss, daughter of the benefactors, who died of cancer in her mid-20s in 1971.
THE ZELLA HALL LECTURE
This annual lecture or series of lectures is presented by one or more distinguished visiting researchers selected by the dean of the School of Medicine or his or her designee. It/they are made possible because of support received in 1998 by the estate of Zella Hall.

THE ROBERT R. KOHN LECTURE
The lecture honors an alumnus of the Class of 1957 and was established in his memory in 1989 by family, friends and colleagues to advance the study of pathology.

THE HANNA LECTURES
Founded in 1913 by G. W. Crile, 1887-0W, in honor of H. Melville Hanna, philanthropist and founder of the M.A. Hanna Co., the Hanna Lectures are delivered by distinguished basic scientists from this country and abroad.

THE WILLIAM D. HOLDEN LECTURESHIP IN SURGERY
Established in 1985 by the members of the Department of Surgery of MetroHealth Medical Center in honor of their former chair and Payne Professor of Surgery, this series of lectures in surgery is delivered by distinguished leaders in American surgery.

THE LORAND V. JOHNSON LECTURE
This lecture, for residents and visiting staff members in ophthalmology, was established in 1967 by the Wright Foundation.

THE KAISER PERMANENTE ENDOWED LECTURESHIP IN BIOETHICS
This lecture is presented by a distinguished visiting lecturer with the goal of advancing the study of bioethics. It was established in 1994.

THE RITA ANN KICHER LECTURE
In this annual lecture, established in 1996, a distinguished visiting lecturer promotes quality health care by emphasizing new developments in the identification and treatment of life-threatening cardiac arrhythmia. Rita Ann Kicher was the daughter of Thomas Kicher, Ph.D., a triple alumnus, long-time faculty member, and dean (1992-1997) of the Case School of Engineering. At the time of her death, she was a systems analyst at University Hospitals of Cleveland’s Center for Quality Assessment and Utilization Management.

THE CLIFFORD L. KIEHN, M.D., AND JOHN DESPREZ, M.D., VISITING LECTURERS IN PLASTIC AND RECONSTRUCTIVE SURGERY
These lecturers are distinguished visitors whose presentations advance the study of plastic and reconstructive surgery. The lecturership was established in 1994. Dr. Kiehn is the former head of plastic and reconstructive surgery, and Dr. Desprez followed him in that role.

THE JEROME I. KLEINERMAN, M.D., LECTURESHIP IN PULMONARY PATHOBIOLGY
This lecturership is named for an internationally respected lung specialist and professor emeritus of pathology at the School of Medicine. Established in 2000 by the late Dr. Kleinerman’s daughters, friends and colleagues, the lecture ship each year supports a distinguished visiting lecturer whose presentation advances the study of pulmonary pathobiology. The lecturer is selected by a faculty committee that includes members having appointments at MetroHealth Medical Center. The members of the committee are chosen by the dean of the School of Medicine.

THE LESTER KRAMPITZ LECTURE AND EDUCATION FUND
The fund was established in 1982 by family, friends and colleagues of former faculty member Lester Krampitz, M.D., to honor him with a lecture fund in microbiology. It is intended to facilitate the interchange of ideas, a process Dr. Krampitz, who joined the faculty in 1946 and retired in 1978, believes is vital to scientific research.

THE CARL H. LENHART SURGICAL LECTURE
Established in 1955 by friends of this alumnus of the Class of 1904, in his memory, this lecture presents outstanding speakers on clinical developments in surgery.

THE ALAN MORITZ, M.D., ENDOWMENT FUND
This fund was established in 1991 by friends and colleagues of the late forensic pathologist, medical school faculty member, and university provost.

THE OLOF H. PEARSON, M.D., LECTURE
Established in 1999 by family and friends of the late endocrinologist, oncologist and faculty member, this lecture features a cancer-related topic at the School of Medicine.

THE ROBERT S. POST, M.D., VISITING LECTURESHIP
Established in 1995 by Dr. Post’s friends and colleagues in the Community Dialysis Center, in memory of the former faculty member and head of nephrology, this lecture features a distinguished visiting expert in the field of nephrology.

THE EDWARD W. PURNELL LECTURESHIP IN OPHTHALMOLOGY
Established in 1991 and named for the late physician, surgeon, researcher, and medical school head of ophthalmology, this lecture features a visiting expert in the Department of Ophthalmology.

THE FREDERICK C. ROBBINS LECTURE IN THE DEPARTMENT OF MEDICINE VISITING LECTURER
Established in 1995 by the Department of Medicine in honor of Frederick C. Robbins, M.D., dean emeritus of the School of Medicine, university professor emeritus, and Nobel Prize winner, this lecture features a distinguished visiting expert each year in the Department of Medicine.

THE HENRY Z. SABLE, M.D., PH.D., ENDOWMENT FUND
Established in 1997 by Mrs. Florence M. Sable in honor of her late husband, who was professor emeritus of biochemistry, this lecture advances the study of biochemistry via a visiting expert selected by the chairperson of the Department of Biochemistry.

THE ROY SCOTT LECTURE
Established by colleagues, students, family and friends in memory of the former head of the Department of Medicine of MetroHealth Medical Center, this lecture involves an annual two-day visit of a leading cardiologist, who presents the lecture and grand rounds to house officers and students of the School of Medicine.

THE ROBERT STERNLICHT VISITING LECTURERS IN PHARMACOLOGY AND CANCER BIOLOGY
Originally established in 1990 by friends and family and named the Robert Sternlicht Memorial Fund, these lectures feature distinguished experts whose presentations will advance the study of oncology at the School of Medicine. Lecturers are chosen by the chair of the Department of Pharmacology and the director of the comprehensive cancer center. Robert Sternlicht was the son of...
Himan Sternlicht, Ph.D., associate professor emeritus of pharmacology.

THE MERTON F. UTTER MEMORIAL LECTURE
Established in 1981 in memory of the former professor of biochemistry and chair of the Department of Biochemistry, this lecture is delivered by a scientist of the highest caliber in a field related to those in which Dr. Utter was interested. Lecturers are chosen by the chair of the Department of Biochemistry.

THE AUSTIN S. WEISBERGER LECTURE
Established in 1972 in the Department of Medicine, this lecture honors the memory of the man who, at the time of his death in 1970, was the John Huntington Hord Professor and chair of the Department of Medicine of the School of Medicine and University Hospitals of Cleveland.

THE HARLAND G. WOOD ENDOWMENT FUND IN THE DEPARTMENT OF BIOCHEMISTRY
Established in 1994 in memory of the late chair and professor of biochemistry and former provost of the university, this fund supports an annual Page-Wood symposium, co-sponsored by the School of Medicine and the Cleveland Clinic Foundation, featuring a leader in the field of biochemistry, an annual guest lecturer in biochemistry, and an annual guest lecturer selected by faculty with the rank of assistant professor in the Department of Biochemistry.

Publications
Below are listed some of the many publications produced in paper form by the Office of Public Affairs. Also see them on the Web, visit http://mediswww.cwru.edu and click on “news and calendars.”

Communiqué
Communiqué is the calendar of events for the School of Medicine. It is published monthly in paper form and also is updated continuously on the Web.

Medical Bulletin
The Medical Bulletin is a magazine for faculty, students, alumni, friends and media. Published three times a year, the Medical Bulletin contains feature articles highlighting research and education, as well as additional areas of interest. Articles provide a glimpse into the people behind the programs. Alumni receive an additional insert, Alumni News, which features class notes and obituaries as well as other news of interest to alumni. A stand-alone edition of Alumni News featuring reunion coverage is published once a year for alumni.

MedLines
MedLines, a newsletter for faculty, staff, students, alumni, friends and media of the School of Medicine, is published six times a year. Its highlights news about research, education, and the people at the medical school.

Admission to Medical School
Those interested in obtaining a degree other than the medical degree should contact the appropriate school within the university. See individual schools’ listings elsewhere in this publication for contact information.

All inquiries about admission and application to the School of Medicine should be addressed to:

Office of Admissions
School of Medicine, T-308
Cleveland OH 44106-4920
Phone: (216) 368-3450

The information below pertains to prospective medical students. For additional information, visit http://mediswww.cwru.edu and click on “admissions.”

Getting Started
Students wishing to apply to the School of Medicine must initiate the process on the Internet through the American Medical Colleges Application Service (AMCAS). To learn more about the AMCAS application process, visit http://www.aamc.org/students/amcas/start.htm

The Admissions Committee
The School of Medicine admissions committee has a tough job to do. Each year, it receives thousands of applications from academically superior students with varied backgrounds. Each class is limited to 145 spots, however, so it’s impossible to interview or extend offers of admission to all applicants.

Here’s how the medical school admissions process works at the school: Each application, when received from the AMCAS, is screened by the admissions committee. The committee sends each student a final application or a preliminary rejection. If a student who receives a final application returns it to the committee, the committee decides whether to grant the student an interview. If the student is granted an interview, afterward, the committee decides whether to extend an offer of admission. The student is notified of the committee’s decision no later than May 1 (or October 1 if he or she applied through the early decision plan [see later section]).

Admissions Criteria
Although the Admissions Committee considers grades and the score on the Medical College Admission Test (MCAT) in the admissions process, high grades and a high score on the MCAT alone are not sufficient criteria for admission (the MCAT is mandatory, however). Just as important are qualities such as integrity, interpersonal skills and leadership ability.

Minimum Academic Requirements
Students must have a solid foundation in the sciences needed to understand modern biomedical information. At a minimum, students should possess the following knowledge:

• Biology. Students ordinarily satisfy this requirement if they’ve taken a one-year course in biology that stressed molecular and quantitative concepts. Courses in anatomy, taxonomy, botany and ecology will not satisfy this requirement.
• Chemistry (through organic). Students normally meet this requirement if they’ve completed a one-year course in basic chemistry and a one-year course in organic chemistry. Other sequences, and courses that included organic/biologic chemistry content, are acceptable, too.
• Basic physics. Students generally satisfy this requirement if they’ve taken a one-year course in physics.
• Writing skills. Students typically meet this requirement if they’ve taken an introductory course in expository writing. The committee considers other courses that required extensive writing, however. Students must have taken these prerequisites at an accredited, four-year, degree-granting American or Canadian college or university.

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Although no other courses are required, many students find that a general survey course in biochemistry helps them in the first semester of medical school.

As an undergraduate, students should pursue a major in a subject of their own choosing; they should not structure their undergraduate experiences in an attempt to sway the medical school admissions committee. Research strongly indicates that the choice of a major has little bearing on ultimate acceptance into medical school. Most applicants to medical school, however, are chemistry or biological science majors.

Early Decision Plan

If their credentials are strong and they’re certain that the Case Western Reserve University School of Medicine is their first choice, students may apply to the medical school through the early decision plan. The School of Medicine must receive the preliminary application from the AMCAS no later than August 1; early decision plan students are notified of the medical school admissions committee’s decision by October 1.

Financial Aid

About 80 percent of the University’s medical students receive some financial aid based strictly on financial need. It’s impossible to provide precise figures on financial aid before each specific situation is completely analyzed, but here is a description of the general aspects of the process:

The School of Medicine adheres to the unit loan concept used by most private medical schools. Under this concept, if a student qualifies for financial aid, he or she is expected to obtain a specific portion of his or her support from outside sources such as a Stafford Loan, savings and family. Once the student obtains this amount, the remaining aid would be provided through School of Medicine resources, up to the amount determined to be his or her reasonable need. The school’s contribution would be a combination of loan and scholarship, with the exact ratio determined by the student’s particular circumstances.

Programs such as the Medical Scientist Training Program, the M.D./Ph.D. in health sciences research program, the M.D., Ph.D. in biomedical engineering (Physician-Engineer Training Program), and others offer financial support for participants. For more information, see other entries in this publication and contact the specific program.

Also, the medical school offers up to 20 merit scholarships annually to each class through its Dean’s Scholars program, Amici Scholars program, Alumni Scholars program, and David Satcher, M.D., Ph.D. Rubens Parnies, M.D. Minority Student Scholarship program. These scholarships are $20,000 annually for up to four years for selected entering students selected each year. Application for the scholarships is by invitation of the admissions committee. Recipients are students with records of exceptional academic and personal achievement.

To Those Currently in College

The admissions committee gives preference to candidates who will have completed the requirements for a bachelor of arts or bachelor of science degree before entering medical school. Most accepted candidates rank in the top one-third of their classes, and a large proportion of them have outstanding scholastic records.

The committee’s main considerations are the overall quality of college performance and general ability and potential. In most instances, students are given priority if they have completed all minimum academic requirements and have taken the MCAT by the time they submit their AMCAS applications. Although no special emphasis is placed on the student’s major field of study, the committee strongly favors the concept of a broad, general college education.

The School of Medicine values a widely diverse student body. Although preference is given to Ohio residents, out-of-state residents are strongly encouraged to apply.

To Students Who Have Been Out of College A Year or More

Students who have been out of college for a year or more are encouraged to apply. Approximately half of the students at the School of Medicine have a year or more between the time they graduate from college and the time they enter medical school, and about 10 percent of them begin medical school when they are 30 years old or older.

Those two or more years removed from full-time college course work should plan to take challenging, advanced-level (junior-, senior- or graduate-level) courses in the biological sciences to prepare for entry.

Academic Regulations for Medical School

M.D. Student Evaluation

The faculty of the School of Medicine is charged with evaluating all aspects of student performance, including knowledge, skills and personal characteristics, that are pertinent to the development of a responsible, competent and humane physician. This responsibility is delegated by the faculty to the Committee on Students, a standing committee of the faculty of medicine, with a majority of its members faculty-elected.

The Committee on Students reviews the performance of every medical student during each of the four years, determines each medical student’s continuing status as a student in the school, and recommends candidates for graduation. The committee reviews a medical student’s total performance, which includes the usual indices such as formal grades and evaluations, as well as the professional attitudes and behavior manifested by the student. Medical school education entails the mastery of didactic, theoretical, and technical matters as well as the demonstration of appropriate professional and interpersonal behavior, sensitivity, sense of responsibility and ethics, and the ability to comport oneself suitably with patients, colleagues and co-workers.

Medical student performance is evaluated throughout the four-year curriculum. To be eligible for promotion and graduation, students must complete the requirements and perform satisfactorily in each of the curricular components. Medical students are graded as “satisfactory” or “identified for remediation” in the first two years and as honors/commendable/satisfactory/unsatisfactory in the clerkships of the third and fourth years. There is no class ranking.

Faculty-prepared interim examinations and a Year 1 comprehensive examination are administered in the Core Academic Program of the first two years. These examinations are secure, with a predetermined pass mark, and are graded anonymously.

Medical students must complete all components of the Year 2 curriculum and pass the U.S. Medical Licensing Examination (USMLE) Step 1 at the end of the second year to advance to the third year. Evaluation of medical students during the clinical components of the first and second years is based on performance in the preceptor group, Family Care Program, Interviewing Program and Physical Diagnosis Program. Subjective and objective assessments are used in the first and second years of the Flexible Program. In the core clerkships of the Patient-based Program,
clinical skills, knowledge and personal characteristics are evaluated. Several methods are used, including instructor observation, personal interaction, review of write-ups, oral examinations, objective structured clinical examinations (OSCEs), written examinations and National Board of Medical Examiners subject examinations.

Senior medical students usually take the USMLE Step 2 in fall of the fourth year. To be eligible for graduation from the school, students must obtain at least the minimum passing score on this examination as established by the USMLE Composite Committee.

Code of Ethics

Although a formal “honor” code has not been established at the school, the medical student code for Case Western Reserve University follows the Code of Medical Ethics for the American Medical Association, which asserts the following principles:

1) “A physician shall deal honestly with patients and colleagues and strive to expose those physicians deficient in character or competence, or who engage in fraud or deception.”

2) “A physician shall respect the rights of patients, of colleagues, and of other health professionals.”

3) “A physician shall continue to study, apply and advance scientific knowledge.”

4) “A physician shall recognize a responsibility to participate in activities contributing to an improved community.”

Because the purpose of medical education at Case Western Reserve University is to graduate physicians whose medical practice is consistent with the highest standards of the profession, these principles are considered to be applicable throughout the course of medical training. All procedures of the Committee on Students incorporate appropriate provisions for due process.

Graduation

A medical student who has satisfactorily completed all the required work in the School of Medicine may be granted the degree of Doctor of Medicine by Case Western Reserve University, provided that:

1) He or she has been registered in an accredited medical school for at least four academic years, the last two of which must have been at Case Western Reserve.

2) The Committee on Students approves his or her record of performance, and the faculty recommends him or her to the trustees for graduation.

3) He or she has discharged all financial obligations to the university.

4) He or she has taken the USMLE Steps 1 and 2 and has obtained a minimum passing score on the examinations as determined by the USMLE Composite Committee.

The requirements for graduation of any class may be altered by the action of the faculty of the School of Medicine.

Licensure

Licensure to practice medicine in the United States and its territories is a privilege granted by the individual licensing boards of the states and territories. Each licensing board of the individual jurisdictions establishes its policies, eligibility and requirements for the practice of medicine within its boundaries pursuant to statutory and regulatory provisions. The degree of Doctor of Medicine awarded by Case Western Reserve University is an academic degree and does not provide a legal basis for the practice of medicine.

Medical Student Organizations

The list of organizations and activities available to medical students continually evolves to reflect the interests of current students.

Here’s a sampling of the organizations and activities available at press time.

Specialty Related Groups

Medical students have formed interest groups to explore and invite speakers to discuss:

- Bioethics
- Emergency medicine
- Geriatric medicine
- Hematology/oncology
- Internal medicine
- Ophthalmology
- Orthopedics
- Radiology
- Surgery

Other Medical Student Groups and Activities

- Alpha Omega Alpha medical honor society
- American Medical Association
- American Medical Students Association
- Arts in Medicine
- Christian Medical and Dental Society
- Committee of Student Representatives governmental group
- Docapella vocal performance group
- Doc Opera annual student/faculty parody show
- Hippocrates Ball black tie dance for students and faculty
- Lesbian, Bisexual, and Gay People in Medicine
- Medical Students for Choice
- Phi Delta Epsilon medical student fraternity
- Photo Journal Club
- Physicians for Social Responsibility
- Student National Medical Association
- Women in Medicine

Professional Program

The School of Medicine of Case Western Reserve University long has been recognized as a national leader in curriculum innovation and development. The educational philosophy and guiding principles include organ systems teaching by interdisciplinary teams of basic science and clinical faculty, introduction to patients in the first year, student anonymity in grading examinations and pass/fail (“satisfactory” or “identified for remediation”) evaluation in the first two years, elimination of class ranking, flexibly scheduled time, and student responsibility for self-education. These factors provide a stimulating and congenial learning environment, which is combined with large and diversified research programs and excellent facilities for patient care and clinical education.

The goal of the educational program is to develop responsible, competent and humane physicians with the capacity and motivation for continued learning and the flexibility to recognize, adapt to, and influence future changes in medicine, health care delivery and society.

Educational Objectives

The four years in medical school can be considered the general professional education of maturing students who, after graduation from medical school, will obtain training as specific preparation for their chosen careers in medical practice or scientific investiga-
tion. Therefore, one objective of the medical school phase of a physician’s education is to provide the basic knowledge and skills that are common to all physicians. Another objective is to enable students to develop habits of self-education, methods for solving unfamiliar problems, and enthusiasm for the continuing study of medical sciences. A third objective is to assist students in developing appropriate attitudes with respect to their responsibilities to their patients and to become skillful in meeting these responsibilities.

Educational Authority

Governance of the educational program resides in the Faculty of Medicine. Each class of students selects representatives who become voting members of the Faculty of Medicine. The faculty of the School of Medicine is responsible for the content, implementation and evaluation of the curriculum. The dean of the School of Medicine serves as its chief academic officer with overall responsibility to the university for the entire academic program. The vice dean for academic affairs carries the dean’s academic and administrative authority and has direct supervisory responsibility over the units that lead and support the curriculum.

The Curriculum Leadership Council is composed of the Curriculum Leadership Council chair and the basic science and clinical faculty teaching leadership of the first two years. The council is responsible for the strategic planning, content, design, selection of teaching leadership, and oversight of the Core Academic Program, and its members jointly oversee integration and coordination within the first two years of the curriculum.

The Clinical Rotation Development Council parallels the Curriculum Leadership Council for the clinical year. It is composed of the Clinical Rotation Development Council chair and all core clerkship directors. The council’s steering committee has representation from each core clerkship discipline, the Primary Care Track, and the school administration.

The Flexible Program Council is composed of the Flexible Program chair, faculty representatives, and curricular leaders participating in the program. An advisory committee assists the council’s planning and implementation of the Flexible Program.

The faculty’s Committee on Medical Education evaluates, reviews and makes recommendations concerning the major units of the medical education program. Acting for the faculty, the Committee on Medical Education evaluates the achievement and outcomes of curricular objectives and reviews the curriculum as a whole. The majority of the members of the Committee on Medical Education are elected by the faculty; student representatives also serve on this committee and its various subcommittees.

Educational Approach

Great emphasis is placed on the creation of a graduate school intellectual environment in which students have the opportunity to demonstrate initiative and to assume a large measure of responsibility for their own education. Much value is attached to personal and informal communication between students and instructors, which is facilitated by small group teaching. During the first two years, lectures are used for approximately half of the teaching activities; small group conferences, multidisciplinary laboratories carried out in integrated teaching areas, clinical correlations, and symposia are other educational approaches used. The medical school program is distinguished by traditions of openness and collegiality as well as by its process of continuing self-renewal.

The Curriculum

The four-year curriculum is composed of three interrelated components; the Core Academic Program, the Patient-based Program, and the Flexible Program. The Core Academic Program of Years I and II provides foundational training in the basic biomedical sciences and organ system pathophysiology, and introduces students to the social, economic and interpersonal dimensions of the doctor-patient relationship. The Patient-based Program extends throughout the four years and prepares students in the skills, knowledge and attitudes necessary to provide supervised patient care during graduate training. The Flexible Program provides students with elective opportunities for enrichment, research and individualized study as well as dual degrees. Students must demonstrate satisfactory performance in all three components of the program to be eligible for graduation.

Core Academic Program

The 1999-2000 academic year represented an exciting new phase in the evolution of medical education at the School of Medicine. Fifty years have passed since Case Western Reserve pioneered cross-disciplinary integration in the teaching of basic medical sciences, an idea considered revolutionary at the time and since adopted by medical schools throughout the world.

The revised Core Academic Program curriculum, introduced in August 1999 with the entering Class of 2003, builds on this successful foundation, incorporating new approaches to integration both within the basic science components of the teaching program and between the basic and clinical sciences. In addition, the learning environment continues to be enhanced by a major initiative to develop the use of electronic learning tools, including an electronic syllabus, to facilitate self-directed learning and exploration.

The latest reforms build on the principles of cross-disciplinary integration in the basic sciences and early exposure to clinical experiences that have been hallmarks of the University’s curriculum since the 1952 “revolution.” Whereas the 1952 reform focused on integrating disciplines (for example, anatomy and physiology) within each organ system, this new effort focuses on integrating learning across organ systems and in the context of biological and social factors that influence patterns of disease expression, treatment strategies and outcomes in individuals and communities.

To graduate physicians who are able to effectively integrate cutting-edge science, medical and information technology, and comprehensive, humanistic care, such integration must be the very fabric of the medical school curriculum. The revised curriculum reflects this vision. Major changes:

• Establishment of the Curriculum Leadership Council.
• Restructuring of the Year I and II curricula so that the major emphasis in Year I is on normal structure and function of each organ system, whereas the major emphasis in Year II is on pathophysiology.
• Coordination of the basic science and clinical science modules in the Year I and Year II curricula so that case-based workshops in the clinical program relate to the concurrent basic science course work.
• Establishment of vertical themes, including genetics, growth and development, aging, and diversity to provide cross-disciplinary integration throughout Years I-IV.
• Development of specific learning objectives for each component of the curriculum.
• Continued development of the electronic curriculum as a comprehensive tool for improved access to information, self-directed learning and exploration, and integrated evaluation. The Core Academic Program consists of consecutive learning modules, or subject committees, representing the major content areas in basic and clinical medical science. Some subject committees are grouped together thematically into sections.
In Year I, these content areas are Cellular and Molecular Biology and Genetics, Integrative Human Biology, Fundamentals of Therapeutic Agents, and Biological Basis of Disease I.

In Year II, the content areas are Organ System Pathophysiology, Drug Action and Biodisposition, Hematology, and Mechanisms of Infection.

Running concurrently with these modules in Year I is Introduction to Clinical Medicine (ICM), a program of small group, case-based, problem-solving workshops and lectures that engage students and faculty in topics ranging from the social and economic context of medicine, epidemiology and biostatistics, to developing the tools of clinical decision-making, such as the critical evaluation and application of information (also known as evidence-based medicine). In addition, ICM workshops focus on dealing with issues that can challenge the doctor-patient relationship, such as death and dying, substance abuse and sexuality, self-directed learning skills, peer education, self-assessment and peer assessment, and the promotion of student-student and student-faculty collegiality are emphasized throughout the ICM program.

The Year I curriculum begins with an introduction to the ICM program called Fundamentals of Medical Decision-Making.

The annual Curriculum Handbook of the School of Medicine provides a detailed description of the subject committees and sections in the Core Academic Program.

Patient-based Program

The Patient-based Program is a four-year continuum. It begins with early involvement with patients in the pre-clerkship activities of the first two years and builds toward intensive clinical experience in the core clerkships of the third year and clinical electives of the fourth year. The emphasis of the Patient-based Program in the first two years is concurrent progress in professional maturation in acquiring clinical skills, knowledge and attitudes. An essential foundation for supervised responsibility for patient care in graduate training, it reinforces and builds on the information base introduced in the Core Academic Program and is complemented by the Flexible Program. The ICM program provides a unique link among these activities.

Preclerkship Years I and II

The three components of the Clinical Science Program are: the lecture series/preceptor groups (which are part of the ICM), the Family Care Program, and the Interviewing Program. Physical Diagnosis completes the pre-clerkship portion of the Patient-based Program.

Year I features all three components of the Clinical Science Program.

Year II focuses on Physical Diagnosis, but activities of the other three components continue.

The process of professional maturation requires developing skills, attitudes and behavior consistent with being a competent, humane and open-minded physician. This process continues throughout the four-year continuum, but the primary focus of the Clinical Science Program and Physical Diagnosis in the first two years is on the various perspectives involved in becoming a professional.

Family Care Program. Early in the first year of medical school, each student is assigned to follow a pregnant woman. (The alternative of a geriatric patient is available for a small number of students.) The student has both an opportunity and a responsibility. The opportunity to observe and support the patient through her antepartum course, delivery, and the later care of her child is accompanied by a responsibility to be accessible to the patient. The student is the principal liaison to the physicians caring for the patient and as such is a part of the patient’s health care team. The process of physical examination begins in this setting. The student attends each clinic visit with the pregnant mother and is with her throughout labor and delivery. The student attends the well-child care visits of the baby through the second year of medical school.

Workshops conducted by the medical directors of the family clinics during the first four weeks of medical school help prepare students for the Family Care experience. Workshops include the physical examination of the pregnant woman, the physiology and psychology of pregnancy, labor and delivery, and interviewing.

Interviewing Program. This component of the ICM is designed to provide opportunities for students to receive instruction in and practice effective doctor/patient communication skills. Students complete two observational and two videotaped patient interviews during their first year. Each interview is observed by a preceptor and a student partner and followed by a structured feedback session to review the tape and analyze the student’s interviewing strengths and weaknesses. The patient also participates in the feedback session. Each session is preceded by a goal-setting session wherein the student identifies different skills to practice in each interview. An interviewing skills checklist is used to record the student’s progress in mastering the skills. Skills practice in self-assessment, the medical write-up, oral presentation skills, how to deliver effective feedback to a colleague, and consultation skills also are integral components of this program.

In Year II, students participate in two observational and two interview sessions with standardized patients to practice the specific interviewing skills of sexual history-taking and how to assess a patient’s readiness for behavioral change. They continue practicing self-assessment skills, oral presentation skills, preparing and delivering feedback, and consult skills. Goal setting before the interview and structured feedback session after each interview continue. In addition to being evaluated on the actual skills practiced, students are assessed in their professional development in the areas of responsibility in making and keeping appointments, receptiveness to feedback, and respectful demeanor to patients and colleagues.

Physical Diagnosis. In a series of didactic lectures, demonstrations and small group sessions during Years I and II, students learn the basics of interviewing and physical exam methodology. Part One of the course focuses on basic techniques and normal physiology. Part Two focuses on abnormal findings. These teaching sessions consist of the demonstration of a regional physical exam technique and medical history-taking skill followed by supervised practice of the interview and examination with a student partner, hospital-based patient and/or standardized patient. To support clarity and integration, each regional examination is coordinated whenever possible to the regions/organ systems being taught simultaneously in the Core Academic Program curriculum. Afternoon lectures and subspecialty-oriented physical diagnosis laboratories supplement the material presented in small group format.

Following completion of this introductory course, students are assigned to individual internal medicine or family medicine faculty mentors from various affiliated hospitals to perform a series of at least six complete histories and physical examinations on either hospital inpatients or patients in the ambulatory setting.

The Year II physical diagnosis experience includes a three-week pediatric physical diagnosis component emphasizing the unique aspects of the examination of the newborn, toddler and adolescent.

Assessment of the students’ skills is measured by tracking their progress on the physical diagnosis checklist and the medical history-taking checklist, as well as by verbal feedback from their instructors. Final assessment for the course is via a physical
diagnosis objective structured clinical examination (OSCE) at the end of Year II.

Core Clerkships

General Educational Goals and Process

The primary goal of the clerkships is for the student to acquire the skills to solve clinical problems scientifically, humanistically and to the objective benefit of the patient. The student learns by case study method the collection of information for a comprehensive database, identification of problems, development of appropriate methodology for solution of the problems, and participation in treatment and observation of the course of the patient’s illness. The student learns to care for patients as human beings in whom organic or psychologic illness may have a profound socioeconomic and emotional impact. The student must learn to work harmoniously with all members of the health profession team to solve these broad patient problems. These fundamental skills can be augmented in graduate training.

The clinical faculty provide the framework for care to patients, in which students participate under supervision. Implicit in this relationship is acceptance of responsibility for the care of patients to a degree appropriate to the individual student’s level of training and the specific clinical situation. This is a new dimension in education for most students and may initially be a source of anxiety. The clinical faculty members are prepared to lend support when necessary. Experience indicates that the majority of students quickly acclimate to involvement in patient care.

In the majority of clerkships, the resident physicians, with the strong support of the clinical faculty, fill an important teaching role in the case study method by direct supervision of students in history-taking, physical examination, laboratory evaluation and problem formulation. The faculty also are responsible for ensuring the proper balance between learning experiences and service functions, and for the quality of supervision provided to students by the resident staff.

Evaluation of student performance in core clerkships also differs from the written examination format used in the core curriculum. Continuous accumulation of information and development of clinical skills are required in the case study method of learning. Students’ acquisition of information, application of knowledge, and development of clinical skills generally are assessed by faculty and house officers’ observations and questioning in the clinical setting. In all clerkships, written and/or oral examinations also are administered and must be passed.

An equally important component of evaluation of clerkship performance concerns behavioral characteristics of students as physicians-in-training. In particular, it is expected that students’ behavior reflects a high level of responsibility and commitment to their patients and colleagues, including an awareness of the necessity for some degree of personal sacrifice in caring for the ill. This includes the daily interpersonal relationships necessary for working in the team situation that characterizes contemporary health care delivery. Excellence in the fundamentals of medical knowledge is never sufficient to outweigh behavioral characteristics detrimental to considerate and ethical human relationships. It is the responsibility of the faculty to inform the student of his or her clerkship performance.

Core Clerkship Year III

The 48-week core clerkship third year was implemented in July 2000 with the Class of 2002. Core clerkships are offered at approximately 21 clinical services in affiliated hospitals and practices. Required rotations through medicine, surgery, pediatrics, obstetrics/gynecology, psychiatry, family medicine, and neurosciences must be taken at one of these affiliates.

Each student is required to take the following in block format:

**Block No. 1**
- Neurosciences (4 weeks)
- Psychiatry (4 weeks)
- Surgery (8 weeks)

**Block No. 2**
- Inpatient Medicine (8 weeks)
- Ambulatory Medicine (3 weeks)
- Family Medicine (4 weeks)
- Psychiatry (1 week)

**Block No. 3**
- Obstetrics/Gynecology (7 weeks)
- Newborn Nursery (1 week)
- Inpatient Pediatrics (4 weeks)
- Ambulatory Pediatrics (3 weeks)
- Psychiatry (1 week)

Each clerkship is directed by a University faculty member who is responsible for certifying to the School of Medicine that each student has achieved the educational goals stated for that clerkship. In this role, the clerkship directors represent the service directors of the affiliated hospitals in their teaching relationship with the School of Medicine. Additionally, the clerkship directors work with the Patient-based Program coordinator, who is responsible for administration of the clinical programs, and the chair of the Clinical Rotation Development Council. The Committee of Clerkship Directors, with representation from all clerkships at all sites, determines the general goals and monitors the educational processes of the required clerkships.

Core Clerkship Descriptions

**Medicine**

The medicine clerkship builds on the knowledge of human biology and pathophysiology developed in the Core Academic Program and the basic interviewing and physical diagnosis skills acquired by students in the Clinical Science Program and Physical Diagnosis. The goals of the core medicine clerkship are that the student:

- increase skills in obtaining reliable and accurate knowledge regarding the anatomy, biochemistry and pathophysiology of a patient’s illness from the interview, physical examination, laboratory and imaging data, and the medical record;
- synthesize from these clinical data and his or her scientific, psychosocial and medical knowledge plausible pathophysiologic hypotheses explaining the problem that is to be evaluated through an ordered, efficient and cost-effective diagnostic algorithm;
- develop a management plan that incorporates medical therapeutics, attention to psychosocial and economic dimensions, and, wherever appropriate, preventive management of disease;
- develop appropriate professionalism; and
- develop adequate knowledge of internal medicine.

This clerkship consists of inpatient and ambulatory experiences. During these rotations, students participate as active members of the health care team.

**Neurosciences**

In this four-week rotation, students learn to perform and understand the neurologic examination, use a clinical database to localize lesions within the nervous system, and characterize the disease process in terms of pathogenic mechanisms. They also actively diagnose and manage inpatient and outpatient neurological and neurosurgical diseases under the supervision of neurology and neurosurgery house officers and attendings. Students participate in outpatient clinics and as members of the inpatient ward team on the neurology or neurosurgery service. Those choosing
the neurosurgical clerkship become familiar with the techniques involved in common surgical procedures as well as neurological intensive care.

Obstetrics/Gynecology

The goal of this clerkship is to teach the basic principles of obstetrics and gynecology and to apply these principles involved in health care for women. The emphasis is on the pathophysiology of the reproductive tract. Students are expected to gain an understanding of normal reproductive physiology and the medical and surgical complications of pregnancy. Students also gain experience in the diagnosis and treatment of common gynecologic problems, insight into the meaning of pelvic disease, and exposure to a major patient care field as a possible career choice.

Students participate in ambulatory and inpatient services as well as in operating and delivery room activities. Roughly half of the time on the clerkship is spent in obstetrics and the other half in gynecology.

Pediatrics

The goals of the pediatrics clerkship are to provide an introduction to the field of pediatrics and to promote an awareness of the concept of disease in a rapidly growing person. The clerkship emphasizes developing the student’s competence in the skills necessary for the case study method of patient care, namely, effective data collection through the history and physical examination, synthesis and presentation of information, problem-solving, patient management, and communication with patients and their families.

Students are exposed to the complete range of pediatric experiences (infancy through adolescence), problems of normal growth and development, ambulatory practice, and tertiary inpatient care. Students work as members of the ward team and are directly involved, with the appropriate supervision, in managing patients.

Family Medicine

This four-week clerkship enables the student to work with a continuity preceptor to gain experience with comprehensive diagnosis, assessment and management of patients of all ages with undifferentiated problems commonly encountered in the broad spectrum of primary care. This allows the student to structure his or her experience from the general to the specific.

This clerkship combines comprehensive office practice with interactive learning experiences in an individually tailored program for third-year students. Students work side-by-side with a community or residency family doctor.

Psychiatry

This clerkship provides intensive clinical experience on the inpatient service, in outpatient clinics, and/or on the consultation liaison service. Clerkship didactics and clinical work build on the didactics, group and interview experiences from the second year Mind Subject Committee.

The objectives of the psychiatry clerkship are to develop the skills and knowledge essential to the psychiatric evaluation, the mental status examination, interviewing techniques, and selection and implementation of treatment modalities. Emphasis is placed on descriptive characteristics of psychiatric disorders and therapies, the rationale for the use of a variety of psychiatric therapies, psychopharmacology, the major psychodynamic mechanisms, and unconscious processes and their applications in clinical situations. Students acquire the clinical experience needed to make accurate psychiatric diagnoses, gain a working knowledge of psychopharmacology, learn principles of treatment sufficient to make referrals, and expand their own understanding of the psychological effects of illness.

Surgery

The goal of this clerkship is to provide students with a broad clinical experience in which to develop diagnostic and management skills, improve their skills for the collection, organization, integration and presentation of data; procedural skills, recognition of treatment priorities; and management of emergencies. The emphasis in this clerkship is on problems unique to the surgical discipline and on participation in frequently used surgical therapeutic methods. At the same time, it becomes clear that surgical judgment and technical approaches require a broad background knowledge of the basic sciences as well as firm clinical knowledge from the non-surgical fields.

Objectives of this clerkship are to acquaint students with surgery as a discipline and to give them an appreciation for working with other members of the team. Students find this a useful time to review basic anatomy and physiology and are expected to acquire a basic understanding of the pathophysiology of surgical disease and the rationale for surgical treatments.

The annual Year III Core Clerkship Catalog of the School of Medicine provides more detail about the core clerkships.

Flexible Program

The Flexible Program encompasses the electives of the first two years, which mainly are short courses offered during the afternoons (Type A) and the clinical electives of one month or longer typically taken in the fourth year (Type B). Catalogs of both Type A and Type B electives are published and distributed to the students annually. Students may take an Area of Concentration (AoC) or take a broad range of electives in the Diversified Medical Sciences. The objectives of the Flexible Program are to:

• increase the student’s capacity for critical and analytical thinking in the medical sciences;
• provide opportunities for meaningful student involvement in scholarly activities, both independently and in consort with professional colleagues;
• allow students to pursue individual areas of concentrated study in depth and across traditional disciplinary boundaries;
• expose students to newer concepts, areas of controversy, issues of social relevance, and changing technology in medical science; and
• increase students’ initiative, responsibility, and capacity in self-education in the medical sciences.

The content of the Flexible Program is designed to complement the Core Academic Program and the Patient-based Program, to extend them, and to promote integration across the usual disciplinary boundaries.

Components of the Flexible Program

The Flexible Program includes two pathways: Areas of Concentration and Diversified Medical Sciences.

Areas of Concentration

All students are required to participate in the Flexible Program, and the minimum course requirement is the same for all students. Within the Flexible Program and within the minimum course requirements, Areas of Concentration (AoCs) are offered to those students who wish to pursue them. Pursuit of an AoC is intended to allow the student to choose a single area and pursue this area in depth. We believe that scholarship of this type is of value for medical students and will establish patterns of study for physicians who must continue their own self-education throughout their lives. Additionally, the collegiality that results from faculty and students working together in areas of common interest adds much to the academic environment of this medical school. The following points describe the basic features on an AoC. They are
modified from the guidelines used by the faculty in developing AoCs.  
• AoCs encompass both Type A and Type B units.  
• Independent scholarly activity is encouraged as a part of AoCs. It is often part of the minimum requirements for completion of an AoC.  
• Most AoCs require four to six Type A units (Year I and II) and two to three Type B units (Years III and IV) as minimum. Many students will devote more time to their AoC. The usual Type B AoC requirements are:  
• Two sharply focused Type B electives or three Type B electives, of which two are sharply focused. AoC directors may choose to allow students to substitute 200 hours of independent scholarship for one of the required Type B units.  
• Distribution requirements are included within some AoCs to ensure that the program’s objectives are met.  
• Courses offered as part of an AoC usually are open to students in other AoCs and in Diversified Medical Sciences. Many courses satisfy requirements for more than one AoC.  
• Election of AoCs occurs in the second half of the first year. The option to change an AoC remains open as long as it is reasonable for students to meet the requirements of the AoC into which they wish to change. Students who do not elect an AoC will be enrolled in the Diversified Medical Sciences Program.  
• Students are encouraged to develop individual programs within an AoC. Students may initiate an AoC in an area not currently offered.  
• Students may not enroll in more than two Areas of Concentration. The student’s completion of an Area of Concentration is recognized by notation on the official transcript. Students achieving excellence in an Area of Concentration are awarded distinction in the Area of Concentration. This award is granted by February of the fourth year, is recognized at commencement, and is noted also on the official transcript. Nomination for distinction is made by the Area of Concentration faculty. This nomination is then reviewed and the award made by an ad hoc faculty committee.

Diversified Medical Sciences

Students who do not choose an Area of Concentration participate in the Diversified Medical Sciences pathway. This path is intended to appeal to those students whose interests have not been refined to the point where they feel comfortable in committing themselves to the in-depth pursuit of a single area. Distribution requirements are imposed for the Type A unit requirements of the first two years as outlined in the Flexible Program Catalog of Type A Electives.

More information about the Flexible Program is available in the annual Type A Catalog and Type B Catalog of the School of Medicine.

The Electronic Curriculum

• The School of Medicine has developed an integrated electronic curriculum that contains a list of learning objectives for every hour of the core curriculum, as well as the resources that allow the students to achieve the objectives. These resources include references to traditional textbooks and journal articles, original textual material, PowerPoint files, illustrations, animations, videos, audio files, and links to Internet-based learning resources (including original journal articles in electronic format). These resources are made available on the Internet by an NT/Internet server system.

An electronic testing system (using an SQL server) has been developed to administer multiple-choice examinations on the student desktop computers over CWRUnet, automatic grading of the examinations, and e-mail feedback to the students that includes the test score, a short descriptive phrase that describes the concepts that the student did not answer questions on correctly, and links to the places in the electronic curriculum where these concepts are introduced and explained. The electronic curriculum is being developed for the core clerkships and the Flexible Program.

Each student is given a notebook computer at the time of matriculation and is provided a series of computer orientation sessions. Students have access to the Internet and the electronic curriculum from their assigned personal desks via fiber optic Ethernet connection to CWRUnet. When off campus, access is through modem.

The Primary Care Track (PCT)

School of Medicine
Room E-414
Program Coordinator: Pamela B. Glover, M.Ed.
Phone 216-368-5966
Website: http://mediswww.cwru.edu/dept/pct

In 1994, as part of the Robert Wood Johnson Generalist Physician Initiative, Case Western Reserve launched the Primary Care Track (PCT), a program within the School of Medicine. The focus is on general pediatrics, general internal medicine, and family medicine, but the program provides a strong foundation for students regardless of what medical discipline they eventually pursue. Students will find the Primary Care Track a program focused on their educational needs as well as the needs of the future health care system.

Students may apply for admission to the Primary Care Track early in the first semester of the first year of medical school. Students in this program have several advantages beginning in the first year of medical school:
• association with a primary care faculty advisor;
• access to innovative educational strategies, such as a pilot program in early physical diagnosis that recently was implemented for the entire class; and
• the opportunity to complete a health promotion project

PCT students have a home base during the third year at one of three affiliated teaching sites: MetroHealth Medical Center or University Hospitals of Cleveland/Louis Stokes Cleveland Department of Veterans Affairs Medical Center, and Henry Ford Health System in Detroit. Their clerkships in the primary care disciplines of medicine, pediatrics and family medicine are all completed at their home base sites. In addition, PCT students pursue a longitudinal continuity preceptorship throughout the third year and participate in small-group activities organized around primary care topics that take advantage of educational strategies such as problem-based learning.

The PCT is designed to continue across the seven years of medical training (school and residency). PCT students in their fourth year of medical school are given considerable autonomy in choosing their courses, but are required to complete a one-month health policy experience. PCT students have the option of taking electives designed especially for the program, such as a pediatric or medicine subspecialty electives, or self-directed electives in international health, adolescent medicine and women’s health. Another option for PCT students is to pursue an integrated fourth year at the Henry Ford Health System.

The PCT’s influence continues into the residency programs in general internal medicine, general pediatrics and family medicine at the affiliated teaching sites. Faculty development programs have been implemented to teach residents to become better teachers.
Other Degree Programs

The degree programs listed in this section may require admission to another school at the university in addition to or instead of the School of Medicine. Each school may have different deadlines and requirements for admissions. Please contact the other schools separately using information provided under that school’s listing in this publication. Please see departmental listings in this section of the General Bulletin for information about additional degree programs offered through the medical school’s departments.

Clinical Research Scholars Program (CRSP)

A program leading to a master of science in clinical research degree, the Clinical Research Scholars Program (CRSP) aims to develop a new generation of clinical investigators in leadership roles in academia and industry.

The program resides in the Center for Academic Clinical Research in the Division of General Medical Sciences of the School of Medicine. Students are individuals who have completed their clinical training and want to develop a professional career based on clinical investigation. A prerequisite for consideration for admission is a degree in medicine, dentistry, nursing, or an allied science such as pharmacy or biomedical engineering, along with postgraduate training in health care provision or similar clinical applications of the applicants’ basic discipline.

The CRSP consists of formal didactic course work, a longitudinal seminar series, and an intensive mentored experience centered on a specific clinical research problem. The curriculum makes use of existing didactic material offered throughout the University’s medical, nursing and dental schools as well as offerings specifically designed for CRSP students.

The program has a two-year curriculum requiring 36 credit hours. A total of 15 hours are accumulated in five required courses common to all fields of clinical investigation. Specialty tracks provide maximum flexibility and can be adapted to meet a wide array of clinical research career goals. Completion of a formal thesis is required for the awarding of the master of science in clinical research degree.

Some financial support may be available based on merit and need.

For more information, see http://mediswww.cwru.edu/CRSP/ or contact Carol Tolin, Program Coordinator, CWRU Clinical Research Scholars Program, c/o MetroHealth Medical Center - Bell Greve 3-45, 2500 MetroHealth Dr., Cleveland OH 44106-1998; e-mail: ctolin@metrohealth.org

Clinical Research Scholars Program (CRSP)

Graduate Courses

CRSP 401. Introduction to Clinical Research Summer Series (3)

This course is designed to familiarize one with the language and concepts of clinical investigation and statistical computing, as well as provide opportunities for problem-solving, and practical application of the information derived from the lectures. The material is organized along the internal logic of the research process, beginning with mechanisms of choosing a research question and moving into the information needed to design the protocol, implement it, analyze the findings, and draw and disseminate the conclusion(s). Prereq: M.D., R.N. Ph.D. or Doctor of Nursing, D.D.S., or doctorate prepared health professionals.

CRSP 651. Clinical Research Scholars Thesis (1-18)

CRSP Thesis M.S. Prereq: Permission of program faculty.

Master of Public Health (M.P.H.)

The master of public health program prepares students to enhance health in human populations through organized community effort. Graduates are qualified to work in local and state health departments, universities and colleges, hospitals, ambulatory medical centers, non-profit organizations, and the insurance and pharmaceutical industries.

The program seeks to attract a rich mix of students—those pursuing degrees in medicine, nursing, dentistry, law, social work, bioethics, management and other fields.

The program has tracks in adolescent health (the first in the country), health services research, urban health, health care policy and administration, health promotion/disease prevention, biostatistics, and epidemiology. The 36-hour program can be completed in two years. Students earn 15 credit hours through five required courses representing the fundamentals of public health: biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral sciences. Also, students receive a total of nine credit hours for three courses in an area of concentration of their choice (adolescent health, biostatistics, epidemiology, health services research, health care administration, urban health, or disease prevention and health promotion), three credit hours for an elective course, and nine credit hours from a one-semester public health field practicum. In the practicum, students work on a project for a public agency and produce a report for the agency.

The M.P.H. program recently has introduced several new dual degree programs. Each program combines a master of public health degree with one of the following degrees: master of science in nursing degree, medical degree, master of business administration degree, juris doctorate degree, or master of arts/Ph.D. in anthropology.

Initial admission is through the University’s School of Graduate Studies. For more information, call (216) 368-3128, e-mail vxg6@po.cwru.edu, or visit http://epbiwww.cwru.edu/pages/mphprg.html on the Web.

Master of Public Health (M.P.H.)

Graduate Courses

MPHP 405. Statistical Methods in Public Health (3)

This one-semester survey course for public health students is intended to provide the fundamental concepts and methods of biostatistics as applied predominantly to public health problems. The emphasis is on interpretation and concepts rather than calculations. Topics include descriptive statistics; vital statistics; sampling; estimation and significance testing; sample size and power; correlation and regression; spatial and temporal trends; small area analysis; statistical issues in policy development. Examples of statistical methods will be drawn from public health practice. Use of computer statistical packages will be introduced.

MPHP 408. Public Policy and Aging (3)

(See EPBI 408.) Cross-listed as EPBI 408.

MPHP 411. Introduction to Behavioral Medicine (3)

Using a biopsychosocial perspective, an overview of the measurement and modeling of behavioral, social, psychological, and environmental factors related to disease prevention, disease management, and health promotion is provided. Cross-listed as EPBI 411.

MPHP 421. Health Economics and Strategy (3)

(See ECON 421.) Cross-listed as ECON 421 and HSMC 421.

MPHP 425. Community Health Advocacy (3)

The objective of this course is to acquaint students with basic theoretical and practical aspects of community health advocacy (including foundations, needs assessment, post assessment and priority setting, ethical issues, and approaches and strategies) and to explore the roles that they can play as health professionals. The course will be taught using an intensive weekend format.
MPHP 429. Introduction to Environmental and Occupational Health (3)
This course is designed to provide an overview of both environmental and occupational health. Students will be introduced to the basics of toxicology and exposure assessment. Topics considered will range from local to global. Socioeconomic, political and public health implications of environmental and occupational issues will be discussed. Students completing the course should be able to recognize environmental and occupational problems, access resources in these fields, and understand control and preventive measures. Core requirement for M.P.H. Degree.

MPHP 431. Statistical Methods I (3)
Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory; random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. Cross-listed as EPBI 431.

MPHP 432. Statistical Methods II (3)

MPHP 433. Community Interventions and Program Evaluation (3)
(See EPBI 433.) Cross-listed as EPBI 433.

MPHP 439. Public Health Management and Policy (3)
This course will include a description of the health care system, an understanding of population based health care, concept and methods of health management, current issues in health policy and the application of these concepts using case studies. Topics will include the role of the manager, organizational design and control, professionals in organizations, adaptation and accountability. This is a required course in the M.P.H. degree. Grades will be based on class participation and a paper.

MPHP 442. Biostatistics II (3)
This course deals with the basic concepts and applications of nonparametric statistics. Topics will include distribution-free statistics, one-sample rank test, the Mann-Whitney and Kruskal Wallis tests, one sample and two sample U-statistics, asymptotic relative efficiency of tests, distribution-free confidence intervals, point estimation and linear rank statistics. Prereq: MPHP 432. Cross-listed as EPBI 442.

The objective of this course is to acquaint students with current issues arising in the urban health context. As such, the focus of the course will change from year to year. Topics to be addressed on a rotating basis include issues in LGBT (lesbian, gay, bisexual, and transgender) health, substance abuse and prevention, public health law, HIV/AIDS in the U.S. urban setting, women’s health, intentional injury, and environmental health and environmental justice.

MPHP 447. Sampling Finite Populations (3)
This course will discuss the basic concepts of sampling theory including simple random and systematic sampling, ratio and regression methods of estimation, stratified and cluster sampling, randomized response survey and their applications in health sciences. Prereq: MPHP 445. Cross-listed as EPBI 447.

MPHP 450. Clinical Trials and Intervention Studies (3)
(See EPBI 450.) Cross-listed as EPBI 450.

MPHP 451. Principles of Genetic Epidemiology (3)
(See EPBI 451.) Cross-listed as EPBI 451.

MPHP 455. Genetic Epidemiology of Complex Diseases (3)
(See EPBI 455.) Cross-listed as EPBI 455.

MPHP 456. Health Policy and Management Decisions (3)
(See HSMC 456.) Cross-listed as HSMC 456.

MPHP 458. Statistical Methods for Clinical Trials (3)
(See EPBI 458.) Cross-listed as EPBI 458.

MPHP 460. Health Research Methods I (3)
This is a course in research methods focusing on practical issues in the conduct of health services research studies. Topics include: an overview of health services research; ethics in health services research; proposal writing and funding; the relationship between theory and research; formulating research questions; specifying study design and study objectives; conceptualizing and defining variables; validity and reliability of measures; scale construction; operationalization of health research relevant variables using observation, self and other report, and secondary analysis; formatting questionnaires; developing analysis plans; choosing data collection methods; sampling techniques and sample size; carrying out studies; preparing data for analysis; and reporting of findings. Cross-listed as EPBI 460.

MPHP 463. Survey Design and Data Collection in Health Research (3)
The purpose for this course is to provide hands-on experience in designing and conducting surveys in health research. The topics include sampling, types of surveys (e.g., interviews, mail, telephone, medical records, questionnaires, and observations), multiple indicator models, index and scale construction, assessing psychometrics properties, field operations (i.e., data collection, editing and coding). Cross-listed as EPBI 463.

MPHP 467. Cost-Effectiveness Analysis in Health Care (3)
Evaluation of alternative medical treatments and drug therapies. Topics include cost-benefit, cost-effectiveness and cost-utility analysis. Measuring cost, benefits and health outcomes. Quality of life and other measures of effectiveness will also be addressed. Emphasis on case studies, course project, and evaluation of publications. Some decision analysis and policy implications will also be included. Cross-listed as EPBI 467.

MPHP 468. The Continual Improvement of Healthcare: An Interdisciplinary Course (3)
The focus of this course is on collaborative work for the benefit of patients and community. Seminar classwork is combined with a field project, in which interdisciplinary student teams apply what they have learned to the improvement activities of a local health care organization. Successful completion of the course depends on participation in seminar sessions and completion of the interdisciplinary student team project. Prereq: Consent of instructor. Cross-listed as EPBI 468.

MPHP 485. Adolescent Development (3)
(See ADHT 485.) Prereq: Consent of instructor. Cross-listed as ADHT 485.

MPHP 486. Adolescent Health Care Policies (3)
(See ADHT 486.) Prereq: Consent of instructor. Cross-listed as ADHT 486.

MPHP 487. Research and Evaluation in Adolescent Health (3)
(See ADHT 487.) Cross-listed as ADHT 487.

MPHP 488. Gender, Ethnicity, and Health Research (3)
The course is designed to acquaint students with the literature addressing the constructs of race, ethnicity, gender and social class; to examine critically the contexts in which these constructs are often applied; and to assess the relationship between each of these constructs and access to health care, quality of care, and health outcome. Cross-listed as EPBI 488.

MPHP 490. Epidemiology: Introduction to Theory and Methods (3)
Epidemiologic principles and methods needed to understand population-based statements of illness and health. Descriptive epidemiology, analytic epidemiology, and epidemiologic inference. Classification, morbidity and mortality rates, sampling, screening, epidemiologic models, field trials, controlled epidemiologic surveys, sources of bias, and causal models. Cross-listed as EPBI 490.

MPHP 491. Epidemiology: Application of Theory/Methods (3)
(See EPBI 491.) Cross-listed as EPBI 491.

MPHP 492. Epidemiology: Statistical Methods (3)
The course focuses on strategies for model building. Topics include the analysis of cohort and case-control studies where the emphasis is on risk estimation. Students are expected to analyze a database obtained from a cohort study of the effects of maternal alcohol drinking on outcomes of pregnancy and from a related nested case-control study. The analysis of survival data focuses on parametric and non-parametric techniques and utilizes data from an ongoing study of quality of life of patients on kidney dialysis. In addition to regular class assignments, students are expected to write a report on each of the databases and present results to the class. Prereq: MPHP 431 and MPHP 491. Cross-listed as EPBI 492.

MPHP 494. Infectious Disease Epidemiology (3)
(See EPBI 494.) Cross-listed as EPBI 494.

MPHP 495. Psychiatric Epidemiology (3)
(See EPBI 495.) Cross-listed as EPBI 495.
MHP 499. Independent Study (1-18)
Cross-listed as EPBI 499.

MHP 501. Graduate Seminar (0)
Students and faculty have the opportunity to meet on a weekly basis to discuss papers in the literature. Each week a paper is reviewed in detail by a graduate student in a formal presentation. Discussion of the strengths and weaknesses of the work gives insight into the complexities of investigations in the Public Health arena. Cross-listed as EPBI 501.

MHP 502. International Health Practice (3)
(See FAMD 502.) Cross-listed as FAMD 502.

MHP 504. Public Health Capstone Seminar (0)
Year-long, weekly seminar course offered in conjunction with the core requirement MHP 652 Capstone Experience. The seminar provides a forum for preparing students to select and support development of the capstone experience and a “think tank” for discussion of public health issues that evolve as relevant in current capstone placements. The seminar features speakers from community based Capstone sites, student presentations on public health topics related to Capstone projects, and debriefing and problem-solving sessions for current capstone experiences.

MHP 508. Ethics, Law, and Epidemiology (3)
This course is designed to provide epidemiology students with basic knowledge about the ethical and legal principles underlying epidemiological research. This is not a public health law class. Issue papers are assigned on a weekly basis. Each issue paper requires that the student analyze the situation depicted and apply the principles learned. Some issue papers may require that the student draft a proposed rule, a portion of legislation, or a document such as an informed consent form. Other exercises may require that students critique an existing agency rule or legislation. Prereq: EPBI 490 and EPBI 491. Cross-listed as EPBI 508.

MHP 652. Public Health Capstone Experience (3-9)
The Public Health Capstone Experience consists of a public health field practicum, involving a placement at a community-based field site, and a Master’s essay. The field placement will provide students with the opportunity to apply the knowledge and skills acquired through their Master of Public Health academic program to a problem involving the health of the community. Students will learn to communicate with target groups in an effective manner; to order priorities for major projects according to definable criteria; to use computers for specific applications relevant to public health; to identify ethical, social, and cultural issues relating to public health policies, research, and interventions; to identify the process by which decisions are made within the agency or organization; and to identify and coordinate use of resources at the placement site. The Master’s essay represents the culminating experience required for the degree program and may take the form of a research thesis, an evaluation study, or an intervention study. Each student is required to formally present the experience and research findings. This course is available only to Master of Public Health students.

Medical Scientist Training Program (MSTP)

A combined M.D./Ph.D. in basic sciences program, the Medical Scientist Training Program (MSTP), is available for students desiring academic careers in medicine and related biosciences. This program takes seven to eight years to complete, depending on the time needed to complete the Ph.D. dissertation research. Candidates must meet established prerequisites for admission to both the School of Medicine and the School of Graduate Studies. Criteria include demonstrated motivation for and participation in research, in addition to superior undergraduate academic credentials. Descriptive materials and applications can be obtained by contacting the MSTP program using the above contact information. Applicants must have either U.S. citizenship or permanent residency status to be considered for admission to the MSTP program.

The Ph.D. component is pursued under the aegis of a selected pre-clinical department or program of the medical school or the MSTP itself. Financial support includes stipend and full tuition support.

The first two years of the program are devoted to the medical school pre-clinical core curriculum, which occupies five mornings each week. Afternoons are available for graduate courses and/or research recommended by the pre-clinical department or program. The next three to four years are devoted to completion of graduate courses and Ph.D. thesis research. After the first research year, the MSTP student can choose to participate in a weekly clinical tutorial to enhance clinical skills. After the Ph.D. thesis is successfully defended, the student returns to medical school to complete clinical clerkships and to qualify for the M.D. degree.

The program is administered by the MSTP Steering Committee, which consists of faculty from both basic science and clinical departments. Its functions include selecting candidates for admission; designing and administering the program curriculum; advising students; evaluating and approving each trainee’s program, including the selection of a Ph.D. thesis advisor and the members of the thesis committee; appointing clinical advisors; and acting as liaison with the Faculty Council of the School of Medicine.

The MSTP director is Clifford V. Harding III, M.D., Ph.D., associate director is Sandra K. Lemmon, Ph.D., and program manager is Deidre J. Gruning.

For more information, write: Case Western Reserve University School of Medicine, Room W-378, 10900 Euclid Avenue, Cleveland, OH 44106-4936; call (216) 368-3404; visit the Website at http://mstp.cwru.edu; and/or e-mail mstp@po.cwru.edu.

M.D./J.D.

This program, offered in conjunction with University’s School of Law, may be completed in six years. Admission is through the School of Medicine and the School of Law. For more information about the J.D. portion of the program, call the law school admissions office at (216) 368-3600 or (800) 756-0036 or e-mail lawadmissions@po.cwru.edu.

M.D./M.A. in Bioethics

The 27-credit-hour master of arts in bioethics program, including a 12-hour foundations course taken during the first year of medical school, emphasizes the interdisciplinary and interprofessional nature of the field. It is designed to provide advance training in bioethics for those who anticipate encountering ethical issues in the course of their primary careers. Medical school students complete the bioethics program while pursuing their medical degrees; no additional time is required. Admission for the master’s degree portion is through the School of Graduate Studies. For more information, please contact the Department of Bioethics at (216) 368-6196, e-mail xx245@po.cwru.edu, or see http://www.cwru.edu/med/bioethics/bioethics.html on the Web.

Ph.D. in Bioethics

At press time, Case Western Reserve is one of only two universities in the country to offer a pure bioethics doctorate program in addition to its master’s and joint degrees with medicine, nursing, law, and genetics. Admission to the Ph.D. program is through the School of Graduate Studies. For more information, please contact the Department of Bioethics at (216) 368-6196, e-mail xx245@po.cwru.edu, or see http://www.cwru.edu/med/bioethics/bioethics.html on the Web.

M.D./M.B.A.

This program, offered in conjunction with the University’s Weatherhead School of Management, may be completed in five to six years. For more information, visit http://weatherhead.cwru.edu/degree/experience/curriculum/
M.D./Ph.D. in Biomedical Engineering

This unique program focuses on the creation of new devices or platform technologies for diagnosis and treatment. The program aims to produce students who can solve medical problems with engineering applications. Students focus on such things as development of artificial or tissue-engineered organs, implantable prosthetics, medical instrumentation, and microelectromechanical systems (MEMS) technology and related nanotechnology for clinical applications. Students, who have their tuition and fees paid and also receive a stipend, can complete the program in seven years. For more information, please contact the Department of Biomedical Engineering at (216) 368-4063 or e-mail bxh12@po.cwru.edu.

M.D./Ph.D. in Health Services Research

This program prepares students for careers in academic medicine, health policy, public health, and/or health care management in group practices, HMOs or health-related industries. The program’s focus is especially pertinent to candidates interested in the health and health care problems of urban and vulnerable populations.

Initial admission for the Ph.D. portion is through the University’s School of Graduate Studies, with the Ph.D. completed within the Department of Epidemiology and Biostatistics and its track in health services research. Students typically complete the Ph.D. by their fourth or fifth year after matriculation and the M.D. at the end of the sixth or seventh year.

For more information, contact Program Director Randall D. Cebal, M.D., at (216) 778-5901 or rdc@po.cwru.edu.

Ph.D. in Genetics/M.A. in Bioethics

The rapid pace of human genetic research has led to an ever-increasing number of complex ethical issues; accordingly, the need for combined training in genetics and bioethics is becoming increasingly important. This is the first joint degree program in Ohio to address this need.

The master of arts in bioethics degree program is a 27 credit hour program. Required courses include a 12-hour foundations course, a three-credit-hour clinical ethics rotation, and 12 hours of electives. Admission to the master’s degree portion is through the School of Graduate Studies. Admission to the Ph.D. in genetics program is a separate process.

For more information, please contact the Center for Biomedical Ethics at (216) 368-6196, e-mail xx245@po.cwru.edu, or see http://www.cwru.edu/med/bioethics/bioethics.html on the Web.

Graduate Programs

Department of Anatomy

School of Medicine, Room W-520
Phone 216-368-2433
http://www.cwru.edu/med/anatomy/

Graduate studies in the Department of Anatomy can lead to the master of science degree in applied anatomy and to the doctor of philosophy degree. The master’s degree may be obtained as part of a joint degree program for qualified individuals participating in other programs at the University, such as the joint M.D./M.S. degree. Every graduate student in the Department of Anatomy must successfully complete 17 credits in the core curriculum of anatomical sciences, human gross anatomy, histology, neuroanatomy and embryology. An additional two credits offered by the department in seminar and research presentations also are required. Elective course work and, for the thesis M.S. and Ph.D. students, laboratory rotations and research, complete the graduate students’ program of study. Research areas of particular strength among faculty in the Department of Anatomy include biological anthropology, cell injury, control of respiration, and non-molecular developmental neurobiology. The department has existing collaborative research efforts with basic scientists in several clinical departments, including medicine, orthopaedics, pediatrics, neurology and neurosurgery. Please see the Department of Anatomy Website for additional information.

Anatomy (ANAT)

Undergraduate Courses

ANAT 312. Basic Histology (3)
Fundamental histology course covering microscopic structure, nomenclature, and function of normal cells, tissues, and selected organs (human emphasis).

ANAT 375. Human Evolution: The Fossil Evidence (3)
This course will survey the biological and behavioral changes that occurred in the hominin lineage during the past five million years. In addition to a thorough review of the fossil evidence for human evolution, students will develop the theoretical framework in evolutionary biology. Prereq: ANTH 103 and BIOL 110 or equivalent. Cross-listed as ANTH 375.

ANAT 377. Human Osteology (4)
This course for upper division undergraduates and graduate students will review the following topics: human skeletal development and identification; and forensic identification (skeletal aging, sex identification and population affiliation). Cross-listed as ANTH 377.

ANAT 383. Evolutionary Anatomy (4)
This course will introduce graduate and advanced undergraduate students to primate comparative anatomy and will examine methods of reconstructing physiology and behavior from fossil remains. Prereq: ANTH 103 and BIOL 110 or equivalent. Cross-listed as ANTH 383.

ANAT 384. Development and Evolution of the Vertebrate Skull (3)
This course will approach vertebrate cranial diversity from the perspective of our rapidly improving knowledge of craniofacial morphogenesis. The course will thoroughly review craniofacial embryology, including new data regarding the genetics of pattern formation, and will cover all major events in vertebrate craniofacial evolution. Prereq: Permission of instructor.

ANAT 391. Embryology (3)
A detailed description of development will be presented, focusing mainly on the developing human. Discussions and presentations will also include several developing systems that have served as useful models in experimental embryology for deciphering mechanisms responsible for producing adult metazoan organisms. One or two sessions will be devoted to studying material with the light microscope. Prereq: BIOL 220 or equivalent.

ANAT 398. Anatomy Departmental Seminar (1)
During the first half of the course, the organization, preparation, and delivery of oral scientific presentations are discussed. During the second half of the course, students, faculty, and invited speakers give presentations. These presentations include literature reviews and/or summaries of individual research projects. Reports on current research opportunities and ethical issues will also be presented.

ANAT 399. Independent Study (1-4)  
(Credit as arranged.) Student must obtain approval of a supervising professor before registration and list the professor’s name on the schedule card.

Graduate Courses

ANAT 410. Medical Gross Anatomy (3)  
An in-depth review and introduction to human gross anatomy. The course will be based on the curriculum at the School of Medicine and lectures will be given by the same faculty. One hour of lecture will precede 3 hours of dissection laboratory Monday through Friday. Lectures and dissection labs will cover all human anatomy, i.e., thorax, abdomen, pelvis and perineum, extremities and back, and head and neck. This is an intense course to which students should be prepared to devote more time than the scheduled hours of 1:00 to 5:00 p.m. Dissection labs are open 24 hours and a teaching assistant is available every morning. Prereq: Written permission of course director, B.A./B.S., or fourth year undergraduate.

ANAT 411. Gross Anatomy (2-6)  
Dissection of the adult human cadaver. Prereq: Consent of instructor.

ANAT 412. Histology and Ultrastructure (4)  
Comprehensive functional histology course integrating microscopic identification (‘structure plus nomenclature’) of normal cells, tissues, and organs with aspects of their cell biology, biochemistry, and physiology (‘function’). Topical coverage includes complete (‘head-to-toe’) tissue and organ survey with human emphasis.

ANAT 413. General Histology Laboratory (2)  
Microscopic structure of tissues and organs.

ANAT 414. Neurological Anatomy (3)  
This course provides a current and comprehensive survey of the structure of the human nervous system. It covers concepts which will be of practical value to students needing an understanding of the working mechanisms of the nervous system. The viewpoints of three closely dependent fields, neuroanatomy, neurophysiology and neurology, are presented, not with a view to covering them exhaustively but in the belief that a truly useful understanding of the morphology of the nervous system can only be attained by bringing together these three disciplines.

ANAT 415. Neurological Anatomy Laboratory (1)  
This laboratory course provides an adjunct to ANAT 414, Neurological Anatomy. It affords the student the opportunity to learn the complex three-dimensional anatomy of the human central nervous system from photographs of brain slices and sections, from glass slides of human brain sections, from actual brain slices, and from dissection of the brain. The material will be approached not only through traditional methods of studying regional morphology but also by “following” the components of functional systems through the spinal cord, brain stem, and/or forebrain. Animated, three-dimensional, and color imagery will also be employed. Prereq or Coreq: ANAT 414.

ANAT 424. Neural Integrative and Regulatory Mechanisms (3)  
This course is designed as a sequence to ANAT 414, Neurological Anatomy, or any other “introductory” course in neuroanatomy. Topics to be addressed include central regulation of pain, the regulation of somatic and visceral motor activity, neurotransmitter substances, the basal forebrain, the blood-brain barrier, levels of consciousness, sleep-wake mechanisms, cognitive behaviors and memory. Appreciation of the three-dimensional anatomy and vasculature of the spinal cord and brain will be gained through brain dissection and study of stained and unstained sections. Prereq: ANAT 414 or permission.

ANAT 425. Techniques in Microscopy (3)  
The microscopic technique course is designed for students to learn the basic knowledge and skills on light microscopy. Students will learn, through demonstration and hands-on experience, how to prepare complete microscopic slides. Routine histological stains, histochemical and immunohistochemical stains will be covered. Some knowledge about electron microscopy and confocal laser scanning microscopy will also be introduced.

ANAT 429. Medical Microscopic Anatomy (3)  
This course covers condensed material in a microscopic anatomy course in most U.S. medical school curriculum. It is intended for students who are interested in professional schools of medicine, dentistry, nursing or allied health sciences or who simply want to learn the structure and functions of cells, tissues and organs of the human or mammalian body. It is for students who want to learn the subject material in a shorter summer session. It also serves as a review course for health professional students. The course will cover basic biology of cells and tissue types of the body. It will further cover how cells and tissues are organized to perform specific functions in organs and organ systems. The format includes lectures followed by laboratory sessions on the same topic using microscope slides and PowerPoint presentations. Optional weekly or biweekly review sessions will be scheduled for students who need these extra sessions.

ANAT 431. Statistical Methods I (3)  
(See EPBI 431.) Cross-listed as EPBI 431.

ANAT 435. Morphometrics of Biological Shape (3)  
Morphometrics is the measurement of biological shape. This course will focus on the collection of data, especially landmarks, from biological forms directly and especially via imaging. We will use best fit and interpolant algorithms (Geometric Morphometrics) to compare two and three dimensional landmark configurations of an individual over time, different individuals to each other, and individuals to average forms. The results are interpreted with standard multivariate statistical techniques. These tools are especially relevant to applications in medical imaging and other areas of biometrics. Background in linear algebra and basic statistics is desirable.

ANAT 462. Advanced Principles of Developmental Biology (3)  
(See BIOL 462.) Cross-listed as BIOL 462.

ANAT 475. Human Evolution: The Fossil Evidence (3)  
(See ANAT 575.) Prereq: ANTH 103 and BIOL 110 or equivalent. Cross-listed as ANTH 475.

ANAT 477. Human Osteology (4)  
(See ANAT 377.) Cross-listed as ANTH 477.

ANAT 483. Evolutionary Anatomy (4)  
(See ANAT 383.) Cross-listed as ANTH 483.

ANAT 484. Development and Evolution of the Vertebrate Skull (3)  
(See ANAT 384.) Prereq: Graduate standing or permission of instructor.

ANAT 491. Embryology (3)  
A detailed description of development will be presented, focusing mainly on the developing human. Discussions and presentations will also include several developing systems that have served as useful models in experimental embryology for deciphering mechanisms responsible for producing adult metazoan organisms. One or two sessions will be devoted to studying material with the light microscope. Prereq: BIOL 220 or equivalent.

ANAT 498. Anatomy Departmental Seminar (1)  
During the first half of the course, the organization, preparation, and delivery of oral scientific presentations are discussed. During the second half of the course, students, faculty, and invited speakers give presentations. These presentations include literature reviews and/or summaries of individual research projects. Reports on current research opportunities and ethical issues will also be presented.

ANAT 499. Independent Study (1-4)  
(See ANAT 399.) Student must obtain approval of a supervising professor before registration and list the professor’s name on the schedule card.

ANAT 503. Readings and Discussions (1-18)  
In-depth consideration of special selected topics through critical evaluation of the literature.

ANAT 513. Surgical Anatomy of the Thorax and Abdomen (4)  
This course is intended for graduate and fourth-year medical students interested in surgery and surgical subspecialties. This integrated course will review basic gross anatomy, provide advanced training in gross and surgical anatomy, introduce common clinical problems and their anatomical consequences, and basic surgical approaches.

ANAT 523. Histopathology of Organ Systems (3)  
Comprehensive course covering the underlying basic mechanisms of injury and cell death, inflammation, immunity, infection, and neoplasia followed by pathology of specific organ systems. Material will include histological (‘structure’) and physiological (‘function’) aspects related to pathology (human emphasis). Prereq: ANAT 412 or permission of instructor.
ANAT 601. Research (1-18)  
(Credit as arranged.)

ANAT 610. Oxygen and Physiological Function (2)  
Lecture/discussion course which explores the significance and consequences of oxygen and oxygen metabolism in living organisms. Topics to be covered include oxygen transport by blood, tissues, oxygen toxicity, and mitochondrial metabolism. Emphasis will be placed on mammalian physiology with special reference to brain oxidative metabolism and blood flow.

ANAT 611. Practicum in Human Gross Anatomy (1-3)  
A course of study designed especially for the preparation of teachers that involves the supervised practical application of previously studied theory. Students accepted into ANAT 611 must participate in one of the sections of the course (as described below). Participation is defined as preparing a section prior to each dissection laboratory and being present to teach in each dissection laboratory. The opportunity exists, at the discretion of the course director, to present classroom lectures. Presentation of classroom lectures is not required. The teaching experience obtained will be obtained in ANAT 411 - Human Gross Anatomy. Teaching will be guided, supervised, and evaluated by the appropriate faculty from the department of anatomy. The three sections of ANAT 611 and the subjects covered are: Trunk Gross Anatomy (6 weeks), Musculoskeletal Gross Anatomy (3 weeks), Head & Neck Gross Anatomy (4 weeks). Prereq: ANAT 411 and permission of instructor.

ANAT 612. Practicum in Histology and Ultrastructure (2)  
A course of study designed especially for the preparation of teachers that involves the supervised practical application of previously studied theory. Students accepted into ANAT 612 must participate in one of two sections of the course: Section 1: Cell biology and tissues (1 credit); Section 2: Organs and organ systems (2 credits). The prerequisite knowledge required for ANAT 612 must have been obtained previously in ANAT 412: Histology and Ultrastructure and the associated laboratory ANAT 413: Histology Laboratory. Permission of the course director is also required. Required participation in ANAT 612 is defined as: 1. meet weekly with course instructor to (pre)review course material; 2. attend all ANAT 412 lectures; 3. participate/assist in all ANAT 413 laboratory sessions. Teaching will be guided, supervised, and evaluated by the course instructor with reference to the graduate student’s overall progress and performance as a teacher. The opportunity exists, but is not required, to present classroom lectures, at the discretion of the director. Prereq: ANAT 412 and ANAT 413, and permission of instructor.

ANAT 614. Practicum in Neurological Anatomy (1)  
A course of study designed especially for the preparation of teachers that involves the supervised practical application of previously studied theory. The graduate student will administer all laboratory sessions, assisting students with identification of structures and with understanding the functional aspects of neuroanatomical pathways. The graduate student will meet with the course director once per week to discuss the student’s performance and progress and to plan for upcoming class sessions. The course director will assist the student in developing the organizational skills necessary to be a course director as the student learns to anticipate questions, define problematic areas, and recognize varying learning styles. The graduate student will be evaluated by the course director with reference to the graduate student’s overall progress and performance as a teacher. Prereq: ANAT 414.

ANAT 651. Thesis M.S. (1-9)  
Master’s Thesis Plan A.

ANAT 691. Practicum in Embryology (1)  
A course of study designed especially for the preparation of teachers that involves the supervised practical application of previously studied theory. In the first half of the course, the graduate student will meet with small groups of three to four students on a twice-weekly basis to guide them in preparing their weekly classroom presentations. Each week, the graduate student will meet with the course director to evaluate the organization and quality of the classroom presentations and to discuss an organizational plan for the presentations scheduled for the next week. In the second half of the course the graduate student will deliver at least two but no more than four lectures covering basic and advanced topics in human embryology. At least one week prior to each lecture, the graduate student will meet with the course director to review the material to be presented and to plan the lecture. The graduate student will be evaluated by the students in ANAT 491 with reference to the help they received in preparing their class room presentations in the first half of the course. The graduate student will be evaluated by both the students and the course director with respect to the lectures the graduate student presents in the second half of the course.

ANAT 701. Dissertation Ph.D. (1-18)  
(Credit as arranged.)

ANAT 702. Appointed Dissertation Fellow (9)  
Department of Anesthesiology  
2536 Lakeside Hospital Building  
Phone 216-844-8077  
The master of science degree in anesthesiology is open to students who have an undergraduate degree from an institution recognized by Case Western Reserve University. Undergraduate degrees in biology, chemistry and physics are preferred. Students who have received an undergraduate degree in an area other than a science may qualify for admission to the program if they have completed two years of biology with laboratory (including one semester each of human anatomy and human physiology), two years of chemistry with laboratory (including one year of organic chemistry), one year of physics with laboratory, one year of calculus for pre-medical/life sciences, and one year of English with one semester of expository writing. Students who have not completed a degree in a science or satisfied the aforementioned science requirements will not be considered for admission until those requirements are satisfied.

Students interested in obtaining admission to the program should present an above-average undergraduate GPA and complete the Medical College Admission Test (MCAT). International applicant admission requirements also include TOEFL (Test of English as a Foreign Language) and Education Credential Evaluation Report for foreign transcripts. Students will be selected by an intrafaculty committee that will review academic credentials, test scores and previous clinical experience; assess work or non-academic experiences/expertise; and conduct personal interviews.

The program is six semesters (24 months), beginning in June and coinciding with the university calendar for graduate studies. The first three semesters include clinical instruction coupled with basic science and clinical didactic course work. During the remaining semesters, students complete one-month clinical rotations in all subspecialties of anesthesiology. The course of study consists of 57 graduate credit hours.

The program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAAEP). Graduates may practice as anesthesiologist assistants and are qualified to take the National Certification Examination for Anesthesiologist Assistants sponsored by the National Commission for Certification of Anesthesiologist Assistants (NCCAA) and the National Board of Medical Examiners (NBME).

Anesthesiology (ANES)  
Graduate Courses  
ANES 403. Physical Methods for Anesthesiologist Assistants (3)  
Basic concepts in electricity, gas/liquid interfaces, acid/base balance, immunology, hematology, statistics, and computer systems needed for subsequent work. Prereq: Consent of department.

ANES 440. Patient Monitoring and Instrumentation I (2)  
Students are taught the proper balance between circuits and engineering concepts and the clinical application of anesthesia instrumentation. Monitors and devices used in the operating room are studied with respect to principles of operation, calibration, and interpretation of data. A
hands-on laboratory is utilized to maximize direct contact to the instrumen-
tation of the profession. Prereq: Consent of department.

ANES 441. Patient Monitoring and Instrumentation II (3)
Continuation of ANES 440. Prereq: ANES 440.

ANES 456. Applied Physiology for Anesthesiologist Assistants I (3)
Basic and applied human systems physiology with emphasis on topics
and areas of special concern to the anesthetist. Prereq: Consent of de-
partment.

ANES 458. Applied Physiology for Anesthesiologist Assistants II
(3)
Continuation of ANES 456. Prereq: ANES 403 and ANES 456.

ANES 460. Introduction to Anesthesia (2)
Introduction to basic concepts dealing with clinical anesthesia. Medical
terminology, human anatomy, medical chart interpretation and drug dos-
age calculations. Prereq: Consent of department.

ANES 461. Orientation to Clinical Experience (3)
Introduction to experience in the operating room with emphasis on the
fundamental procedures and techniques used in administering an anes-
thetic. Preoperative assessment, IV placement techniques, airway man-
agement, intraoperative patient care and postoperative management are
all emphasized in this course. Prereq: Acceptance in the M.S.A. program.

ANES 462. Anesthesia Clinical Correlation I (1)
A series of conferences presented by students that applies to anesthetic
theory as it relates to the clinical experience. Specific anesthetic situa-
tions are emphasized. Prereq: ANES 460.

ANES 463. Anesthesia Clinical Experience I (3)
A continuation of the preparation, observation and hands-on learning for-
mat initiated in ANES 461. Patient management and technical skills are re-
fining with close attention to the didactic course work. A comprehensive
clinical examination is administered at the end of the semester. BLS (Ba-
sic Life Support) certification is required for course completion. Prereq:
ANES 461.

ANES 464. Anesthesia Clinical Correlation II (1)
A spectrum of case presentation conferences presented by the students
dealing with basic and major problems in anesthesia management. Medi-
cal and surgical history of individual patients and the outcomes of anes-
thesia and surgery are emphasized. Journal Club and Morbidity and Mor-
tality conferences are included. Prereq: ANES 462.

ANES 465. Anesthesia Clinical Experience II (3)
A continuation of ANES 463. A comprehensive clinical examination is ad-
ministered at the end of the semester. PALS (Pediatric Advanced Life Sup-
sport) and ACLS (Advanced Cardiac Life Support) certification is required
for course completion. Prereq: ANES 463 and BLS certification.

ANES 467. Anesthesia Clinical Experience III (4)
Extended exposure to all of the clinical subspecialties of anesthesiology
(obstetrics, pediatrics, neurosurgery, cardiovascular, etc.). Students alter-
nate through rotations at several area hospitals. Prereq: ANES 465 and
ACLS certification.

ANES 468. Anesthesia Clinical Correlation III (1)
The second-year equivalent of ANES 462. Prereq: ANES 464.

ANES 469. Anesthesia Clinical Experience IV (8)
A continuation of ANES 467. A comprehensive clinical examination is ad-
ministered at the end of the semester. Prereq: ANES 467.

ANES 470. Anesthesia Clinical Correlation IV (1)
The second-year equivalent of ANES 464. Prereq: ANES 468.

ANES 471. Anesthesia Clinical Experience V (8)
A continuation of ANES 469. A comprehensive clinical examination is ad-
ministered at the end of the semester. Prereq: ANES 469.

ANES 475. Pharmacology for Anesthesiologist Assistants (2)
Pharmacodynamics, pharmacokinetics, uptake, distribution and action of
the volatile and intravenous anesthetics, muscle relaxants, narcotics,
hypnotics and other pharmaceuticals used in the administration of an
esthetic. Prereq: Consent of department.

ANES 477. Electrocardiography for Anesthesiologist Assistants (2)
Diagnosis and practical applications of electrocardiography and
echocardiography as monitoring techniques in the operating room.
Prereq: Consent of department.

ANES 480. Fundamentals of Anesthetic Sciences I (1)
A continuum of courses over the fall and spring semesters that covers a
series of topics in basic medical science with special emphasis on the ef-
fect of anesthetics on normal physiology. An examination is administered
at the end of each semester. Prereq: Consent of department.

ANES 499. Clinical Remediation (1-10)
(Credit as arranged.) Course offered to the student one time during the
program of study which remediates “C” or below work in a clinical
course. Prereq: Consent of department.

ANES 580. Fundamentals of Anesthetic Sciences II (1)
The second-year equivalent of ANES 480. An examination is administered
at the end of each semester. Prereq: ANES 480.

ANES 599. Clinical Remediation (1-10)
(Credit as arranged.) Course offered to the student one time during the
program of study which remediates “C” or below work in a clinical
course. Prereq: Consent of department.

ANES 651. Thesis (M.S.) (1-9)

Department of Biochemistry
Room W-427 School of Medicine
Phone 216-368-3344
Fax 216-368-3419
Michael Weiss, M.D., Ph.D., Chair
http://www.cwru.edu/med/biochemistry/

Biochemistry is the study of the molecular basis of cellular
function, making it a central discipline in the biological sciences.
Biochemists ask the question, “How do life processes work on the
molecular level?”

The Department of Biochemistry offers undergraduate programs
leading to the bachelor of arts degree and bachelor of science
degree in biochemistry and graduate programs leading to the
master of science, doctor of philosophy, and combined doctor of
medicine/doctor of philosophy. Many interdisciplinary and
interdepartmental programs available with other departments in
the School of Medicine and at Case Western Reserve University
provide many additional avenues of study.

Research interests within the department include a broad
spectrum of modern biochemical topics in six broad areas:
enzymology, protein chemistry, structural biology, gene expres-
sion, cell biology, and molecular medicine/gene therapy. These
areas are described in detail later in this section. The department
has state-of-the-art equipment and facilities for research in modern
biochemistry. More complete information about the undergradu-
ate and graduate programs may be obtained by contacting the
departmental office.

Undergraduate Programs
Please see the College of Arts and Sciences section of this
publication.

Graduate Programs
Master’s Degrees
The master’s of science degree programs provide advanced
training for students who wish to continue beyond the B.A. or B.S.
degree without committing themselves to the Ph.D. curriculum.
Two lines of study are offered: the three-year research program
leading to the master’s of science in biochemical research and the
two-year course work program leading to the master’s of science
in biochemistry.

Master’s of Science Degree in Biochemical Research
The program leading to the M.S. degree in biochemical research
is uniquely designed to provide interested students with sufficient
background and laboratory experience to enable them to function
as senior research assistants and eventually as laboratory supervi-
sors in university departments, research institutes or industrial
Students in this three-year program receive a stipend, and tuition costs are covered by the department. The student pursues a flexible and individually designed schedule related to his or her research career and interests, which leads to an independent research project in the second and third years of the program. The program simultaneously develops background knowledge and technical skills in modern biochemistry, which can be applied to several career opportunities. A more complete description of the program, admission policies and financial aid is available from the departmental office.

**Master’s of Science Degree in Biochemistry**

The program leading to the M.S. degree in biochemistry is designed to provide students with knowledge of the latest advancements in biochemistry and related fields. It is intended for students who desire to pursue a career not directly involved with research, such as teaching, or various administrative positions in the pharmaceutical industry. The student typically enrolls in three courses for each of four semesters. Required courses are BIOC 407 (General Biochemistry) and BIOC 408 (Molecular Biology). Other lecture courses are selected by the student in consultation with an academic advisor who is assigned to the student upon matriculation into the program. A more complete description of the program and admission policies is available from the departmental office.

**Ph.D. in Biochemistry**

The aim of the Ph.D. in biochemistry program is to prepare students for careers in teaching and research in biochemistry. The emphasis of the doctoral program is on research culminating in the completion of an original independent research project under the guidance of a faculty member in the biochemistry program. The research areas in the department are described later in this section.

In addition to the research activities, graduate students participate in formal courses both within and outside the department, formal and informal seminars, and discussions of current literature. Schedules are flexible and are individually tailored to each student’s needs. Although students choose from the various tracks within the department, they are broadly trained in modern aspects of biochemistry and become familiar with techniques and literature in a variety of areas. Many collaborative projects with other departments are also available to broaden the spectrum of training offered. Most students select a multidisciplinary, integrated curriculum in cellular and molecular biology in addition to specialized courses in biochemistry.

Most Ph.D. students in biochemistry are admitted through the Biomedical Sciences Training Program (BSTP). This program, which combines 13 graduate programs in the School of Medicine, is described under a separate listing in this publication. A complete description of the program, including research activities, admission policies and financial aid, may be obtained from the departmental office or the BSTP coordinator.

**Integrated Graduate Program in Biochemistry**

Undergraduate biochemistry majors in the College of Arts and Sciences are eligible to apply for an Integrated Graduate Program in Biochemistry. This program allows Case Western Reserve biochemistry majors to enter graduate school at the end of the junior year and to obtain the B.A. degree while completing the first year of graduate school at the University. The first year of course work in graduate school substitutes for the last year of undergraduate course work. The admitted student takes the same course work and chooses a thesis advisor from among the faculty in the same fashion as do other Ph.D. students. The program is highly competitive, and only one or two outstanding graduates may be selected in any year.

**Biochemistry Medical Scientist Training Program**

Students may pursue a Ph.D. in biochemistry as part of the combined M.D./Ph.D. program. Information on this program may be obtained from the departmental office or the Medical Scientist Training Program coordinator. Please see the separate listing in this publication for information on the MSTP program.

**Research Areas**

Research of Department of Biochemistry faculty members covers a broad spectrum of topics from events at the level of electron movement in biochemical reactions to the intracellular trafficking of proteins. Research in the department is broadened by collaborations with faculty in other University departments and with scientists at other Cleveland research institutions. The specific areas of active research within the department are outlined below.

**Enzymology**

Research in this area studies the detailed functions of proteins and RNAs as biological catalysts. Specific areas of research include RNA helicases, RNA polymerase, enzymes of fatty acid synthesis, RNA splicing, processing of peptide hormone precursors, and enzymes of intermediary metabolism.

**Protein Chemistry**

Research in this area combines chemical, biochemical and molecular biological approaches to define critical structural and functional regions of proteins. A major focus is the posttranslational modification of proteins, including glycosylation, proteolysis, phosphorylation, methylation, and oxidation. Proteins being studied are involved in the initiation of protein translation, RNA transcription, signaling by hormones and neurotransmitters, and intermediary metabolism.

**Structural Biology**

Three dimensional structures of proteins and nucleic acids are required to understand the detailed function of these complex molecular systems. Techniques include x-ray crystallography, as well as NMR and Raman spectroscopy. Areas of research include hormones, neurotransmitters and their receptors, bacterial toxins, dehydrogenases, and transcription factors.

**Gene Expression**

Control of development and tissue-specific responses necessary for the survival of multicellular organisms is accomplished by several mechanisms that regulate gene expression. Research in the department is concerned with hormonal and developmental control of gene transcription, pre-mRNA splicing, initiation of protein synthesis, post-translational modifications of proteins.

**Cell Biology**

The control of the metabolism, differentiation and cell signaling within and between cells is a key part of understanding the interplay necessary for the growth and metabolic regulation of multicellular organisms. Research in the department is focused on protein traffic, inflammatory responses, G-protein coupled receptors, transforming growth factors, enzyme regulation in metabolism, and the control of respiration.

**Molecular Medicine/Gene Therapy**

Many human diseases are caused by defects in specific proteins caused by mutations. Delivery of normal DNA replacements to cells harboring defective genes is the goal of research in the department. Other efforts are aimed at understanding the structure and function of biochemical targets of therapeutic agents, which in turn may lead to the rational design of new drugs and treatments. Research in the department is targeted at cancer, diabetes and schizophrenia. Other work is developing transgenic mice as models of human diseases.
Biochemistry (BIOC)

Undergraduate Courses

BIOC 407. General Biochemistry (4)
Overview of the macromolecules and small molecules key to all living systems. Topics include: protein structure and function; enzyme mechanisms; kinetics and regulation; membrane structure and function; bioenergetics; hormone action; intermediary metabolism, including pathways and regulation of carbohydrate, lipid, amino acid, and nucleotide biosynthesis and breakdown. One semester of biology is recommended. Prereq: CHEM 223 or CHEM 224. Cross-listed as BIOL 407.

BIOC 408. Molecular Biology: Genes and Genetic Engineering (4)
(See BIOL 408.) Cross-listed as BIOL 408.

BIOC 409. Biochemistry of G-Protein Coupled Receptors (3)
G-protein coupled receptors (GPCRs) represent a large multi-gene family of proteins which are essential for the actions of a large number of pharmaceuticals. Participants in this course will gain a detailed understanding of the structure and function of GPCRs. Particular emphasis will be placed on gaining a working knowledge of the quantitative aspects of GPCR biochemistry and pharmacology. In particular, mathematical modeling techniques for understanding receptor binding and activation will be emphasized. Additionally, participants will become familiar with most major technologies currently used to study GPCRs. Prereq: CBIO 455, CBIO 454, CBIO 455, and CBIO 456.

BIOC 412. Macromolecular Structure and Function (3)
Interactions between biomolecules are discussed in a system-based approach that stresses quantitative and structural characterization. Topics discussed include site-directed mutagenesis of enzymes, DNA-protein and protein-protein interactions. Prereq: BIOC 307 and CHEM 301 and CHEM 302.

BIOC 420. Molecular Genetics of Cancer (3)
Using a combination of lectures and student presentations, this course provides an in-depth analysis of cancer as a genetic disease in the Mendelian sense of inheritance and in the sense of causation by somatic mutation. The objectives of the course are to examine both the proto-oncogenes and tumor suppressor genes that are the targets of oncogenic mechanisms and the mechanisms of mutational change. Discussions emphasize experimental approaches used to identify oncogenes and tumor suppressor genes. This course also covers viral mechanisms of oncogenesis which involve interactions between viral proteins and the products of cellular proto-oncogenes or tumor suppressor genes. Prereq: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456. Cross-listed as MBIO 420 and MVIR 420.

BIOC 430. Advanced Methods in Structural Biology I (3)
Provides students with an in-depth introduction to biophysical techniques used to quantify macromolecular structures. A major part of the course will deal with the use of nuclear magnetic resonance to derive a 3-D structures of macromolecules in solution. Other topics include electron spin resonance, absorption, fluorescence and circular dichroism spectroscopies, Raman and infrared spectroscopies and methods used in modeling. Offered with BIOC 431, “Advanced Methods Biology II” in alternate years. BIOC 430 deals with protein hydrodynamics and thermodynamics, crystallography, and mass spectrometry. The course will be mostly lecture based. This course will provide an extensive overview for graduate students specializing in structural biology. Cross-listed as CHEM 430 and PHRM 430.

BIOC 431. Advanced Methods in Structural Biology II (3)
This course provides an introduction to biophysical techniques for graduate students who are interested in structural biology and biophysical chemistry. Offered with BIOC 430, “Advanced Structural Biology I” in alternate years. Advanced Methods I (430) focuses on NMR and optical spectroscopies. Advanced Methods II deals with protein hydrodynamics and thermodynamics, crystallography, and mass spectrometry.

BIOC 434. Structural Biology of Proteins, Enzymes, and Nucleic Acids (3)
(See BIOL 434.) Cross-listed as BIOL 434.

BIOC 446. Host-Virus Interactions (3)
(See MVIR 446.) Cross-listed as MVIR 446.

BIOC 452. Nutritional Biochemistry and Metabolism (3)
Mechanisms of regulation of pathways of intermediary metabolism; amplification of biochemical signals; substrate cycling and use of radioactive and stable isotopes to measure metabolic rates. Prereq: BIOC 307 or equivalent. Cross-listed as NTRN 452.

BIOC 486. Protein Structure, Folding and Design (3)
Reading in the current literature with computer program and model building workshops. Prereq: BIOC 407.

BIOC 515. Endocrine Pharmacology (3)
(See PHRM 515.) Prereq: Consent of instructor. Cross-listed as PHRM 515.

BIOC 521. Chromatin Structure and Transcription (3)
(See GENE 521.) Cross-listed as GENE 521.

BIOC 523. Advanced NMR Spectroscopy in Structural Biology (3)
(See PHOL 523.) Cross-listed as PHOL 523.

BIOC 601. Biochemical Research (1-18)
(Credit as arranged.) Prereq: BIOC 407.

BIOC 605. Independent Project in Biochemical Research (1-18)
(Credit as arranged.) Limited to students in the M.S. program in biochemical research. Prereq: BIOC 407 and BIOC 601.

BIOC 611. Biochemistry Seminar I (1)
Discussion of current research. Prereq: BIOC 407.

BIOC 612. Biochemistry Seminar II (1)
Discussion of current research. Prereq: BIOC 407.

BIOC 617. Special Topics in Biochemistry (2)
Special topics courses on areas of current interest in biochemistry. Prereq: BIOC 407.

BIOC 618. Special Topics in Biochemistry (2)
Special topics courses on areas of current interest in biochemistry. Prereq: BIOC 407.

BIOC 641. Proposition I (2)
Design of research proposal. Prereq: BIOC 407.

BIOC 643. Proposition II (2)
Design of research proposal. Prereq: BIOC 407.

BIOC 651. Thesis M.S. (1-6)
(Credit as arranged.)

BIOC 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

BIOC 702. Appointed Dissertation Fellow (9)

Department of Bioethics
Room TA-200 School of Medicine
Phone 216-368-6196
http://www.cwru.edu/med/bioethics/bioethics.html
Stuart J. Youngner, M.D., Susan E. Watson Professor of Biomedical Ethics and Director

The Department of Bioethics provides a forum for the study and discussion of ethical issues in medicine. Its mission is to improve public and professional understanding of the ethical issues involved in health sciences research, health care delivery, and health policy development through teaching, research and community dialogue.

The department has offices at the University’s School of Medicine and at MetroHealth Medical Center and has faculty from several disciplines, including philosophy, religion, law, political science, anthropology, nursing and medicine.

Department faculty teach in both core and elective components of the medical school curriculum, undergraduate courses in ethics, and an intensive course in ethics of scientific work for Ph.D.
students in the Biomedical Sciences Training Program. The department also has a highly successful master’s degree program in bioethics.

Department faculty have gained international prominence for research in many areas of biomedical ethics that collectively address the concerns of the School of Medicine’s spectrum of biomedical disciplines.

The Department of Bioethics publishes two newsletters, CenterViews and MetroEthics. CenterViews contains information and articles on a variety of ethical issues of interest to both professional and lay communities. It is published three times a year and features faculty research and activities, center events, and master’s degree alumni information.

The department has a Website where visitors can read CenterViews online, obtain information about the master’s degree program, and learn about department and faculty activities: http://www.cwru.edu/med/bioethics/bioethics.html.

Master of Arts Degree in Bioethics

The Department of Bioethics offers a program leading to the master of arts degree in bioethics, emphasizing the interdisciplinary and interprofessional nature of the field. This graduate program is designed to provide advanced training in bioethics for students and professionals who anticipate encountering ethical issues in the course of their primary careers.

The 27 credit-hour degree can be earned full-time in one year or part-time in up to three years. Core courses are taught by center faculty and are scheduled so that part-time students can continue their professional responsibilities while completing the degree.

The master of arts program provides students with a firm understanding of the intellectual content of the study of bioethics, of bioethical literature, and of the underlying philosophical arguments and empirical assumptions that inform it. Students are taught to understand the institutions and structures of health care and the ethical issues that arise in medical practice. They are trained to identify and analyze a range of clinical ethics issues.

All students pursuing a master of arts degree in bioethics are required to complete the interdisciplinary core of 12 credit hours (the equivalent of four courses) in the first two semesters of their first year of study.

The courses, BETH 401: Foundations in Bioethics I, and BETH 402: Foundations in Bioethics II, each six credits, examine 10 basic topic areas in bioethics, including death and dying, the therapeutic relationship, method and theory in bioethics, organ transplantation, health care justice, defining health care needs, reproduction and fertility, families, babies and children, research ethics and genetics. Classes meet two evenings per week for seminar sessions (two hours per session).

Another required course is BETH 405: Clinical Ethics Rotation (three credits). This course requires a minimum of 10 hours of clinical experience per week during two 10-week rotations. Although there are some didactic and seminar sessions, students spend most of their time observing rounds in relevant services (intensive care units, pediatrics, genetics, etc.) with leading clinicians at several area hospital sites. Students must complete rotations at two sites. At the conclusion of each rotation, students are familiar with the clinical, psychological, social, professional, and institutional contexts in which ethical problems arise. Also, they are able to identify, analyze and understand ethical issues as they develop.

In addition, all students must complete 12 credit hours of electives. Electives are selected in consultation with a faculty advisor. Electives must enhance the student’s understanding of bioethical issues and must be relevant to the student’s academic goals.

The department currently offers dual degree programs with the School of Medicine (M.D./M.A.), the School of Medicine’s Department of Genetics (Ph.D./M.A.), the School of Law (J.D./M.A.), and the Frances Payne Bolton School of Nursing (M.S.N./M.A.) and the Weatherhead School of Management (M.B.A./M.A.) at the University. Students must apply and be accepted to each program to qualify.

Admission policies conform to those of the University’s School of Graduate Studies. In general, an applicant for admission and concurrent financial consideration must have completed application forms on file by March 1 for the fall semester.

For more information, contact:
Coordinator for Graduate Programs
Department of Bioethics
School of Medicine
10900 Euclid Ave.
Cleveland OH 44106-4976
Phone: (216) 368-8718
E-mail: xx245@po.cwru.edu

Bioethics (BETH)

Undergraduate Course

BETH 271. Bioethics: Dilemmas in Research and Clinical Practice (3)
We have the genetic technology to change nature and human nature, but is this the right thing to do? We have the medical technology to extend almost any human life, but is this always good for people? Should we clone human beings? Should we allow doctor-assisted suicide to hasten the deaths of the terminally ill? This course invites students from all academic disciplines and fields to begin thinking now about current and likely future issues in bioethics. These general areas are covered: theory and method in bioethics, death and dying, organ transplantation, genetics, research, neonatology, aging and dementia, fertility and reproduction, distributive justice in health care access, and concepts of health and disease. In addition to classroom learning with Center for Biomedical Ethics faculty well known nationally for their contributions in all of these general areas, students will benefit from visits to clinical settings under the guidance of the Center’s experienced clinical ethicists. Cross-listed as PHIL 271 and RLGN 271.

Graduate Courses

BETH 401. Foundations in Bioethics I (6)
The first of the two required seminar courses, this course covers five basic topic areas in bioethics: death and dying; health professional-patient relationship; method and theory in bioethics; organ transplantation; and ethics and children. The course meets twice weekly and is taught in seminar format by Center faculty members who are experts on specific topics. Preentry.

BETH 402. Foundations in Bioethics II (6)
This course completes the required seminar core and covers the basic bioethics topic areas: health care justice; defining ‘health care needs;’ reproduction and fertility ethics; research ethics; and ethics in genetics. The course meets twice weekly and is taught in seminar format by Center faculty members who are experts on specific topics. Preentry.

BETH 405. Clinical Ethics Rotation (1.5-3)
In this course students will become familiar with the clinical, psychological, social, professional and institutional context in which ethical problems arise. This course exposes students to clinical cases, to hospital ethics committees and ethics consultation programs, to institutional review boards (IRB), and to hospital policies covering the “do not resuscitate” orders (DNR), advance directives, withdrawal of artificial feeding, organ procurement and transplantation, and medical futility. Requires minimum of 10 total hours of rotation experience per week during two semester 10-week rotations. Locations for this course include: MetroHealth Medical Center, University Hospitals of Cleveland, and the Hospice of the Western Reserve. Prereq: BETH 401 or concurrent enrollment.
Beth 452. Models of Mind, Mental Disorders, and Bioethics (3)
Discussions of basic theories in the philosophy of mind with analysis and application of these theories to issues raised by real mental disorders and case studies in psychiatry. Emphasis on the interaction between philosophical understandings of the mind and society, with examples from psychiatric writings and general literature on the philosophy of mind. Advance reading is necessary. Classes include a combination of lecture presentation, student presentations from pre-reading, and discussion around key questions.

Beth 463. Anthropology and Bioethics (3)
This course will review theoretical work on anthropology and values, the discipline of bioethics, its philosophical roots, the body of anthropological work in bioethics, and critically examine a number of current bioethical issues in the United States and internationally. Cross-listed as Anth 463.

Beth 501. Advanced Seminar in Bioethics (3)
Special topics of interest, such as advanced studies in theory and method in bioethics, ethics and reproduction, the ethics of research with human subjects, religion and medicine, historical perspectives on medical ethics, cross-cultural issues in bioethics, or ethics in applied settings such as hospitals and long term care facilities. Seminar typically taught by visiting professor in intensive format. Consult the term roster of courses for the specific topic. Prereq: Beth 401 or concurrent enrollment.

Beth 602. Special Topics in Bioethics (1-3)
Students will explore particular issues and themes in biomedical ethics in depth through independent study and research under the direction of a faculty member. Prereq: Consent of instructor.

Biomedical Sciences Training Program
Room W-G46 School of Medicine
Phone 216-368-3347
E-mail: bstp@po.cwru.edu
Website: www.cwru.edu/med/BSTP; Applications may be submitted online at this site.

The Biomedical Sciences Training Program (BSTP) offers graduate studies leading to the Ph.D. degree. The program is designed to prepare qualified and motivated students for careers in research and teaching.

The BSTP is comprised of 14 graduate programs in the School of Medicine and the College of Arts and Sciences. These programs have more than 200 faculty, based in both basic science and clinical departments. The research of this faculty covers the entire range of biomedical research. Students in the BSTP have the opportunity to study within any research discipline represented in the training programs. This opportunity gives students a tremendous range of research choices. It also provides a distinct advantage over traditional programs, which restrict choices of research area and faculty advisors.

The First Year
Course work
Students take an integrated series of courses in cell and molecular biology (CBIO 453, 454, 455 and 456). This year-long series emphasizes the molecular approach that forms the basis of modern biology. Qualified students also may take more specialized elective courses.

Research rotations
The research rotations allow the student to sample areas of research and become familiar with faculty members and their laboratories. The main purpose of these rotations is to aid the student in selecting a laboratory for the thesis work. Students are encouraged to begin their rotations in July. Doing so gives them the opportunity to complete one rotation during the summer before classes begin at the end of August. A minimum of three rotations must be completed during the year.

Choosing a thesis advisor
In February of the first year, students select an advisor for the dissertation research. Each student also joins the training program with which the advisor is affiliated. Once a student has chosen a program, the specific requirements of that program are followed to obtain the Ph.D. The emphasis of the Ph.D. work is on research, culminating in the completion of an original, independent research thesis.

Participating Training Programs

Anatomy
Biochemistry
Biology
Cell biology
Developmental and Human Genetics
Developmental Biology
Environmental Health Sciences
Molecular Biology
Molecular and Cellular Basis of Disease
Molecular Virology
Neuroscience and Bioengineering
Neurosciences
Nutritional Sciences
Pharmacological Sciences

Training faculty, course offerings and individual degree requirements are described in detail in the separate listings for each of these programs.

Biomedical Scientist Training Program (BSTP)

Graduate Course

BSTP 400. Research Rotation in Biomedical Sciences Training Program (0-6)
Prereq: Consent of BSTP program coordinator.

Cell Biology Program

115 Pathology Building
Phone 216-368-5544
E-mail: amt10@po.cwru.edu

The Cell Biology Program provides educational and research opportunities through its journal clubs and colloquia and through graduate training toward the Ph.D. degree. The research environment includes all the basic science departments of the School of Medicine, the Department of Biology, and several laboratories at University Hospitals of Cleveland and the Cleveland Clinic Foundation. These departments collectively cover a diverse set of areas of contemporary interest in the cell biology of higher animals, plants, yeast and other microorganisms. These include the extracellular matrix, secretion and endocytosis, cell adhesion, the cytoskeleton, the nuclear envelope, and others. Many of these areas interface with local research in biochemistry, genetics, immunology, molecular biology, neuroscience, pharmacological sciences, and physiology and biophysics.

First-year graduate students follow the Correlated Curriculum in Cell and Molecular Biology (CBIO 453-456, 12 credit hours) along with students from all graduate departments. They also complete three laboratory rotations (starting July 1) among the laboratories of training faculty, which span the entire campus. The goal of the rotations is to guarantee that the student has sufficient breadth of familiarity with cell biology faculty to allow him or her to make the best choice of a permanent research laboratory. In all cases, this selection must be made, with the consent of the sponsor and his or her department, before nine months have elapsed. First-year
students also actively participate in the weekly Cell Biology Journal Club and attend the cell biology colloquia. During the subsequent years, students devote most of their time to laboratory research, while also attending courses, seminars and journal clubs. The courses may be given by any department or program on campus. Students must take a total of 36 credit hours of courses and maintain a B average. Preparation for the qualifying exam and the writing of research proposals and the dissertation match the norm of the department in which the student elects to do his or her thesis work; however, the content of the exams and proposal(s) must have a clear emphasis on cell biology itself.

All efforts should be made to complete the Ph.D. within four years. It is expected that the student will be the first author on at least two articles accepted for publication in highly regarded scientific journals.

Participating Faculty

Courses in Cell Biology

Required (first year)

CBIO 453-456. Correlated Curriculum in Cell and Molecular Biology (12 credits)
Representative Electives
BIOC 408 Molecular Biology: Genes and Genetic Engineering (4)
PHRM 413 Molecular Pharmacology (3)
PATH 444 Neurodegenerative Diseases: Pathological, Cellular and Molecular Perspective (3)
NEUR 473 Introduction to Neurobiology (3)
PATH 477 Cellular and Molecular Basis of Immune Dysfunction (3)
PATH 481 Immunology of Infectious Diseases (3)
GENE 500 Advanced Eukaryotic Genetics (3)
GENE 510 Human Genetics (3)
GENE 520 Gene Expression in Replication and Differentiation (3)
CLBY/PATH 527 Mechanisms of Cell Growth Control (3)
CLBY 701 Dissertation (credit as arranged)

Cellular Biology (CLBY)

Graduate Courses

CLBY 416. Fundamental Immunology (3)
CLBY 416. Fundamental Immunology (3)
(See PATH 416.) Cross-listed as CBIO 416.
CLBY 417. Cytokines: Function, Structure and Signaling (3)
(See PATH 417.) Cross-listed as BIOL 417 and PATH 417.
CLBY 466. Cell Signaling (3)
(See PHOL 466.) Cross-listed as PHOL 466.
CLBY 468A. Membrane Physiology II (3)
(See PHOL 468A.) Cross-listed as PHOL 468A.
CLBY 487. Cell Biology of the Nucleus (3)
(See PATH 487.) Prereq: CBIO 453 and CBIO 454 or consent of instructor.
Cross-listed as PATH 487.
CLBY 488. Yeast Genetics and Cell Biology (3)
(See MBIO 488.) Cross-listed as MBIO 488.
CLBY 501. Genetic Control of Development (3)
CLBY 518. Cell Surfaces and Matrices (3)
Lecture and discussion course emphasizing current advances in cell-cell and cell-substrate interactions. Cross-listed as NEUR 518.

CLBY 519. Molecular Biology of RNA (3)
(See MBIO 519.) Cross-listed as MBIO 519.
CLBY 525. Transport and Targeting of Macromolecules in Health and Disease (3)
(See PATH 525.) Cross-listed as PATH 525.
CLBY 601. Special Problems (1-18)
This is the listing for independent research. Students should enroll in this course once they have selected their laboratory for Ph.D. research. The number of credit hours depends on how many didactic courses they are following at the same time. Once they have passed their qualifying examination they should register for CLBY 701.
CLBY 701. Dissertation Ph.D. (1-18)
This is the listing for independent research toward the Ph.D. The number of credit hours depends on how many didactic courses students are following at the same time. Students may register for this course only once they have passed their qualifying examination.
CLBY 702. Appointed Dissertation Fellow (9)

Cellular and Molecular Biology (CBIO)

Graduate Courses

CBIO 453. Cell Biology I (3)
Part of the first semester curriculum for first-year graduate students along with CBIO 455. Topics include: genetics, from classical genetics to genomics; and cell biology—an introduction to cellular organelles and structures in both eukaryotic and prokaryotic cells. Prereq: BIOC 307 or BIOC 407.

CBIO 454. Cell Biology II (3)
Part of the curriculum for first-year graduate students. The course is divided into minicourse units covering a wide range of topics, including: Molecular Therapeutics, Neurodegenerative Diseases, Nutrition, Cell Cycle and Cancer, Tissues; Protein Structure and Function; Immunology; RNA Structure and Function; and Signal Transduction. Students choose three of these units. Taught with CBIO 456. Prereq: CBIO 453 or CBIO 455.

CBIO 455. Molecular Biology I (3)
Part of the first semester curriculum for first-year graduate students along with CBIO 455. Topics include: the replication of DNA, transcription of RNA and its regulation, mechanism of protein synthesis, and the regulation of gene expression in growth and development. Prereq: BIOC 307 or BIOC 407.

CBIO 456. Molecular Biology II (3)
Part of the curriculum for first-year graduate students. The course is divided into minicourse units covering a wide range of topics, including: Molecular Therapeutics, Neurodegenerative Diseases, Nutrition, Cell Cycle and Cancer, Tissues; Protein Structure and Function; Immunology; RNA Structure and Function; and Signal Transduction. Students choose three of these units. Taught with CBIO 454. Prereq: CBIO 453 or CBIO 455.

Department of Emergency Medicine

Phone 216-778-3577
Charles L. Emerman, M.D.
Chair - MetroHealth Medical Center
The MetroHealth Medical Center Department of Emergency Medicine provides a full range of bedside supervision of patient care 24 hours each day to emergency medicine residents, resident physicians from related disciplines, and to medical students. The emergency department accounts for about 40 percent of the hospital’s admissions. The department treats about 70,000 patients annually, one-third of whom are aged 19 or fewer years. It is equipped to manage all levels of acute and sub-acute care. A trauma operating suite is adjacent to the emergency department and is available at all times. Around-the-clock laboratory support is also available within the department.
The emergency medicine education program at the Case Western Reserve University School of Medicine has been designed to provide students with basic skills as well as support and career counseling for students interested in pursuing careers in emergency medicine. Emergency medicine residents work with medical students at all four medical school grade levels, especially those students who elect an emergency medicine area of concentration, which MetroHealth Medical Center faculty have directed since its inception in 1988.

Courses offered include the Introduction to Emergency Medicine/Critical Care/Trauma elective, Principles of Emergency Medicine, and a clinical elective in emergency medicine.

MetroHealth Medical Center emergency department faculty also sponsor the Emergency Medicine Interest Group of Case Western Reserve medical students.

Department of Environmental Health Sciences

Room W-G19 School of Medicine
Phone 216-368-5961
http://mediswww.meds.cwru.edu/dept/evhs/evhs.htm

The Department of Environmental Health Sciences is devoted to the study of the fundamental mechanisms responsible for disease processes initiated or aggravated by environmental agents. Indoor and outdoor environments consist of complex interacting systems. These systems require the development of new approaches to understanding the basis of their action. This realization was the impetus for the creation of the department. Current research interests of the faculty include chemical and environmental carcinogenesis, genetic and reproductive toxicology, cytogenetics, radiation biology, and clinical and forensic toxicology.

The Department of Environmental Health Sciences participates in the integrated Biological Sciences Training Program (BSTP) and offers M.S. and Ph.D. degrees. In addition to participating in the flexible program and offering research opportunities to medical students, the department sponsors an M.D./M.S. program that allows students to complete the requirements for both degrees within a four-year period.

Graduate Programs

The master of science and doctor of philosophy degree programs are designed to increase the student’s knowledge of environmental health science as well as to provide a firm foundation in the life sciences. The programs are multidisciplinary and emphasize cancer biology, environmental toxicology, and nutrition and toxicology. They are based on a core classroom curriculum in the biological sciences, including biochemistry, biostatistics, microbiology, genetics, molecular biology, pharmacology, epidemiology and toxicology.

Current areas of research of the participating faculty include genetic toxicology, xenobiotic metabolism, cytogenetics, radiation biology, DNA damage and repair, radical mechanisms in carcinogen metabolism, approaches to the study of structure, activity relationships, and clinical and forensic toxicology.

Master’s Degree Programs

The department also offers a doctor of medicine/master of science program for students who have received formal acceptance to the School of Medicine and are interested in expanding their training in the area of environmental health sciences.

Thesis (Plan A) and non-thesis (Plan B) master of science degree programs are offered to students who have completed an undergraduate degree program from an accredited university or college. Course schedules are arranged to accommodate individuals who wish to enroll on a part-time basis. Both programs require a total of 27 semester hours at the 400 level or higher. A minimum of 27 semester hours of formal course work is required for the non-thesis degree, and a minimum of 18 semester hours is required for the thesis degree. The remaining credits may be research credits (EVHS 651). Students enrolled in the non-thesis program must pass a comprehensive examination before being awarded the degree. The requirements for the master’s program must be completed within five consecutive calendar years after matriculation.

Ph.D. Program

Admission to the doctoral degree program may follow successful completion of the undergraduate degree or master’s degree program. A minimum of 36 semester hours of graduate study is required for students entering with an undergraduate degree, and 18 semester hours typically are required for students who have completed an M.S. degree program. A proposal-type examination is required before admission to candidacy. Award of the Ph.D. degree is dependent on successful completion of an original, independent research project under the guidance of a faculty advisor as well as the submission and defense of a written dissertation. There is no foreign language requirement.

Financial support is available for Ph.D. candidates and for a limited number of full-time master’s degree candidates.

Facilities and Equipment

Research laboratories and instrumentation are located in the medical school and affiliated hospitals. These include laboratories for general preparation, metabolic studies and restricted-access toxicology cell culture and biohazard facilities. Supporting these laboratories are specialized rooms for instrumentation, the weighing of toxic substances, constant temperature studies and low temperature storage.

Equipment includes centrifuges, liquid scintillation counters, chromatographic equipment (HPLC), spectrophotometers, spectrofluorometers, incubators, freezers and microscopes. Also, the department has a dedicated DEC VAX-I 1/750 computer, and microcomputers and modem-equipped terminals are housed within the department and at special terminal sites.

Environmental Health Sciences (EVHS)

Graduate Courses

EVHS 401A. Fundamentals of Environmental Health Sciences: Biochemical Toxicology (1.5)

This core course details the fundamentals of biochemical toxicology. Specific topics include oxidations reductive reactions. Phase I and II xenobiotic metabolism, and mechanisms of cellular toxicity.

EVHS 401B. Effects of Exposure to Environmental Mutagens (1.5)

This course provides an overview of compounds found in the environment. The toxicity, mutagenicity, carcinogenicity, and teratogenicity of these environmental agents and the potential for human exposure to these agents through environmental, occupational and medicinal routes are discussed. Prereq: EVHS 402A.

EVHS 402A. Fundamentals of Environmental Health Sciences: Risk Assessment (1.5)

This course presents an overview of the scientific approaches used to determine whether environmental agents are potentially dangerous to people. In this course, criteria utilized for establishing exposure limits are presented and short term assays, epidemiology studies and clinical trials are discussed which are used to assess the impact of environmental exposure on normal and genetically susceptible individuals.

EVHS 402B. Fundamentals of Environmental Health Sci: Biochemical Toxicology II (1.5)

This core course focuses on pharmacology. General principles of pharmacology drug transport and absorption, drug metabolism, neuropharma-
The department maintains a scientific computer center comprised of three Sun servers that provide an overall disk storage of 700 gigabytes. The two servers, one on the University campus and one at MetroHealth, are in labs to assist the instructors and research needs of students and faculty.

The main server is an Enterprise 450 with four 300 Mhz processors and 1 Gigabyte of RAM, and the other servers are Sparc 1000. The storage on the enterprise 450 is a raid5 configuration that hosts 240 Gigabytes of disk space. Several national health care and demographic databases are stored on the servers. Other departments in the School of Medicine are encouraged to use the facilities for statistical analyses. Several very large national health care and demographic databases are stored on the servers and are used for faculty and student research and educational projects.

Epidemiology and Biostatistics (EPBI)

Graduate Courses

EPBI 407. Basic Biostatistics for Medical Scientists (1)
A survey course designed to introduce residents and fellows of clinical departments to the terminology, concepts and methods of biostatistics as applied to clinical and basic medical research. Medical examples will illustrate statistical concepts and methods including descriptive statistics and graphical presentation, estimation and hypothesis testing, power and sample size considerations, statistical analysis on continuous and categorical data, parametric and nonparametric methods, regression and correlation and basics of statistical modeling and survival analysis.

EPBI 408. Public Policy and Aging (3)
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Cross-listed as ANTH 498, GER 496, HSTY 480, MPHP 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

EPBI 411. Introduction to Behavioral Medicine (3)
Using a biopsychosocial perspective, an overview of the measurement and modeling of behavioral, social, psychological, and environmental factors related to disease prevention, disease management, and health promotion is provided. Cross-listed as MPHP 411.

EPBI 414. Introduction to Statistical Computing (3)
This course introduces the use of computers in epidemiologic investigations and biostatistical applications. Topics covered include an overview of microcomputer hardware, computer operating systems including Windows 95 and UNIX, the use of the Internet and World Wide Web, and database and spreadsheet concepts, along with instruction in the use of several useful software packages for database management, spreadsheet construction, statistical analysis, and graphics. Primary emphasis is on developing the knowledge and familiarity required for running these particular programs in connection with data collection, analysis, and presentation of results in clinical studies. Students will be required to complete assignments using personal computers and UNIX systems maintained by the department. Knowledge of basic statistics is recommended but is not vital to understanding the material in this course.

EPBI 420. Structured Computer Programming (3)
This course introduces structured computer programming as a discipline beginning with the precise statement of a problem, development and stepwise refinement of an algorithm using pseudo-code, and the final expression of the algorithm in a modern high-level programming language. Emphasis is placed on both the process of algorithm development and the details of the high-level, structured programming language in which the final algorithm is expressed. Students will be required to complete assignments in the C language using personal computers and UNIX systems maintained by the department.

EPBI 431. Statistical Methods I (3)
Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence. Prereq: Two semes-
ors of calculus or consent of instructor. Cross-listed as ANAT 431 and BIOL 431.

EPBI 432. Statistical Methods II (3)

EPBI 433. Community Interventions and Program Evaluation (3)
This course prepares students to design, conduct, and assess community-based health interventions and program evaluation. Topics include assessment of need, evaluator/stakeholder relationship, process vs. outcome-based objectives, data collection, assessment of program objective achievement based on process and impact, cost-benefit analyses, and preparing the evaluation report to stakeholders. Prereq: EPBI 490, EPBI 451, or MPH 405. Cross-listed as MPH 453.

EPBI 434. Genetic Linkage Analysis (3)
This course deals with the basic concepts and applications of nonparametric statistics. Topics will include distribution-free statistics, one sample rank test, the Mann-Whitney and Kruskal Wallis tests, one sample and two sample U-statistics, asymptotic relative efficiency of tests, distribution-free confidence intervals, point estimation and linear rank statistics. Prereq: EPBI 441. Cross-listed as MPH 442.

EPBI 444. Applied Multivariate Analysis (3)
Starts with review of matrix algebra as it pertains to multivariate statistics, then proceeds to study inference about multivariate means: Hotelling’s T^2, Manova, Mancova, growth curves, and other linear models, such as simultaneous confidence interval, and linear discriminant analysis and its relationship to logistic model. Prereq: EPBI 432.

EPBI 447. Sample Survey Design and Analysis (2)
Prereq: EPBI 431 or EPBI 432.

EPBI 448. Theory and Methods of Experimental Design (3)
This course deals with basic problems of experimental design. Topics will include completely randomized and balanced incomplete block designs, parallel groups designs, Youden and Latin squares, repeated measures studies, factorial experiments and designs for bioassays and response surfaces. Prereq: EPBI 432. Cross-listed as STAT 466.

EPBI 450. Clinical Trials and Intervention Studies (3)
Issues in the design, organization, and operation of randomized, controlled clinical trials and intervention studies. Emphasis on long-term multicenter trials. Topics include legal and ethical issues in the design; application of concepts of controls, masking, and randomization; steps required for quality data collection; monitoring for evidence of adverse or beneficial treatment effects; elements of organizational structure; sample size calculations and data analysis procedures; and common mistakes. Cross-listed as MPH 450.

EPBI 451. Principles of Genetic Epidemiology (3)
A survey of the basic principles, concepts and methods of the discipline of genetic epidemiology, which focuses on the role of genetic factors in human disease and their interaction with environmental and cultural factors. Many important human disorders appear to exhibit a genetic component; hence the integrated approaches of genetic epidemiology bring together epidemiologic and human genetic perspectives in order to answer critical questions about human disease. Methods of inference based upon data from individuals, pairs of relatives, and pedigrees will be considered. Prereq: EPBI/MHPH 431 or MHPH 405, EPBI/MHPH 490. Cross-listed as GENE 451 and MHPH 451.

EPBI 452. Statistical Methods for Genetic Epidemiology (3)
Analytic methods for evaluating the role of genetic factors in human disease, and their interactions with environmental factors. Statistical methods for the estimation of genetic parameters and testing of genetic hypotheses, emphasizing maximum likelihood methods. Models to be considered will include such components as genetic loci of major effect, polygenic inheritance, and environmental, cultural and developmental effects. Topics will include familial aggregation, segregation and linkage analysis, ascertainment, linkage disequilibrium, and disease marker association studies. Prereq: EPBI 431 and EPBI 451.

EPBI 453. Categorical Data Analysis (3)
Descriptive and inferential methods for categorical data with applications: bivariate data; models for binary and multinomial response variables, with emphasis on logit models; loglinear models for multivariate data; model fitting using the maximum likelihood approach; model selection and diagnostics; and sample size and power considerations. Topics in repeated response data as time allows. Prereq: EPBI 441.

EPBI 454. Population Genetics for Genetic Epidemiology (3)
This course will cover basics of population genetics (mutation, migration, natural selection) as well as topics such as random mating populations and inbred populations. Emphasis will be placed on migration studies and on linkage disequilibrium mapping. Measures on linkage disequilibrium, methods for linkage disequilibrium mapping of disease genes and the use of isolated versus outbred population in linkage disequilibrium mapping will be discussed. Prereq: EPBI 431.

EPBI 455. Genetic Epidemiology of Complex Diseases (3)
This course gives an integrated view to the process of genetic epidemiology as applied to complex diseases. To provide a basis, we initially study concepts of logic and causality. We then investigate the steps involved with a coherent approach to deciphering complex diseases in genetic epidemiology. In particular, the course covers: migrant studies, familial aggregation, linkage, disequilibrium, association studies, characterizing genes, gene-environment interactions, molecular epidemiology, ecogenetics, and pharmacogenomics. Prereq: EPBI 451. Cross-listed as MHPH 455.

EPBI 456. Genetic Epidemiology of Cancer (3)
This course describes the methods of quantitative analysis aimed at elucidating the genetic mechanisms governing or influencing the development of cancer. A variety of designs and analytic approaches appropriate to such investigations will be considered. Specific characteristics of cancer biology, diagnosis, development and mechanism that require consideration in the statistical genetic analysis of cancer data will be elucidated, as well as aspects of population genetics, screening and other issues that have implications for genetic epidemiologic studies of cancer. Prereq: EPBI 451, EPBI 452, and EPBI 457.

EPBI 457. Genetic Linkage Analysis (3)
Methods of analyzing human data to detect genetic linkage between disease traits, discreet and continuous, and polymorphic markers. Both model-based maximum likelihood (lod score) and model-free robust methods will be discussed. Additional topics covered will include measures of informativeness, multipoint analysis, numerical methods and model score analysis. Prereq: EPBI 452.

EPBI 458. Statistical Methods for Clinical Trials (3)
This course will focus on special statistical methods and philosophical issues in the design and analysis of clinical trials. The emphasis will be on practically important issues that are typically not covered in standard bio-
statistics courses. Topics will include: randomization techniques, intent-to-treat analysis, analysis of compliance data, equivalency testing, surrogate endpoints, multiple comparisons, sequential testing, and Bayesian methods. Prereq: EPBI 432 or MPHP 432. Cross-listed as MPHP 458.

**EPBI 459. Longitudinal Data Analysis (3)**
This course will cover statistical methods for the analysis of longitudinal data with an emphasis on application in biological and health research. Topics include: exploratory data analysis, response feature analysis, growth curve models, mixed-effects models, generalized estimating equations, and missing data. Prereq: EPBI 432.

**EPBI 460. Health Research Methods I (3)**
This is a course in research methods focusing on practical issues in the conduct of health services research studies. Topics include: an overview of health services research; ethics in health services research; proposal writing and funding; the relationship between theory and research; formulating research questions; specifying study design and study objectives; conceptualizing and defining variables; validity and reliability of measures; scale construction; operationalizing health research relevant variables using observation, self and other report, and secondary analysis; formatting questionnaires; developing analysis plans; choosing data collection methods; sampling techniques and sample size; carrying out studies; preparing data for analysis; and reporting of findings. Cross-listed as MPHP 460.

**EPBI 461. Health Research Methods II (3)**
Focus on measurement strategies for key health services research concepts including case mix, severity of illness, functional status, and patient outcomes. Examine the interplay between physician practice patterns, geography, standards of care, and practice guidelines and patient management and outcomes. Statistical methods especially useful in health services research (e.g., cost-effectiveness and cost-benefit analysis, conjoint analysis, utility assessment, and meta-analysis) will be introduced as well as examining approaches to the assessment of care quality. Prereq: EPBI 460.

**EPBI 462. Computation Methods in Genetic Epidemiology (3)**
Methods for computing genetic likelihoods and estimating genetic parameters; Elston-Stewart algorithm, IBD computation; Markov chain Monte Carlo methods; Gibbs sampling; Newton-Raphson; E-M algorithm. Prereq: EPBI 457 and EPBI 482.

**EPBI 463. Survey Design and Data Collection in Health Research (3)**
The purpose for this course is to provide hands-on experience in designing and conducting surveys in health research. The topics include sampling, types of surveys (e.g., interviews, mail, telephone, medical records), questionnaire design (i.e., multiple indicator models, index and scale construction, assessing psychometrics properties), field operations (i.e., data collection, editing and coding). Cross-listed as MPHP 465.

**EPBI 464. Decision Support Systems (3)**
Review of methods for decision support in medicine. Discussion of the need for such methods motivated by psychological literature on human perceptual and judgmental limitations. Review of existing methods for aiding decisions including artificial intelligence and statistical methods to enhance diagnostic accuracy (Bayesian methods, classical multivariate analysis, dynamic screening (Markov) models). Methods for improving the display of information. Theoretical and empirical limitations of these decision aids. Prereq: MATH 491.

**EPBI 465. Clinical Decision Analysis (3)**
Application of decision trees to clinical problems, estimation and revision of probabilities including Bayes theorem, utility analysis, cost benefit and cost effectiveness, sensitivity analysis, roc curves, and microcomputer programs for clinical decision analysis.

**EPBI 467. Cost-Effectiveness Analysis in Health Care (3)**
Evaluation of alternative medical treatments and drug therapies. Topics include cost-benefit, cost-effectiveness and cost-utility analysis. Measuring cost benefits and health outcomes. Quality of life and other measures of effectiveness will also be addressed. Emphasis on case studies, course project, and evaluation of publications. Some decision analysis and policy implications will also be included. Cross-listed as MPHP 467.

**EPBI 468. The Continual Improvement of Healthcare: An Interdisciplinary Course (3)**
The focus of this course is on collaborative work for the benefit of patients and community. Seminar classwork is combined with a field project, in which interdisciplinary student teams apply what they have learned to the improvement activities of a local health care organization. Successful completion of the course depends on participation in seminar sessions and completion of the interdisciplinary student team project. Prereq: Consent of instructor. Cross-listed as MPHP 468 and NURS 468.

**EPBI 471. Special Topics in Biostatistics (3)**
Sampling methods, bioassay, statistical genetics, multivariate analysis, sequential analysis, and stochastic models. Prereq: EPBI 442.

**EPBI 472. Special Topics in Statistical Genetics (1-4)**
Various topics in statistical genetics will be discussed, depending on student interest and needs. Examples of topics are paternity and zygosity testing, path analysis for genetic epidemiology, the analysis of racial admixture and modeling such phenomena as imprinting and anticipation. The course will consist of four modules. A student may, in consultation with the instructor, elect to take 1 - 4 modules for the corresponding amount of credit. Prereq: EPBI 452.

**EPBI 480. Introduction to Mathematical Statistics (3)**
An introduction to statistical inference at an intermediate mathematical level. The concepts of random variables and distributions, discrete and continuous, are reviewed. Topics covered include: expectations, variance, moments, the moment generating function; Bernoulli, binomial, hypergeometric, Poisson, negative binomial, normal, gamma and beta distribution; the central limit theorem; Bayes estimation, maximum likelihood estimators, unbiased estimators, sufficient statistics; sampling distributions (chi-square, t) confidence intervals, Fisher information, hypothesis testing, uniformly most powerful tests and multi-decision problems. Prereq: EPBI 431.

**EPBI 481. Theoretical Statistic I (3)**

**EPBI 482. Theoretical Statistics II (3)**
(See STAT 446.) Prereq: MATH 223 or STAT 445 or consent of instructor. Cross-listed as STAT 446.

**EPBI 486. Seminar in the Epidemiology of Violence (2)**
Graduate standing only. Epidemiology of injuries caused by violent behavior based on analysis of current literature with emphasis on use of epidemiologic tools in studying fatal and nonfatal injuries. Consideration of: (1) methods of surveillance of injuries; (2) epidemiologic analytic studies; (3) development and evaluation of interventions, using national and local databases. Students and field workers will give oral and written presentations.

**EPBI 487. Pharmacoepidemiology (3)**
Basis principles underlying pharmacoepidemiology, including study design and sample size; ethical issues in drug testing and approval; the use of large databases for research; and pharmacoconomics. Prereq: EPBI 490 and EPBI 491.

**EPBI 488. Gender, Ethnicity, and Health Research (5)**
This course is designed to acquaint students with the literature addressing the constructs of race, ethnicity, gender and social class; to examine critically the contexts in which these constructs are often applied; and to assess the relationship between each of these constructs and access to health care, quality of care, and health outcome. Cross-listed as MPHP 488.

**EPBI 489. Biomedical Perspectives on Women's Health (3)**
This course explores constructs of gender, women's access to healthcare, the quality of women's healthcare, and women's participation in biomedical research. These themes are examined in the context of various substantive areas, including reproductive health, mental health and illness, cancer, and cardiovascular disease. The course also examines methodological issues in study design that are related to gender.

**EPBI 490. Epidemiology: Introduction to Theory and Methods (3)**
Epidemiologic principles and methods needed to understand population-based statements of illness and health. Descriptive epidemiology, analytic epidemiology, and epidemiologic inference. Classification, morbidity and
mortality rates, sampling, screening, epidemiologic models, field trials, controlled epidemiologic surveys, sources of bias, and causal models. Prereq: STAT 201 or STAT 207 or STAT 312 or equivalent. Cross-listed as MPHP 490.

EPBI 491. Epidemiology: Application of Theory/Methods (3) This course will cover the methods used in the conduct of epidemiologic research. Topics include: case control studies, cohort studies, clinical trials, cross-section studies, exposure measurement, subject selection, validity, reliability, sample size and power, effect modification, confounding, bias, chance, risk assessment, frequency matching, matching meta-analysis. Analysis of data sets will be given as well. A statistical package will be used to analyze all data sets. Prereq: MPHP 431 and MPHP 490. Cross-listed as MPHP 491.

EPBI 492. Epidemiology: Statistical Methods (3) The course focuses on strategies for model building. Topics include the analysis of cohort and case-control studies where the emphasis is on risk estimation. Students are expected to analyze a database obtained from a cohort study of the effects of maternal alcohol drinking on outcomes of pregnancy and from a related nested case-control study. The analysis of survival data focuses on parametric and non-parametric techniques and utilizes data from an ongoing study of quality of life of patients on kidney dialysis. In addition to regular class assignments, students are expected to write a report on each of the databases and present results to the class. Prereq: EPBI 432 and EPBI 491. Cross-listed as MPHP 492.

EPBI 493. Epidemiology of Cardiovascular Disease (3) Prereq: EPBI 490.

EPBI 494. Infectious Disease Epidemiology (3) The epidemiology, prevention and control of representative infectious disease models. Emphasis on the triad of agent, host and environment and the molecular and genetic basis of agent and host interaction in the population. Prereq: EPBI 490, EPBI 491, and a microbiology course or consent of instructor. Cross-listed as MPHP 494.

EPBI 495. Psychiatric Epidemiology (3) This course provides an overview of various topics in the area of psychiatric epidemiology. These include a history of psychiatry as it is relevant to psychiatric epidemiology, methodological issues critical to research in this area, the social, ethical, and legal context of research in this area, and the epidemiology of various psychiatric disorders. Cross-listed as MPHP 495.

EPBI 496. Mathematical Models of Disease (3) This course covers introductory concepts of stochastic processes, with particular emphasis on Poisson, renewal and Markov processes. Examples highlight the art of modeling, focusing on models of chronic and infectious disease progression and infectious disease transmission. Simulation methods are used to obtain solutions. Prereq: EPBI 492 and EPBI 420.

EPBI 497. Epidemiologic Studies of Cancer Etiology and Prevention (3) Descriptive epidemiology of most major types of cancer. Current knowledge of the role that host factors, lifestyle, chemicals, radiation, viruses, familial factors, and benign diseases play in the etiology of various cancers, as determined from studies of human populations. Applications of epidemiologic principles to programs of primary and secondary cancer prevention. Prereq: EPBI 490.

EPBI 498. Cancer Data Analysis (3) Practical experience in analysis of cancer data including defining a hypothesis, conducting a literature search, designing appropriate analyses, analyzing the data, and reporting the findings. Students analyze cancer data sets currently on file, such as National Cancer Institute’s surveillance, epidemiology, and end results (see program data, using contemporary epidemiologic methods as taught in EPBI 452 and EPBI 491). Prereq: EPBI 432 and EPBI 492.

EPBI 499. Independent Study (1-18) Cross-listed as MPHP 499.

EPBI 501. Graduate Seminar (0) Students and faculty have the opportunity to meet on a weekly basis to discuss papers in the literature. Each week a paper is reviewed in detail by a graduate student in a formal presentation. Discussion of the strengths and weaknesses of the work gives insight into the complexities of investigations in the Public Health arena. Cross-listed as MPHP 501.

EPBI 502. Seminar in Genetic Epidemiology (0) Presentation of original research or recent journal publications by faculty and students.

EPBI 503. Seminar in Biostatistics (0) Presentation of original research or recent journal publications by faculty and students in the area of Biostatistics.

EPBI 507. Environmental Epidemiology (2) This course is designed to provide epidemiology students with basic knowledge about the ethical and legal principles underlying epidemiological research. This is not a public health law class. Issue papers are assigned on a weekly basis. Each issue paper requires that the student analyze the situation depicted and apply the principles learned. Some issue papers may require that the student draft a proposed rule, a portion of legislation, or a document such as an informed consent form. Other exercises may require that students critique an existing agency rule or legislation. Prereq: EPBI 490 and EPBI 491. Cross-listed as MPHP 508.

EPBI 514. Advanced Statistical Computing (3) Computational aspects of statistics and statistical modeling, including both graphical and analytic methods. The use of S-Plus and other computational tools to explore and analyze data in ways that are difficult to accomplish with standard statistical packages. Prereq: EPBI 414 and EPBI 420 and EPBI 482.

EPBI 515. Secondary Analysis of Large Health Care Data Bases (3) Development of skills in working with the large-scale secondary data bases generated for research, health care administration/billing, or other purposes. Students will become familiar with the content, strength, and limitations of several data bases; with the logistics of obtaining access to data bases; the strengths and limitations of routinely collected variables; basic techniques for preparing and analyzing secondary data bases and how to apply the techniques to initiate and complete empirical analysis. Prereq: EPBI 414 or equivalent; EPBI 431 or EPBI 460 and EPBI 461 (for HSR students) or EPBI 495 (for EPI students).

EPBI 535. Topics in Advanced Survival Analysis (3) Topics or current research interest in survival analysis. Topics may change from year to year. Prereq: EPBI 435.


EPBI 592. Selected Topics in Epidemiology (1-10) Vaccine development; epidemic models; nutritional epidemiology, genetic epidemiology; opportunistic infections; nosocomial infections; prevention strategies.


Department of Family Medicine

The Department of Family Medicine offers a master’s degree in family medicine. The program includes basic training in biostatistics, epidemiology and research methods, with a specific emphasis on the family. The department has particular research strengths in health services and prevention.
Family Medicine (FAMD)

Graduate Courses

FAMD 420. Seminar in Medical Education (3)
FAMD 421. Professional Academic Ethics (3)

What it means to be a successful member of the professoriate in an academic medical center is explored through a case study approach in academic ethics. Topics include: higher education governance, promotion and tenure, participation in school and university committees, informed consent, and grievance procedures.

FAMD 430. Research in Medical Education (3)
Prereq: Consent of instructor.
FAMD 431. Applied Statistics in Medical Education (3)

FAMD 502. International Health Practice (3)

This course aims to provide practical knowledge to prepare students to serve and study for international health work particularly in complex humanitarian emergencies. The course is organized and discussed from the perspective of health care professional. This course is intended for graduate-level students in medicine, nursing, public health, social work, and medical anthropology. Historical development of the discipline, key methodological issues, and essential principles in key topics will be discussed in multidisciplinary approach. Prereq: Consent of instructor. Cross-listed as MPH 502.

FAMD 601. Independent Study (1-18)
FAMD 651. Thesis M.S. (1-18)

Division of General Medical Sciences

The Division of General Medical Sciences at the School of Medicine was established in 1986 to provide an organizational unit with interdisciplinary research and education objectives. Special centers—with individual directors and missions—currently based in the division include centers for adolescent health, bioarchitectonics, biomedical ethics, cancer research, international health, and physical medicine and rehabilitation.

Center for Adolescent Health
Room W-G5 School of Medicine
Phone 216-368-3770
http://www.cwru.edu/med/adolescenthealth/blah.html
Barbara A. Cromer, M.D., Director and Frederick C. Robbins, M.D., Professor of Child and Adolescent Health

The School of Medicine established the Center for Adolescent Health in 1990 in recognition of the multidimensional biopsychosocial problems of contemporary youth. It was formed by educators and researchers from a variety of disciplines seeking to bring their expertise to bear on the serious problems facing youth. The center seeks to address these issues through an integrated, transdisciplinary approach that incorporates research, professional education, programmatic intervention and collaboration among community agencies and programs.

This unique program has four objectives:

1) To promote and coordinate collaborative research activities relevant to adolescents;
2) To provide interdisciplinary educational training at undergraduate, post-baccalaureate, and post-graduate levels for professionals interested in adolescent health;
3) To serve as a resource for Greater Cleveland community agencies that provide services for adolescents; and
4) To help promote the development of rational public policies addressing health and social issues that concern youth.

For information about the adolescent health track of the master of public health degree, please see “Other Degree Programs” in the medical school section of this General Bulletin or contact the center. A certificate in adolescent health also is offered; please contact the center for more information.

Although based at the School of Medicine, the center has developed relationships with other schools and departments at Case Western Reserve University and the community at large. In addition, the center is the umbrella organization for Cuyahoga County’s Adolescent Consortium, a networking organization for local youth-serving agencies. In addition, the center provides evaluation services and consultation to community-based youth-serving projects.

Current research interests of the faculty include adolescent sexuality, mental health, substance abuse prevention, and the establishment of a database to document the prevalence of high-risk behaviors in adolescents in Cuyahoga County.

Adolescent Health (ADHT)

Graduate Courses

ADHT 485. Adolescent Development (3)
Adolescent Development can be viewed as the overriding framework for approaching disease prevention and health promotion for this age group. This course will review the developmental tasks of adolescence and identify the impact of adolescent development on youth risk behaviors. It will build a conceptual and theoretical framework through which to address and change adolescent behavior to promote health. Prereq: Consent of instructor. Cross-listed as MPH 485.

ADHT 486. Adolescent Health Care Policies (3)
The focus of the course is a critical analysis of health care policies that impact the public health care needs of adolescent populations. Legal and ethical implications will be discussed. Prereq: Consent of instructor. Cross-listed as MPH 486.

ADHT 487. Research and Evaluation in Adolescent Health (3)
This course prepares students to develop an understanding of the practical skills needed to conduct relevant and timely research and evaluation related to adolescent health in the public health field. Cross-listed as MPH 487.

Center for Bio-architectonics
Room BRB B-17 School of Medicine
Phone 216-368-2390
Raymond J. Lasek, Ph.D. (Anatomy)
Professor and Director of Center

Bio-architectonics is the study of complex biological architectures. The center was established in 1986 to explore biological architectures in medicine, and it has focused specifically on the teaching of medical anatomy.

Center for International Health
Room T-505 School of Medicine
Phone 216-368-6321
James W. Kazura, M.D.
Professor of Medicine and International Health and Director of Center

The Center for International Health in the School of Medicine was established in 1987 to link the numerous international health resources of the university, its affiliated institutions, and the northern Ohio community in multidisciplinary programs of research and education related to global health. The challenges presented by world health problems are enormous, and the opportunities presented to the university community are great. In meeting these challenges and in responding to these opportunities at the University, those affiliated with the center have the opportunity to promote health in the world and to enrich the community.
Center faculty are appointed with secondary appointments, their primary appointments being in departments throughout the university. The center has both faculty and community advisory committees.

The center endeavors to foster programs that encourage creative people from many disciplines and cultures to work toward solutions of global health issues. The center was built on a strong base of specialized strengths in international health in many academic units of the university and its community. For example, the School of Medicine and its affiliated hospitals have substantial international health research, training and clinical care programs in the departments of medicine, pediatrics, epidemiology and biostatistics, family medicine, molecular biology and microbiology, and pathology. Other examples of international health programs are found at the University’s Frances Payne Bolton School of Nursing, Weatherhead School of Management, and Department of Anthropology.

The division of geographic medicine in the Department of Medicine is one of the world’s leading centers for research and training in the application of modern immunology and molecular biology to global health problems. The Uganda-CWRU International Collaboration for AIDS Research is a large, multifaceted program for the study of AIDS and its complications in Uganda, with funding from many national and international agencies. These and other activities are conducted by faculty from multiple departments in the school, including pediatrics and medicine.

Educational programs sponsored by the Center for International Health include an annual course in international health, electives in international health and overseas rotations for medical students, and training programs at Case Western Reserve for visiting students and scholars from developing countries.

In the Greater Cleveland community, substantial international expertise and experience exist in corporate, private, institutional and voluntary agency sectors. Citizen interest and commitment is high. The center seeks to provide a focal point for this interest, encouraging cooperative activities among these groups and academic units of the university.

Specific objectives of the center:

1) Linkages. To foster interdisciplinary and intercultural linkages related to international health in the university and our community.

2) Training. To promote training programs throughout the university that will equip a cadre of scientists from diverse backgrounds to address global health issues.

3) Research. To facilitate collaborative, multidisciplinary research programs by investigators from the University and elsewhere that will lead to improved health in the world.

4) Application. To work with institutions and agencies in developing countries to help design and establish research and education programs that meet their needs and function as models of sustainable health systems.

International Health (INTH)

Graduate Course

INTH 801. Annual Course in International Health (4)
Comprehensive, intensive course in international health given the entire month of July with approximately 27 classroom hours each week. Modalities of primary healthcare and the major infectious and parasitic diseases of developing countries are considered in depth. Lectures, including presentations by internationally recognized expert visiting faculty, as well as University faculty, are supplemented by problem solving exercises and laboratories. The course presumes an M.D. degree; other health professionals or health science students may be admitted with consent of the course director. Prereq: Permission of course director.

Center for Physical Medicine and Rehabilitation
Phone 216-778-3205
Gary S. Clark, M.D., C.P.E.
Director of Center

Physical medicine and rehabilitation is a medical specialty devoted to restoring people’s maximal functional ability following a wide variety of disabling medical conditions, from traumatic brain injury and spinal cord injury to acute and chronic back or knee pain. The Center for Physical Medicine and Rehabilitation was established in 1995 to coordinate and expand the research and training activities of the medical school that are devoted to the rehabilitation of people with disabling conditions and injuries.

The goals of the center:

1) To foster high-quality innovative research that concerns impairments, disabilities and handicaps resulting from illness, injury and developmental processes and that focuses on health-related improvement (physical, cognitive, behavioral and social) in human functioning and quality of life.

2) To promote and conduct effective teaching and training of principles and methods for rehabilitation of people with disabling chronic conditions and injuries at the undergraduate, graduate and post-graduate levels of medical education.

3) To enhance the quality and access to physical medicine and rehabilitation clinical services at University-affiliated medical centers.

4) To foster collaborative rehabilitation training and research among clinicians and basic scientists from a wide range of disciplines within the university.

The center’s faculty includes physicians and psychologists with varied backgrounds who have a broad array of clinical and research interests. Current research is focused on: 1) enhancing motor recovery and functional ability following paralysis from spinal cord injury and stroke; 2) improving methods for managing bladder and bowel dysfunction following spinal cord injury; and 3) outcomes research related to health and human functioning, from specific functional abilities that can be enhanced by individual therapy methods to the cost-benefit of integrated trauma and rehabilitation care systems. Many opportunities are available for physicians, graduate students and allied health trainees to gain knowledge and skills related to clinical rehabilitation and/or related research areas.

Center for RNA Molecular Biology
Room W-113 School of Medicine
Phone 216-368-1606
Website: http://www.maresearch.org
Timothy W. Nilsen, Ph.D.
Professor and Director of Center

Formally established in 2001, the goal of the Center for RNA Molecular Biology is to create a focus of excellence in the study of all aspects of RNA metabolism, including molecular biology and cell biology, and to investigate the potential clinical and commercial applications of these studies. The center strives for an national reputation for excellence in research and training of both graduate students and medical students, while maintaining interactions with other departments, centers and programs at Case Western Reserve, University Hospitals of Cleveland, and the Cleveland Clinic.

The primary faculty in the center and secondary faculty housed in other university departments and the Cleveland Clinic Foundation form a highly cohesive group. Current research areas include the roles of protein factors in cis- and trans-splicing of mRNA, mechanisms of cis- and trans-splicing in nematodes, protein-
Dependent RNA catalysis, RNA-RNA and RNA-protein interactions studied by nuclear magnetic resonance, apolipoprotein B RNA editing, RNA editing in Physarum, the structure and catalytic function of RNA, RNA helicases, alternative pre-mRNA processing, the subcellular organization of RNPs in mammals, mRNA splicing in S. cerevisiae, mRNA transport in S. cerevisiae, pre-mRNA splicing by the major and minor spliceosomes, alternative splicing in Drosophila, and the control of gene expression and protein folding.

Center faculty participate in teaching first-year graduate and medical student courses, as well as special-topics graduate courses. Graduate students are encouraged to apply directly to the Department of Molecular Biology and Microbiology or to the Biomedical Sciences Training Program (BSTMSTP, please see separate listing in this publication). Students interested in pursuing the combined M.D./Ph.D. program should apply directly to the Biomedical Sciences Training Program (BSTMSTP, please see separate listing in this publication). Direct admission into the program provides for an accelerated course of study in one of the more than 20 laboratories. Alternatively, the department also participates in the integrated Biomedical Sciences Training Program (BSTP, please see separate listing in this publication). Students interested in pursuing the combined M.D./Ph.D. program are admitted through the Medical Scientist Training Program (MSTP, please see separate listing in this publication). Those students interested in a career in genetic counseling may apply directly to the Genetic Counseling Training Program in the department.

The Center for Human Genetics is an integral part of the Department of Genetics and consists of both research and clinical laboratories involved in human and clinical genetics. This center supports research and clinical programs focusing on chromosome structure and behavior, human genome mapping, the molecular basis of inherited disease, and the genetic dissection of complex disease, as well as providing clinical care and training for postdoctoral fellows and genetic counseling students.

Genetics (GENE)

Graduate Courses

GENE 451. Principles of Genetic Epidemiology (3)
A survey of the basic principles, concepts and methods of the discipline of genetic epidemiology, which focuses on the role of genetic factors in human disease and their interaction with environmental and cultural factors. Many important human disorders appear to exhibit a genetic component; hence the integrated approaches of genetic epidemiology bring together epidemiologic and human genetic perspectives in order to answer critical questions about human disease. Methods of inference based upon data from individuals, pairs of relatives, and pedigrees will be considered. Prereq: EPBI 431 and EPBI 490 or consent of instructor. Cross-listed as EPBI 451.

GENE 488. Yeast Genetics and Cell Biology (3)
This seminar course provides an introduction to the genetics and molecular biology of the yeasts S. cerevisiae and S. pombe by a discussion of current literature focusing primarily on topics in yeast cell biology. Students are first introduced to the tools of molecular genetics and special features of yeasts that make them important model eukaryotic organisms. Some selected topics include cell polarity, cell cycle, secretory pathways, vesicular and nuclear/cytoplasmic transport, mitochondrial import and biogenesis, chromosome segregation, cytoskeleton, mating response and signal transduction. Cross-listed as MBIO 488.

GENE 500. Advanced Eukaryotic Genetics I (3)
Fundamental principles of modern genetics; transmission, recombination, structure and function of the genetic material in eukaryotes, dosage compensation, behavior and consequences of chromosomal abnormalities, mapping and isolation of mutations, gene complementation and genetic interactions. Prereq: BIOL 362.

GENE 503. Readings and Discussions in Genetics (0-3)
(Credit as arranged.) In-depth consideration of special selected topics through critical evaluation of classic and current literature.

Department of Genetics

School of Medicine
Biomedical Research Building
Phone 216-368-3431
http://genetics.cwru.edu/

The Department of Genetics embraces a unified program devoted to outstanding research and teaching in all areas of genetics, with a particular emphasis on human genetics. Research interests in the department include the genetic basis of human disease, the molecular biology and genetics of embryonic development, sex determination and recombination in Drosophila, C. elegans, the mouse and humans; chromosome structure and function; human and mouse genome mapping; and regulation of gene expression.

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GENE 504. Advanced Eukaryotic Genetics II (3)
Fundamental principles of modern genetics: population and quantitative genetics, dissection of genome organization and function, transgenic, developmental genetics, genetic strategies for dissecting complex pathways in organisms ranging from Drosophila and C. elegans to mouse and human. Prereq: GENE 500 or permission of instructor.

GENE 508. Bioinformatics and Computational Genomics (3)
The course is designed to provide an understanding of theory and application of computational methods for molecular biology research. The course will be divided into four primary sections: DNA methods, protein methods, structure analysis (RNA and protein) and phylogenetic analysis. Special emphasis will be placed on the use and development of tools to search and analyze large amounts of sequence data generated as part of the Genome Projects in human, Drosophila and other eukaryotic organisms. The course offers extensive hands-on computational training using UNIX, Web and PC-based software. As such, for every hour of lecture material there will be two corresponding hours of computational laboratory time. In the initial year, enrollment will be limited to five students. Preference will be given to senior-level genetics graduate students or post-doctoral fellows. Prereq: GENE 500 and GENE 504 or permission of instructor.

GENE 509. Complex Genetic Traits (3)
A combination of lecture, readings-based, and discussions that survey the origins of variation and disease and the genetic and phenotypic analysis of complex traits. The course emphasizes the sources of variation, genetic and phenotypic analysis of complex traits, and gene families and physiological pathways. Prereq: GENE 500 and GENE 504 or permission of instructor.

GENE 510. Advanced Human Genetics (3)
Comprehensive course surveying major areas of contemporary human genetics, including population genetics, Mendelian genetics, chromosome abnormalities, genetic disease, genomics, and molecular genetics. Prereq: GENE 500.

GENE 511. Specialized Topics in Human Genetics (2)
Presentation and discussion of any aspect of human genetics but emphasizing recent molecular insights into defects in humans. Both classical and recent papers are analyzed and critiqued.

GENE 512. Structural Analysis of Complex Genomes (3)
Lectures, readings and discussion course surveying the status of mapping and sequencing the human genome and those of model organisms. Prereq: GENE 500 and GENE 504.

GENE 513. Developmental Genetics (3)
This course focuses on the genetic control of animal development. Topics covered include the organization of genetic regulatory circuits which govern the determination of embryonic axes, germ layers and cell fates as well as the cell interactions and cell movements which lead to emergence of the basic body plan of the organism. Emphasis is placed on the use of the genetic approach and genetic tools to uncover the molecular basis of these developmental processes. Prereq: GENE 500 and GENE 504.

GENE 514. Mammalian Cytogenetics (3)
Overview of classical and molecular cytogenetic methods available to study mammalian chromosomes with interphase and metaphase preparations, and a summary of the origin, etiology and phenotypic consequences of chromosome abnormalities, primarily in the human. Prereq: GENE 500 and GENE 504 or permission of instructor.

GENE 515. Chromosome Structure and Function (3)
An advanced literature-based course examining specific topics relating to the structure and function of eukaryotic chromosomes. Topics will vary from year to year. Examples include: chromosome and chromatid organization; centromeres and kinetochores; chromosome segregation, recombination, and nondisjunction; genomic imprinting, its molecular mechanisms, and its effect on gene expression; heterochromatin and position effect variegation; and molecular mechanisms of chromosome abnormalities. Prereq: GENE 500 and GENE 504.

GENE 516. Introduction to Clinical Genetics (3)
The major focus of this course is to allow graduate students in Human Genetics to become familiar with the medical genetics and counseling aspects of the genetics evaluation and counseling process. It provides the student an opportunity to see an application of bench research in the clinical arena as well as to observe and appreciate the various functions, roles and responsibilities of different members of the medical genetics team. Course includes seminars and clinical observations. Prereq: Consent of instructor.

GENE 517. Principles of Biomedical Technology Development (3)
Analyses of strategies employed by biomedical companies in identifying and developing new technologies, highlighting genomics and gene therapy companies. Topics of discussion will include the financial analysis of new gene-based technologies, the challenges of developing technologies in-house versus licensing, and the impact of intellectual property (especially patent law) on gene-based product development. An overview of relevant federal regulatory law will also be provided, concentrating on current FDA requirements for new drugs and devices. Prereq: Consent of instructor.

GENE 519. The Genetics of Emerging Infectious Diseases (3)
This course will survey the genetics, transmission and life cycle of emerging infectious agents. Lecturers will include local and visiting scientists internationally recognized as experts in infectious disease research. Prereq: Consent of instructor.

GENE 521. Chromatin Structure and Transcription (3)
A critical review of selected topics and current literature on the role of chromatin structure in the regulation of gene expression. Cross-listed as BIOL 521.

GENE 522. Genetics of the Cardiovascular System (3)
The course covers the newest concepts in the development and function of the cardiovascular system. Topics include the genetics of cardiovascular diseases in humans and the comparative genetics and biology of animal models of cardiovascular diseases. Prereq: GENE 500.

GENE 523. Embryonic Patterning in Development (3)
This course will focus on current understanding of patterning mechanisms in animal development. The seminal contributions of Turning, Stern, Crick, Lawrence, Wolpert, and Lewis will be covered, as will the most recent advances in the field. Models and theory will be considered, in addition to experimental analysis and the identification of patterning molecules. The course will end with a consideration of how development changes to create different adult morphologies over the course of evolution. Prereq: Permission of instructor.

GENE 524. Advanced Medical Genetics: Cytogenetics (2-3)
Fundamental principles regarding clinical cytogenetics including discussion of autosomal numerical and structural abnormalities; sex chromosome abnormalities; population cytogenetics; mosaicism; uniparental disomy; contiguous gene deletions, and cancer cytogenetics. Prereq: Consent of instructor.

GENE 525. Advanced Medical Genetics: Clinical Genetics (2-3)
Fundamental principles regarding congenital malformations, dysmorphology and syndromes. Discussion of a number of genetic disorders from a systems approach: CNS malformations, neurodegenerative disorders, craniofacial disorders, skeletal dysplasias, connective tissue disorders, hereditary cancer syndromes, etc. Discussions also include diagnosis, etiology, genetics, prognosis and management. Prereq: Consent of instructor.

GENE 526. Advanced Medical Genetics: Molecular and Quantitative Genetics (2-3)
Molecular: Fundamental principles of gene structure; mechanisms, detection and effects of mutations; imprinting; triplet repeat disorders; X-chromosome inactivation; application of molecular analysis to genotype/phenotype correlations and gene therapy. Quantitative: Fundamental principles of pedigree analysis, segregation analysis, Bayes theorem; linkage analysis and disequilibrium; risk assessment ad consanguinity. Prereq: Consent of instructor.

GENE 527. Advanced Medical Genetics: Biochemical Genetics (2-3)
Fundamental principles of metabolic testing; amino acid disorders; organic acid disorders; carbohydrate disorders; peroxisomal disorders; mitochondrial disorders; etc. Discussion of screening principles and newborn screening as well as approaches to diagnosis, management and therapy for metabolic diseases. Prereq: Consent of instructor.
GENE 528. Principles and Practices of Genetic Counseling (3)
Fundamental principles needed for the practicing genetic counselor. Topics include skills in obtaining histories (prenatal, perinatal, medical, developmental, psychosocial and family); pedigree construction and analysis, physical growth and development; the genetic evaluation; the physical examination and laboratory analyses; prenatal issues, prenatal screening and diagnosis; and teratogenicity. Prereq: Consent of instructor.

GENE 529. Psychosocial Issues in Genetic Counseling (3)
Fundamental principles regarding the psychosocial aspects of genetic disease and birth defects, its psychological and social impact on the individual and family. Topics include the genetic counseling interview process, issues regarding pregnancy and prenatal diagnosis, chronicity, death and loss. Cultural issues and their impact on the genetic counseling session are addressed. Resources for families are also explored. Basic interviewing skills are presented. Students will have an opportunity for practice of skills through role play and actual interviewing situations. Prereq: Consent of instructor.

GENE 530. Ethical and Professional Issues in Genetic Counseling (2)
Professional issues inherent in medical genetics and genetic counseling are addressed, including ethical, legal, religious, and cultural concepts. Fundamental principles of ethics are explored in some depth as they relate to genetic issues, such as autonomy and informed consent; use of the NSGC Code of Ethics is emphasized. Genetic counseling roles and responsibilities and aspects of a career as a professional are explored. Prereq: Consent of instructor.

GENE 532. Clinical Practicum in Genetic Counseling (1-6)
This clinical practicum provides the student an opportunity to function as a genetic counselor by preparing for cases; obtaining appropriate histories; determining risks; performing psychosocial assessments; discussing disease characteristics, inheritance, and natural history; providing anticipatory guidance and supportive counseling; using medical and community resources; and follow-up. Students rotate through four clinical areas and one laboratory and will register for a total of 12 hours over the course of the program. Prereq: Admission to Genetic Counseling Training Program.

GENE 533. Genetics of Aging (3)
This course will focus on our current understanding of the genetic mechanisms underlying cellular and organismal aging as well as age-related diseases. Theories of aging will be covered as well as the most recent experimental analysis in a variety of systems (yeast, worms, flies, mice, and humans). While aging research has long been primarily descriptive in nature, the most recent genetic-based experiments are providing the first insights into the molecular pathways involved with striking similarities across model systems. Prereq: GENE 500, GENE 504, or consent of instructor.

GENE 534. Neurogenetics (3)
This course will explore how principles of genetics can be used as tools to study the complex organization of the nervous system. Examples will be drawn from all relevant model organisms including nematode, fruit fly, mouse, and human. Meant primarily for students with an interest in neuroscience, this course will offer a strong foundation in genetic principles using examples drawn from the neuroscience literature. Students in other disciplines, especially genetics, will benefit from the examples to learn important aspects of the neurosciences ranging from behavior to development. These interdisciplinary features make this course unique in its offerings and a valuable addition to many students’ course of study. Prereq: CBIO 453 and CBIO 455. Cross-listed as NEUR 554.

GENE 601. Research in Genetics (1-9)
(Credit as arranged.)

GENE 651. Thesis M.S. (1-9)
(Credit as arranged.) Master’s Thesis Plan A.

GENE 701. Dissertation Ph.D. (1-9)
(Credit as arranged.)

GENE 702. Appointed Dissertation Fellow (9)

Institute for Public Health Sciences
Alfred A. Rimm, Ph.D.
Director of the Institute
Department of Epidemiology and Biostatistics
School of Medicine, Room W-G57
Phone: (216) 368-3195
E-mail: gradpro@hal.cwru.edu

The Institute for Public Health Sciences, located at MetroHealth Medical Center and at the School of Medicine, incorporates the disciplines of epidemiology and biostatistics, bioethics, and environmental health sciences to form the scientific foundation for public health research and education at the School of Medicine. The institute faculty are engaged in numerous research projects in the complementary disciplines and conduct collaborative studies with the basic and clinical science departments in the School of Medicine.

Graduate Programs
Bioethics (M.A.)
The master of arts in bioethics program, through the Center for Biomedical Ethics, examines the ethical, cultural and policy dimensions of health care, technology and the life sciences. The program contains a significant clinical component in which students become familiar with the clinical, psychological, social, professional and institutional context in which ethical problems arise. Please see the Center for Biomedical Ethics listing in this publication for more information.

Biostatistics (M.S. and Ph.D.)
The biostatistics track deals with concepts underlying the scientific method in biomedical research, the interpretation of medical and biological data, and both the theory and the practical realities of study design, data collection, statistical analysis and computing, and the reporting of results. An important activity involves the design and analysis of randomized clinical trials and intervention studies, either for prevention or treatment of disease in humans.

Epidemiology (M.S. and Ph.D.)
The epidemiology track includes the search for factors causing disease in humans and the study of the occurrence and distribution of diseases in human populations. The field of epidemiology also is concerned with the education of the public and strategies for adopting good health behavior practices.

Genetic and Molecular Epidemiology (M.S. and Ph.D.)
The track in genetic and molecular epidemiology involves the role of genetic factors in the etiology of disease in human populations, including investigation of their interactions with environmental and cultural factors as part of the disease process. Its integrated approach brings together genetic and epidemiologic perspectives to answer critical questions about human disease.

Health Services Research (M.S. and Ph.D.)
The health services research track focuses on the description, analysis and evaluation of the organization; staffing; financing; utilization; and delivery of health care, with emphasis on equity of access, cost-effectiveness, and certainty of quality of care to all individuals.

For information and an application to the graduate programs of the Institute of Public Health Sciences, contact:
Desiree A. Knauer, Admissions Secretary
Department of Epidemiology and Biostatistics
School of Medicine
Case Western Reserve University
10900 Euclid Ave.
Cleveland OH 44106-4945
Integrated Biological Sciences
Room W-378 School of Medicine
Phone 216-368-3404

This curriculum is primarily designed for students in combined M.D./Ph.D. programs—for instance, the Medical Scientist Training Program (MSTP), Health Services Research Program, and the Physician Engineer Training Program (PETP). Please see the separate listings for these programs in this publication. The curriculum uses the curriculum of the first two years of the School of Medicine to provide a general education in biomedical science and medicine. It does not provide specialized research training, which is provided by the curricula of specific graduate programs. Inquiries about specific requirements should be addressed to the student’s own program.

For more information, contact:
Program Manager
Medical Scientist Training Program
School of Medicine
10900 Euclid Ave.
Cleveland, Ohio 44106-4936
Phone: (216) 368-3404
E-mail: mstp@po.cwru.edu

Integrated Biological Sciences (IBIS)

Graduate Courses

IBIS 401. Integrated Biological Sciences I (1-9)
A four-semester sequence encompassing anatomy, biochemistry, physiology, pharmacology, pathology, and microbiology.

IBIS 402. Integrated Biological Sciences II (1-9)
A continuation of IBIS 401.

IBIS 403. Integrated Biological Sciences III (1-9)
A continuation of IBIS 402.

IBIS 404. Integrated Biological Sciences IV (1-9)
A continuation of IBIS 403.

IBIS 411. Clinical Science I (2)
IBIS 412. Clinical Science II (2)
IBIS 413. Clinical Science III (2)
IBIS 414. Clinical Science IV (2)

IBMS 500. Being a Professional Scientist (0)
The goal of this course is to provide graduate students with an opportunity to think through their professional ethical commitments before they are tested, on the basis of the scientific community’s accumulated experience with the issues. Students will be brought up to date on the current state of professional policy and federal regulation in this area. The course is designed to meet the requirements for ‘instruction about responsible conduct in research’ for BSTP and MSTP students supported through NIH/ADAMHA institutional training grants programs at the University. The course will meet on four consecutive mornings, and attendance is required. Prereq: BSTP enrollment.

Graduate Programs

The Department of Molecular Biology and Microbiology participates in the Biological Sciences Training Program (BSTP, please see separate listing in this publication) and offers a program of study leading to the Ph.D. degree. The program emphasizes direct research participation under the guidance of a faculty mentor. The goal is to produce scientists who will function as independent researchers in the forefront of biomedical science. Students pursue their thesis research in several areas of eukaryotic and prokaryotic molecular biology. A minimal amount of didactic material is included in the first two years to provide a base of knowledge for selecting a research area and to prepare the students to read and critically interpret the primary literature.

First-year students are admitted to the BSTP and may choose a laboratory rotation within the department. They participate in the integrated cellular and molecular biology sequence. (CBIO 453, 454, 455 and 456) and in department seminars. They also may be required to take a biochemistry course if proficiency cannot be demonstrated. Near the end of the first year, students select a thesis advisor and are assigned to a department.

After successful completion of the first-year curriculum, students are expected to complete a minimum of 12 credit hours of advanced course work. Any combination of courses from within or outside the department can fulfill the requirement as long as it has the approval of the student’s committee. Students take a qualifying examination to determine their readiness for advancement to candidacy. This exam consists of oral and written components and is given near the end of the second year in subsequent years, students pursue their research activities full-time.

Each laboratory is fully equipped for state-of-the-art research in molecular biology and microbiology. In addition, several major instrument systems (oligonucleotide synthesis and purification, DNA sequence analysis, machine shop and instrumentation shop, etc.) are available to all members of the department.

Current research programs: post transcriptional modification of RNA and its role in gene expression; mechanisms of viral, messenger and ribosomal RNA processing; pre-messenger RNA splicing; RNA editing; retrovirus host interactions; regulation of viral and cellular oncogene expression and tumorigenesis by oncogenes; DNA catalysis; cell surface biochemistry and architecture; molecular parasitology; genetics and biochemistry of intracellular transport and sorting in yeast; bacterial cell division; biochemistry and genetics of bacterial transport systems; molecular biology of antibiotic resistance; and mechanisms of bacterial pathogenesis. Extensive interdepartmental collaborations ensure that a broad range of resources are available to every student.

Molecular Biology and Microbiology (MBIO)

Undergraduate Course

MBIO 399. Undergraduate Research (1-3)
Permits qualified undergraduates to work in a faculty member’s laboratory.
Molecular Virology (MVIR)

Graduate Courses

**MBIO 420. Molecular Genetics of Cancer (3)**
(See MBIO 420.) Cross-listed as MBIO 420 and MVIR 420.

**MBIO 434. Mechanisms of Drug Resistance (3)**
Resistance to drugs is an important health concern in the new millennium. Over the past century, modern medicine has developed and prescribed drugs for various ailments and diseases with known therapeutic benefit. Since the discovery of antibiotics by Dr. Fleming, we have struggled with a new complication in infectious diseases, development of drug resistance. This course will focus on and compare the drug resistant mechanisms selected by viruses, bacteria, parasites, fungi, and tumor cells. Topics to be covered include antiretroviral resistance (e.g., AZT and protease inhibitors), antibiotic resistance (e.g., B-lactams), resistance to chemotherapeutic agents, and resistance to anti-malarial drugs (e.g., chloroquine). Cross-listed as MVIR 434 and PHRM 434.

**MBIO 461. Prokaryotic Molecular Biology (3)**
Basic techniques and research topics of microbial genetics and pathogenesis. Lecture and discussion format.

**MBIO 472. Transcriptional Mechanisms (3)**
A literature based course considering the transcriptional machinery and process of the RNA polymerases I, II, and III.

**MBIO 488. Yeast Genetics and Cell Biology (3)**
This seminar course provides an introduction to the genetics and molecular biology of the yeasts S. cerevisiae and S. pombe by a discussion of current literature focusing primarily on topics in yeast cell biology. Students are first introduced to the tools of molecular genetics and special features of yeasts that make them important model eukaryotic organisms. Some selected topics include cell polarity, cell cycle, secretory pathways, vesicular and nuclear/cytoplasmic transport, mitochondrial import and biogenesis, chromosome segregation, cytoskeleton, mating response and signal transduction. Cross-listed as CLBY 488, GENE 488, and PATH 488.

**MBIO 518. Cell Surfaces and Matrices (3)**
Molecular mechanisms by which cells interact with and are regulated by extracellular matrices and other cells. Cross-listed as NEUR 518.

**MBIO 519. Molecular Biology of RNA (3)**
Selected topics regarding editing, enzymatic function, splicing, and structure of RNA. Cross-listed as CLBY 519.

**MBIO 601. Research in Molecular Biology and Microbiology (1-18)**

**MBIO 651. Thesis M.S. (1-18)**

**MBIO 701. Dissertation Ph.D. (1-18)**

**MBIO 702. Appointed Dissertation Fellow (9)**

Molecular Virology Program

Room W-427 School of Medicine
Phone 216-368-3344

The Molecular Virology Program offers graduate studies leading to the Ph.D. and combined M.D./Ph.D. degrees. The training program is designed to prepare highly qualified and motivated students for careers in biomedical research focused on viruses, viral vectors and virus-host interactions. The program draws its 18 faculty from several departments at Case Western Reserve University, University Hospitals of Cleveland, and the Lerner Research Institute of the Cleveland Clinic Foundation. The faculty have particular strengths in the areas of viral replication, virus-host interactions, viral oncogenesis and the use of viral vectors for gene therapy.

The Molecular Virology Program participates in the Biomedical Sciences Training Program (BSTP), please see separate listing in this publication), which is a Ph.D. program consisting of 12 additional graduate training programs within the School of Medicine. Students interested in graduate training in molecular virology are admitted into the BSTP and are afforded the opportunity to study in any of the training program’s laboratories. During their first year, graduate students divide their time between course work, research rotations and research seminars.

All first-year students take the integrated BSTP core curriculum in cell and molecular biology (12 credit hours). They also complete at least three research rotations in laboratories of prospective advisors chosen by the students with the aid of a faculty advisor. These rotations provide the basis for choosing a permanent research advisor, which is done during the second semester of the first year. By choosing a faculty member who is affiliated with the Molecular Virology Program and deciding to satisfy its degree requirements, a student becomes a member of the program.

Students in the combined Medical Sciences Training Program (MSTP, an M.D./Ph.D. program, please see separate listing in this publication) also may join the Molecular Virology Program by the same route involving research rotations and selection of a program faculty member as the thesis advisor.

During the subsequent years, students devote most of their time to laboratory research while also completing four advanced courses, participating in the monthly virology seminar series, and attending journal clubs and other research seminars. By the end of the second year, each student must write and defend a research proposal, which serves as the qualifying exam for Ph.D. candidacy. The final requirement for the Ph.D. degree is the submission and defense of an acceptable dissertation based on original research of the student.

Faculty


**MVIR 420. Molecular Genetics of Cancer (3)**
Using a combination of lectures and student presentations, this course provides an in-depth analysis of cancer as a genetic disease in the Mendelian sense of inheritance and in the sense of causation by somatic mutation. The objectives of the course are to examine both the proto-oncogenes and tumor suppressor genes that are the targets of oncogenic mutations and the mechanisms of mutational change. Discussions emphasize experimental approaches used to identify and study oncogenes and tumor suppressor genes. This course also covers viral mechanisms of oncogenesis, which involve interactions between viral proteins and the products of cellular proto-oncogenes or tumor suppressor genes. Prereq: CBIO 453, CBIO 454, CBIO 455, and CBIO 456. Cross-listed as BIOC 420 and MBIO 420.

**MVIR 434. Mechanisms of Drug Resistance (3)**
Resistance to drugs is an important health concern in the new millennium. Over the past century, modern medicine has developed and prescribed drugs for various ailments and diseases with known therapeutic benefit. Since the discovery of antibiotics by Dr. Fleming, we have struggled with a new complication in infectious diseases, development of drug resistance. This course will focus on and compare the drug resistant mechanisms selected by viruses, bacteria, parasites, fungi, and tumor cells. Topics to be covered include antiretroviral resistance (e.g., AZT and protease inhibitors), antibiotic resistance (e.g., B-lactams), resistance to chemotherapeutic agents, and resistance to anti-malarial drugs (e.g., chloroquine). Cross-listed as MBIO 434 and PHRM 434.

**MVIR 445. Molecular Biology and Pathogenesis of RNA and DNA Viruses (3)**
Through a combination of lectures by faculty and guest lecturers, along with student discussion of current literature, this course emphasizes mechanisms of viral gene expression and pathogenesis. RNA viruses to be discussed include positive, negative, and retroviruses. DNA viruses include SV40, adenovirus, herpes, papilloma, and others. Important aspects of host defense mechanisms, antiviral agents, and viral vectors will also be covered. Students will be evaluated based on their quality of presenta-
tion of course papers assigned to them and their overall participation in class discussions. Prereq: CBIO 453, CBIO 454, CBIO 455, and CBIO 456.

**MVIR 446. Host-Virus Interactions (3)**
This course will explore both historical and contemporary literature with emphasis on: control of cell cycle, transformation, and cellular differentiation by viruses; viral manipulation of signal transduction, how viruses control cell apoptosis, viral manipulation of cytokine and cellular immune responses, and persistent viral infections. The format will be both lecture- and paper-based seminars. Grades are based upon class participation, a final examination, and a written proposal on a subject of interest chosen by the student. Prereq: CBIO 453, CBIO 454, CBIO 455, and CBIO 456. Cross-listed as BIOC 446 and PATH 446.

**MVIR 481. Immunology of Infectious Diseases (3)**
(See PATH 481.) Prereq: Introductory immunology course or consent of instructor. Cross-listed as PATH 481.

**MVIR 601. Research (1-18)**
Grade of S/U only.

**MVIR 611. Seminar (1)**
Discussion of current research.

**MVIR 612. Seminar (1)**
Discussion of current research.

**MVIR 641. Proposition (2)**
Design of research proposal. Grade of S/U only.

**MVIR 642. Proposition (2)**
Design of research proposal. Grade of S/U only.

**MVIR 701. Dissertation (1-18)**
Grade of S/U only.

**MVIR 702. Appointed Dissertation Fellow (9)**

### Neuroscience and Biomedical Engineering Program

**Departments of Neurosciences and Biomedical Engineering**

**Schools of Medicine and Engineering**

**Case Western Reserve University**

**Phone 216-368-6974**

**E-mail: nrb@po.cwru.edu**

This program was developed to provide training to graduate students interested in pursuing research that merges traditional neurobiology with engineering methodologies. Often these research projects quantitatively explore the mechanisms that underlie neuronal function at the single-cell or systems levels. Projects also can include applying computational techniques to important biological questions or, conversely, using biologically inspired neuronal networks to solve engineering problems. Students in this program also may work on problems related to interfacing external devices to the nervous system. Faculty associated with the program generally have their primary academic appointments in the Neurosciences, Physiology and Biophysics, Biology, or Biomedical Engineering departments. Affiliated faculty are organized around five general areas: (1) neural tissue engineering and development, (2) neural interfacing, (3) cellular neurophysiology, (4) molecular neurobiology, and (5) systems neuroscience. Students in the program are expected to take a series of core and elective courses from both primary departments. Interested students should contact the Department of Neurosciences at the e-mail address listed above to obtain a brochure that describes this program in detail.

### Department of Neurosciences

**Room E-653 School of Medicine**

**Phone 216-368-6251**

http://neurowwww.cwru.edu/

Neurosciences are the last great frontier in the biological sciences. How the nervous system functions to process information and mediate behavior, and how it forms during embryonic development and is modified to encode experience, are central questions in the neurosciences. Answering these questions requires a multidisciplinary approach combining the tools of electrophysiology, anatomy, biochemistry and molecular biology in studies of animals and tissue culture models.

The department offers a Ph.D. program that provides interdisciplinary training in modern neurosciences through a combination of course work, seminars and research experience. Medical students are encouraged to pursue research projects with neurosciences faculty and/or to make neurosciences an area of concentration.

Neuroscientists at Case Western Reserve are using state-of-the-art techniques and instrumentation to study several aspects of nervous system function, including neural circuitry and plasticity, development and regeneration, and cellular and molecular neurobiology. Techniques used include patch and voltage clamping neuronal membranes to study ion channels, gene cloning, sequencing and other molecular and genetic approaches to study the structure, function and regulation of neuronal proteins; electron microscopy, confocal and other imaging methods to study development and function of synapses; immunocytochemical techniques to study the molecular and biochemical basis of nervous system development and plasticity; and traditional anatomical, biochemical and physiological techniques.

### Neurosciences (NEUR)

#### Graduate Courses

**NEUR 402. Principles of Neural Science (3)**
Lecture/discussion course covering concepts in cell and molecular neuro-science, principles of systems neuroscience as demonstrated in the somatosensory system, and fundamentals of the development of the nervous system. This course will prepare students for upper level Neuroscience courses and is also suitable for students in other programs who desire an understanding of neurosciences. Prereq: CBIO 453. Cross-listed as BIOL 402.

**NEUR 405. Cellular and Molecular Neurobiology (3)**
Cell biology of nerve cells, including aspects of synaptic structure physics and chemistry. The application of molecular biological tools to questions of synaptic function will be addressed. Prereq: BIOL 473.

**NEUR 406. Systems Neurosciences (4)**
A comprehensive course designed to give graduate students a wide-ranging introduction to the organization and function of the nervous system. Topics to be covered include the anatomy, physiology and function of the mammalian central nervous system, as well as the organization of simple nervous systems. Lectures, laboratories and student presentations of classic papers will be used.

**NEUR 411. Neurobiology of Disease (1)**
Designed to show how basic research in neuroscience has contributed to the management of clinical problems in human neurology and to discuss some of the further challenges posed by human disease for research in neurobiology. The general format will include clinical descriptions of patient presentation, discussion of the disease mechanisms and an analysis of contributions of cellular and systems neuroscience to understanding of the human disorder. Specific topics to be discussed include myasthenia gravis, dementia (including Alzheimer’s disease), multiple sclerosis, Duchenne’s muscular dystrophy, poliomylitis, seizures and strokes. Prereq: NEUR 405 or NEUR 406.

**NEUR 415. Neuroscience Seminars (1)**
Current topics of interest in neurosciences. Students attend weekly seminars. From this series, students prepare critiques. No credit is given for less than 75% attendance.

**NEUR 427. Neural Development (3)**
Topics include cell commitment, regulation of proliferation and differentiation, cell death and trophic factors, pathfinding by the outgrowing nerve fiber, synapse formation, relationships between center and periphery in development and the role of activity. Cross-listed as BIOL 427.
NEUR 432. Biochemical and Molecular Aspects of Vision (3)
Increasingly, progress in the study of vision science is requiring
multidisciplinary approaches that draw from the areas of biochemistry,
genetics, molecular biology, neuroscience and pathology. We have recog-
nized this fact and have adapted this course to fit the needs of
tomorrow’s scientists. This course encompasses the basic science aspects
of the eye. Subjects include retinal anatomy and function; biochemical,
molecular aspects of retinal disease and cataract; cellular and molecular
neuroscience aspects pertinent to the visual system. Cross-listed as PATH
452 and PHRM 432.

NEUR 433. Membrane Transport Processes (3)
(See PHRM 433.) Cross-listed as PHRM 433.

NEUR 435. Vision: Molecules to Perception (3)
The organization, physiology, and function of the vertebrate visual sys-
tem are considered in detail. The visual pathway from retina to LGN and
visual cortex is described with an emphasis on circuits that produce suc-
cessively more complex receptive field properties. Classic papers and
current literature form the basic course material. Assessment is based on
student presentations, class participation, and a term paper. Prereq:
NEUR 402 or consent of instructor. Cross-listed as PSCL 435.

NEUR 440. Synaptic Transmission (2)
This course will explore the basic mechanisms of synaptic transmission
that operate at central and peripheral synapses. Students will read and
present a mixture of historical and modern papers that established the
fundamental principles of synaptic transmission and plasticity. The
course will begin with a brief review of cellular neurophysiology and the
techniques used to study synaptic potentials. We will then read classic
papers by Katz and colleagues that defined the mechanisms controlling
transmitter release at the neuromuscular junction. Next we will consider
the role of calcium in regulating the release of neurotransmitters and in
short-term modulation of synaptic potentials. We will then explore pre-
and post-synaptic processes such as receptor saturation and vesicle dy-
namics that govern the amplitude and time course of post-synaptic poten-
tials. Quantal analysis and silent synapses will be discussed in the context
of the present-day controversies regarding long-term potentiation at cen-
tral synapses. We will also consider the relationship between short- and
long-term synaptic plasticity and behavioral functions such as learning and
memory. Occasional faculty lectures will complement student presen-
tations on primary research articles. Student grades will be based on
two short (5 page) essays and class participation. Prereq: Permission of
the course director.

NEUR 473. Introduction to Neurobiology (3)
(See BIOL 473.) Cross-listed as BIOL 473.

NEUR 474. Neurobiology of Behavior (3)
(See BIOL 474.) Cross-listed as BIOL 474.

NEUR 476. Neurobiology Laboratory (3)
(See BIOL 476.) Cross-listed as BIOL 476.

NEUR 478. Computational Neuroscience (3)
Computer simulation of neurons and neural circuits, and the computa-
tional properties of nervous systems. Students are taught a range of mod-
els for neurons and neural circuits, and are asked to implement and ex-
ploration the computational and dynamic properties of these models. The
course introduces students to dynamical systems theory for the analysis
of neurons and neural networks, as well as to cable theory, passive and ac-
tive compartmental modeling, numerical integration methods, models of
plasticity and learning, models of brain systems, and their relationship to
artificial neural networks. Term project required. Two lectures per week.
Cross-listed as EECS 478.

NEUR 479. Seminar in Computational Neuroscience (3)
Readings and discussion in the recent literature on computational neuro-
science, adaptive behavior, and other current topics. Cross-listed as BIOL
479.

NEUR 518. Cell Surfaces and Matrices (3)
Lecture and discussion course emphasizing current advances in cell-cell
and cell-substrate interactions. Cross-listed as CLBY 518 and MBIIO 518.

NEUR 534. Neurogenetics (3)
This course will explore how principles of genetics can be used as tools
to study the complex organization of the nervous system. Examples will
be drawn from all relevant model organisms including nematode, fruit
fly, mouse, and human. Meant primarily for students with an interest in
neuroscience, this course will offer a strong foundation in genetic prin-
ciples using examples drawn from the neuroscience literature. Students
in other disciplines, especially genetics, will benefit from the examples
to learn important aspects of the neurosciences ranging from behavior to
development. These interdisciplinary features make this course unique in
its offerings and a valuable addition to many students’ course of study.
Prereq: CBIO 453 and CBIO 455. Cross-listed as GENE 534.

NEUR 601. Research in Neuroscience (1-18)
NEUR 701. Dissertation Ph.D. (1-18)
NEUR 702. Appointed Dissertation Fellow (9)

Department of Nutrition
School of Dentistry Building
Room 201
Phone 216-368-2440
Fax 216-368-6644
Website: http://www.cwru.edu/med/nutrition/home.html

Chair: Henri Brunengraber, M.D., Ph.D.

The department’s focus is on human nutrition and the applica-
tion of the science of nutrition to the maintenance and improve-
ment of health. Undergraduate programs are designed for students
interested in nutritional biochemistry and metabolism, molecular
nutrition, professional study in dietetics, public health nutrition,
medicine, dentistry or nursing. Graduate programs emphasize
dietetics, public health nutrition, nutritional biochemistry and
molecular nutrition.

The Department of Nutrition offers programs leading to the
following: bachelor of science degree in nutrition, bachelor of arts
degree in nutrition, bachelor of arts degree in nutritional biochem-
istry and metabolism, bachelor of science degree in nutritional
biochemistry and metabolism, master of science degree in
nutrition, master of science degree in public health nutrition, and
doctor of philosophy degree. A nutrition minor is available.
Specialty programs are available in areas such as maternal and
child nutrition or gerontology. The specialty is in addition to the
basic graduate degree.

Special announcements describing the various programs and
providing additional information are available from the depart-
ment.

Undergraduate Programs
Please see the College of Arts and Sciences section in this
publication.

Graduate Programs
Master of Science Degree in Nutrition

This degree program offers two options. For those pursuing the
thesis option, 30 semester hours of a planned program of study are
required, including six to nine semester hours of research, as well
as a final oral defense of the thesis. The non-thesis option requires
30 semester hours and a final written, comprehensive examina-
tion.

All candidates are required to take 15 semester hours of nutri-
tion, including six hours of advanced human nutrition. In addition,
students are encouraged to pursue complementary studies in the
biomedical sciences, social and behavioral sciences, or manage-
ment. The plan of study may vary considerably depending on the
education, goals and specific interests of each student. Students
may elect to focus on nutritional biochemistry and metabolism,
and molecular nutrition. The individual program also may be
planned to fulfill the academic requirements for dietetic registra-
tion and membership in the American Dietetic Association.
Master of Science Degree in Public Health Nutrition/Internship

The primary goal of this program is to prepare nutrition specialists to function in public health/community agencies. A minimum of 35 semester hours of combined academic work and field experience is required to earn the degree. Course work focuses on human nutrition, dietetics, and the public health sciences. Field experience is concurrent with course work utilizing local community agencies for direct application of theory to practice. The final phase of the program is an eight-week, full-time experience with a public health agency that has a strong nutrition component. The student works closely with an advisor throughout the program, on an individual basis.

In addition to the general health program, students may elect to specialize in maternal and child nutrition or gerontology. The gerontology specialty is certified through the Center on Aging and Health located on campus. Each specialty requires additional semester hours of academic work. A portion of the field experience is specified for either population group.

For students wishing to become eligible to sit for the Registered Dietitian (R.D.) examination, the program is also currently granted developmental accreditation by the Commission on Accreditation for Dietetics Education (CADE) of the American Dietetic Association as an Internship. CADE is a specialized accrediting body recognized by the Commission on Recognition of Postsecondary Accreditation and the United States Department of Education.

Coordinated Dietetic Internship/Master’s Degree Program

The Coordinated Dietetic Internship/Master’s Degree Program combines academic work with clinical practice at either of the dietetic internships at University Hospitals of Cleveland or the Louis Stokes Cleveland Department of Veterans Affairs Medical Center. A minimum of 27 semester hours is required. Admission is contingent on the student’s being selected and matched to one of the hospitals. Appointment to these internships follows the admission procedure outlined by the Commission on Accreditation for Dietetics Education of the American Dietetic Association. Contact the Department of Nutrition for information regarding application.

Doctor of Philosophy Degree in Nutrition

The Doctor of Philosophy degree in nutrition is awarded for study and research in nutrition. Areas of concentration are: clinical or community nutrition, nutritional biochemistry and metabolism, and molecular nutrition.

Additional information about graduate degree programs may be obtained from the department.

Nutrition (NTRN)

Undergraduate Courses
(Please see College of Arts and Sciences)

Graduate Courses

NTRN 410. History of Food and Nutrition (3)
Investigations of the development of nutrition as a science and interactions with medicine, agriculture, public health and dietetics. Food and technological effects on health. Prereq: Consent of instructor.

NTRN 433. Advanced Human Nutrition I (4)
Emphasis on reading original research literature in energy, protein and minerals with development of critical evaluation and thinking skills. Prereq: NTRN 201 and CHEM 223 and BIOL 348 or equivalent.

NTRN 434. Advanced Human Nutrition II (3)
Emphasis on reading original research literature on vitamins with development of critical evaluation and thinking skills. Prereq: NTRN 433 or consent.

NTRN 435. Maternal and Child Nutrition (3)
Study of current research literature on nutrition for pregnancy, lactation, infancy and childhood, including assessment and requirements. Prereq: Nutrition major or consent of instructor.

NTRN 437. Evaluation of Nutrition Information for Consumers (3)
Reading and appraisal of food and nutrition literature written for the general public, including books, periodicals, and audio and visual sources. Prereq: Nutrition major or consent of instructor.

NTRN 438. Trends in Diet Therapy (3)
Evaluation and interpretation of modern concepts of nutrition related to abnormalities requiring dietary modifications. Prereq: NTRN 365 or equivalent.

NTRN 440. Nutrition for the Aging and Aged (3)
Consideration of the processes of aging and needs which continue throughout life. The influences of food availability, intake, economics, culture, physical and social conditions and chronic disease as they affect the ability of the aged to cope with living situations. Prereq: Nutrition major or consent of instructor.

NTRN 446. Advanced Maternal Nutrition: Special Topics (3)
Analysis of the problems commonly associated with high-risk pregnancies and fetal outcome. Discussion of causes, mechanisms, management and current research. Prereq: NTRN 455 or consent.

NTRN 451. Food Service Systems Management (3)
Application of organizational theory and skills in the preparation and service of quantity food. Laboratory experiences in professional food services are included. Students will analyze one aspect of food service management in depth. Prereq: Nutrition Major or consent.

NTRN 452. Nutritional Biochemistry and Metabolism (3)
Mechanisms of regulation of pathways of intermediary metabolism; amplification of biochemical signals; substrate cycling and use of radioactive and stable isotopes to measure metabolic rates. Prereq: BIOC 307 or equivalent. Cross-listed as BIOC 452.

NTRN 454. Isotope Tracer Methodology (3)
Stable and radioactive isotopes in metabolic research concentrating on the design of in-vitro and in-vivo investigative protocols using mostly stable isotopes and mass spectrometric analysis; critical interpretation of data from the recent literature; and pathway identification and kinetics. Prereq: BIOC 407.

NTRN 455. Molecular Nutrition (3)
Nutrient control of gene expression in mammalian cells and deregulation of expression of these genes. The molecular basis of nutrition-related diseases, such as diabetes mellitus, PKU, and LDL-receptor deficiency, will be discussed. The application of genetic manipulation to metabolism and nutrition will be evaluated. Prereq: BIOC 407.

NTRN 460. Sports Nutrition (3)
Study of the relationships of nutrition and food intake to body composition and human performance. Laboratory sessions include demonstrations of body composition and fitness measurements and participation in a research project. Prereq: NTRN 365 or NTRN 433 or consent.

NTRN 516. Seminar in Dietetics I (4)
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Prereq: Dietetic internship.

NTRN 517. Seminar in Dietetics II (4)
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Prereq: Dietetic internship.

NTRN 528. Introduction to Public Health Nutrition (3)
Philosophy, objectives, organization, and focus of government and voluntary agencies with emphasis on nutrition components. Prereq: Public health nutrition majors only.
NTRN 530. Public Health Nutrition (3)
Analysis of public health programs in government and voluntary health agencies and the effect of legislation. Emphasis on integration with other disciplines working in public health settings and the role of a public health nutritionist. Prereq: Consent of instructor.

NTRN 531. Public Health Nutrition Field Experience (1-6)
Individually planned public health experience. May be concurrent with course work in local agencies or in blocks of full-time work with a city, county, or state health agency. Prereq: Open to public health nutrition students only.

NTRN 532A. General Nutrition Care (1-3)
Individually arranged clinical experience.

NTRN 532C. Specialized Public Health Nutrition Field Experience (1-3)
Individually arranged clinical experience. Prereq: Public Health Nutrition students only.

NTRN 532D. Hospital Dietetics (1-3)
Individually arranged clinical experience.

NTRN 532E. Clinical Research: Methods in Nutrition and Metabolism (3)
Individually arranged.

NTRN 533. Nutritional Care of Neonate (3)
Nutritional assessment and management of high-risk newborns with emphasis on prematurity and low birth weight. Review of current literature coordinated with clinical experience in the neonatal intensive care unit. Issues on follow-up included. Prereq: NTRN 455 or consent.

NTRN 550A. Advanced Community Nutrition (3)
Development of skills needed by the community dietitian. Emphasis on effective tools for service development and delivery. Recommended courses of action for the professional.

NTRN 550B. Seminar: Dietetics (1)

NTRN 551. Seminar in Advanced Nutrition (2-3)

NTRN 561. Investigative Methods in Nutrition (1-4)
Research methods appropriate for nutrition. Methods for conducting research in nutrition and food sciences, food service management and dietetics. Designing research proposals. Prereq: Nutrition major or consent of instructor.

NTRN 601. Special Problems (1-18)

NTRN 651. Thesis M.S. (1-18)

NTRN 701. Dissertation Ph.D. (1-18)

NTRN 702. Appointed Dissertation Fellow (9)

Department of Pathology
Institute of Pathology
2085 Adelbert Road
Phone 216-368-0360
Website: http://www.cwru.edu/med/pathology/

Graduate Programs
The Department of Pathology offers graduate educational and research programs in a diverse set of areas, collectively referred to as experimental pathology. The doctoral program is designed to train the graduate for a career in basic biomedical science, academic medicine or industry via an experience that provides a fundamental understanding of normal and disease processes and an ability to apply sophisticated research tools for their analysis. Training leading to the Doctor of Philosophy (Ph.D.) degree can be predoctoral, postdoctoral (Doctor of Medicine, Doctor of Dental Surgery, Doctor of Veterinary Medicine) or part of a combined M.D./Ph.D. (Medical Scientist Training Program, please see separate listing in this publication) program.

Facilities
The research facilities are commensurate with the needs of the most contemporary of laboratories. Facilities include, for example, equipment for flow cytometry, mass spectrometry, confocal microscopy, transmission electron microscopy, cell culture, monoclonal antibody production, and recombinant DNA technologies. The department has particular commitments to immunology, cancer biology, tissue injury and healing, biomaterials biocompatibility, neurobiology and aging. Members of the faculty are specialists in immunology, neuropathology, cell biology, vascular biology, molecular biology, virology and carcinogenesis.

Pathology (PATH)

Undergraduate Courses
PATH 390. Undergraduate Research in Cancer Biology, Immunology, or Pathology (1-3)
Students undertake a research project directly related to ongoing research in the investigator's/instructor's laboratory. Written proposal outlining research topic, a schedule of meetings and format and length of final written report to be prepared prior to registration for credit. Prereq: One year of college chemistry and consent of instructor.

PATH 395. Selected Readings in Immunology, Cancer Biology, or Pathology (1-3)
Relevant readings and literature search on particular immunology, cancer biology or pathology topic(s) chosen by the student and directed by the instructor. Written proposal outlining chosen topic, type of work to be done, a schedule of meetings and format and length of final written report to be prepared prior to registration for credit. Prereq: Consent of instructor.

Graduate Courses
PATH 410. Aging and the Nervous System (1)
Lectures and discussion on aspects of neurobiology of aging in model systems; current research on Alzheimer's, Parkinson's, and Huntington's diseases. Prereq: Consent of instructor.

PATH 412. Theories of Aging and Longevity (1)
Insight into current theories of aging of molecules, cells, extracellular elements and their relationship to lifespan in human beings and other vertebrates. Lecture/journal club format. Prereq: Consent of instructor.

PATH 415. Cytoskeleton and Disease (1)
Discussion of recent papers that have added to knowledge of normal cytoskeletal functions and their alterations in disease. Prereq: Consent of instructor.

PATH 416. Fundamental Immunology (3)
Introductory immunology providing an overview of the immune system, including activation, effector mechanisms, and regulation. Topics include antigen-antibody reactions, immunologically important cell surface receptors, cell-cell interactions, cell-mediated immunity and basic molecular biology of B and T lymphocytes. Lectures emphasize experimental findings leading to the concepts of modern immunology. Prereq: BIOL 210 or BIOL 215, graduate standing and consent of instructor. Cross-listed as BIOL 416 and CLBY 416.

PATH 417. Cytokines: Function, Structure, and Signaling (3)
Regulation of immune responses and differentiation of leukocytes is modulated by proteins (cytokines) secreted and/or expressed by both immune and non-immune cells. Course examines the function, expression, gene organization, structure, receptors, and intracellular signaling of cytokines. Topic include regulatory and inflammatory cytokines, colony stimulating factors, chemokines, cytokine and cytokine receptor gene families, intracellular signaling through STAT proteins and tyrosine phosphorylation, clinical potential, and genetic defects. Lecture format using texts, scientific reviews and research articles. Prereq: PATH 416 or equivalent. Cross-listed as BIOL 417 and CLBY 417.

PATH 418. Tumor Immunology (2)
Interactions between the immune system and tumor cells. Topics include the historical definition of tumor specific transplantation antigens, immune responses against tumor cells, the effects of tumor cell products on host immune responses, molecular identification of tumor specific transplantation antigens and recent advances in the immunotherapy of human cancers. Prereq: PATH 416.
PATH 430. Oxidative Stress and Disease Pathogenesis (1)
Oxidative stress and free radicals are implicated in a number of disease processes including aging, arthritis, emphysema, Alzheimer’s disease and cancer. Lecture course with discussion of recent studies concerning the formation and destructive mechanisms of free radicals in the context of various disease processes. Students read assigned papers and discuss these in class. Prereq: Consent of instructor.

PATH 432. Biomedical and Molecular Aspects of Vision (3)
Increasingly, progress in the study of visual science is requiring multidisciplinary approaches that draw from the areas of biochemistry, genetics, molecular biology, neuroscience and pathology. We have recognized this fact and have adapted this course to fit the needs of tomorrow’s scientists. This course encompasses the basic science aspects of the eye. Subjects include retinal anatomy and function; biochemical, molecular aspects of retinal disease and cataract; cellular and molecular neuroscience aspects pertinent to the visual system. Cross-listed as NEUR 432 and PHRM 432.

PATH 444. Neurodegenerative Diseases:Pathological,Cell. & Molecular Perspectives (3)
This course, taught by several faculty members, encompasses the full range of factors that contribute to the development of neurodegeneration. Subjects include pathological aspects, neurodegeneration, genetic aspects, protein conformation and cell biology in conditions such as Alzheimer’s disease, Parkinson’s disease, amyotrophic lateral sclerosis and prion diseases. Students read assigned primary literature and present and discuss these in class. Prereq: Consent of instructors.

PATH 446. Host-Virus Interactions (3)
(See MVIR 446.) Cross-listed as MVIR 446.

PATH 465. Advanced Immunobiology (3)
Advanced immunology topics course covering the most important and recent advancements in specific areas of immunobiology. Course organization includes lectures by the faculty to give an overview of each topic emphasizing the recent advancements in that area, followed by student presentations of important papers and discussion on related topics. Course also includes participation in an immunology journal club (literature review/discussion session). Prereq: PATH 416.

PATH 477. Cellular and Molecular Basis of Immune Dysfunction (3)
Lectures and student presentations focusing on immunologic mechanisms of tissue injury, disorders of the immune response and diseases of immunocompetent cells. Hypersensitivity, allergy, immune complex disease, immune deficiency, lymphoma and multiple myeloma discussed from chemical, cellular and physiological perspectives. Prereq: PATH 416 or consent of instructor.

PATH 480. Immunology, Evolution, and Logic (3)
Review and discussion of current research papers and selected sections of scientific books to explore connections between immunological recognition, evolution and logic. Emphasis placed on student analysis of scientific concepts, interpretation of data and synthesis of ideas. Prereq: PATH 416 or PATH 510 or consent of instructor.

PATH 481. Immunology of Infectious Diseases (3)
Lectures and discussion on the immune response to infectious organisms, including bacteria, viruses and parasites. Emphasis on human responses but includes discussions of animal models. Other topics include vaccines and infections in immuno-compromised hosts. Prereq: PATH 416 or consent of instructor. Cross-listed as MVIR 481.

PATH 487. Cell Biology of the Nucleus (3)
Discussion of current cell biology research on the structure and functions of the nuclear envelope, the matrix and chromatin. Prereq: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456 or consent of instructor. Cross-listed as CLBY 487.

PATH 488. Yeast Genetics and Cell Biology (3)
(See MBIO 488.) Prereq: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456. Cross-listed as MBIO 488.

PATH 510. Basic Pathologic Mechanisms (4)
An interdisciplinary introduction to the fundamental principles of molecular and cellular biology as they relate to the pathologic basis of disease. Lectures, laboratories, conferences. Prereq: Consent of instructor.

PATH 511. Experimental Pathology Seminar I (1)
Weekly discussions of current topics and research by students, staff and distinguished visitors.

PATH 512. Experimental Pathology Seminar II (1)
Weekly discussions of current topics and research by students, staff and distinguished visitors.

PATH 525. Transport and Targeting of Macromolecules in Health and Disease (3)
Each class includes introductory lecture, followed by student participation in interactive discussion of 3 to 5 research publications. At the end of the course, the students are expected to submit a paper or a short research proposal on any of the topics discussed during the course. Prereq: CBIO 453, CBIO 454, CBIO 455, and CBIO 456. Cross-listed as CLBY 525.

PATH 527. Mechanisms of Cell Growth Control (3)
In-depth study of examples of cellular growth control involving hormonal, metabolic, transcriptional and post-translational mechanisms in higher eukaryotes using current scientific reviews and research articles. During each class period, students summarize research articles orally and lead discussions of the scientific points raised in the papers, with facilitation by the instructor. Emphasis placed not only on the scientific content of the papers, but also on developing skills of interpretation of published work and oral presentation. Attendance at research seminars relevant to the topic also required. Prereq: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456 and consent of instructor.

PATH 601. Special Problems (1-18)
Research on the nature and causation of disease and on host factors which tend to protect against disease. Special courses and tutorials in subspecialty areas of general and/or systemic anatomy and/or clinical pathology. Prereq: Consent of Chair of Graduate Committee.

PATH 651. Thesis M.S. (1-18)

PATH 701. Dissertation Ph.D. (1-18)

PATH 702. Appointed Dissertation Fellow (9)

Department of Pharmacology
Room W-312 School of Medicine
Phone 216-368-4617
http://pharmacology.cwru.edu/

Graduate Program

The Department of Pharmacology offers training leading to the Ph.D. or M.D./Ph.D. degree for highly qualified post-undergraduate candidates committed to academic research careers in the biomedical sciences. Adequate preparation in the biological sciences, calculus, organic chemistry, and physics or physical chemistry is a prerequisite for admission.

Multidisciplinary training, carried out by faculty in pharmacology and other basic science departments, emphasizes molecular, cellular and clinical aspects of the pharmacologic sciences. Areas of faculty expertise include drug/xenobiotic metabolism; drug/hormone/mediator receptors, receptor-ligand interactions, and biochemical reaction mechanisms; cell biology and structure of membrane components; macromolecular structure and function; intracellular signaling, endocrine and metabolic regulation; hormonal regulation of gene expression; neuroscience/neuropsychopharmacology-oncology; psychopharmacology; developmental biology/pharmacology; structural analysis of function; and clinical pharmacology.

Students seeking the Ph.D. degree are admitted directly into the Department of Pharmacology or through the Biomedical Sciences Training Program (BSTP, please see separate entry in this publication), which provides an introduction to many related training areas within the biomedical field during the first year. Thus,
students follow an integrated first-year sequence of course work that involves a core curriculum in cell and molecular biology. In addition, the first year includes three research rotations that allow the students to sample areas of research and become familiar with faculty members and their laboratories. Selection of a specific training program and thesis advisor is made before the end of the first year.

Students pursue advanced-level courses—including a core of courses on molecular pharmacology, fundamentals of therapeutic agents, and pharmacokinetics—that emphasize principles of molecular structure, drug receptor interactions, mechanisms of drug action, and the absorption, distribution, metabolism and excretion of drugs, as well as adverse drug interactions illustrating these principles.

Admission to Ph.D. candidacy is based on successful course work, laboratory performance and the completion of a two-part qualifying exam. The Ph.D. degree is awarded to students who complete a research project leading to an original and meritorious scientific contribution that is accepted for publication by a leading journal in the chosen field.

Students who desire the combined M.D./Ph.D. degrees are admitted to the Medical Scientist Training Program (MSTP, please see separate listing in this publication). These students participate in the two-year integrated preclinical curriculum of the School of Medicine, which features clinical correlation of basic biologic concepts. Combined degree students who select the Ph.D. in pharmacology undertake a series of advanced courses, research rotations, preliminary examinations and dissertation research similar to that described above for conventional Ph.D. candidates.

Facilities

The Department of Pharmacology occupies more than 20,000 net square feet in the School of Medicine Harland Goff Wood Building. It currently houses the Basic Sciences Instrumentation Shop, a nuclear magnetic resonance spectrometer, and a dark room. In addition to cell/tissue culture and advanced chromatographic separation capabilities, more specialized research techniques utilized include various aspects of recombinant DNA and hybridoma technology, in situ hybridization histochemistry and mass spectroscopy.

Pharmacology (PHRM)

Undergraduate Course

PHRM 301. Undergraduate Research (1-18)

Graduate Courses

PHRM 400. Research Experience in Pharmacology (0)

Research rotation in Pharmacology.

PHRM 413. Molecular and Genomic Pharmacology (3)
The primary goal of this seminar style course is the development of a critical approach to the evaluation and design of research in the broad context of the interaction of receptors with endogenous ligands and with drugs and the determination of the polygenetic basis of disease states and interindividual variation in responsiveness to drugs. Lectures and/or journal article presentation will illustrate the application of fundamental principles of chemistry, biochemistry, thermodynamics, genomics, and pharmacology to experimental problem solving. Students and faculty participate as discussion leaders. Prereq: Consent of instructor.

PHRM 421. Fundamentals of Therapeutic Agents (3)
A rational approach to the use of drugs based upon a knowledge of receptor theory and a consideration of the pharmacokinetic factors that limit the duration of drug action. Prereq: Consent of instructor.

PHRM 423. Drug Action and Biodisposition (3)
Mechanisms of therapeutic action and adverse side effects for major drug classes leading to a rational approach to drug choice using a problem-solving approach based on selected disease states. Prereq: Consent of staff.

PHRM 430. Advanced Methods in Structural Biology I (3)
(See BIOC 430.) Cross-listed as BIOC 430.

PHRM 432. Biochemical and Molecular Aspects of Vision (3)
Increasingly, progress in the study of visual science is requiring multidisciplinary approaches that draw from the areas of biochemistry, genetics, molecular biology, neuroscience and pathology. We have recognized this fact and have adapted this course to fit the needs of tomorrow’s scientists. This course encompasses the basic science aspects of the eye. Subjects include retinal anatomy and function; biochemical, molecular aspects of retinal disease and cataract; cellular and molecular neuroscience aspects pertinent to the visual system. Cross-listed as NEUR 452 and PATH 452.

PHRM 433. Membrane Transport Processes (3)

PHRM 434. Mechanisms of Drug Resistance (3)
Resistance to drugs is an important health concern in the new millennium. Over the past century, modern medicine has developed and prescribed drugs for various ailments and diseases with known therapeutic benefit. Since the discovery of antibiotics by Dr. Fleming, we have struggled with a new complication in infectious diseases, development of drug resistance. This course will focus on and compare the drug resistant mechanisms selected by viruses, bacteria, parasites, fungi, and tumor cells. Topics to be covered include antimicrobial resistance (e.g., AZT and protease inhibitors), antibiotic resistance (e.g., B-lactams), resistance to chemotherapeutic agents, and resistance to anti-malarial drugs (e.g., chloroquine). Cross-listed as MBIO 434 and MVIR 434.

PHRM 435. Integrative Systems Physiology and Therapeutics (3)
This is a lecture-based and interactive learning course that will provide in-depth overviews of the major physiological systems in humans and the important drug classes that are used to treat pathophysiologic states within each system. The major topics of discussion include the circulatory, renal, nervous, muscle, gastrointestinal, and endocrine systems as well as a basic chemotherapy section. Typical drugs that target components of each system will be presented by faculty and students. Learning activities will emphasize the molecular mechanisms of action of each drug. Each major topic area will conclude with a problem-based learning session that will consist of interactive, small group learning experiences on drug discovery, action, or related topics. Prereq: Consent of instructor.

PHRM 506. Central Nervous System Pharmacology (3)
Principles of neurotransmission in the central nervous system: the pharmacology of drug-induced alterations in these central systems and neurochemical basis of behavior and selected neurological and psychiatric diseases. Lecture seminar.

PHRM 511. Pharmacology Seminar Series (0-1)
Current topics of interest in the pharmacologist sciences.

PHRM 514. Pharmacokinetics (2)
Seminar on drug absorption, distribution, metabolism and excretion and the mechanisms of adverse drug interaction. Prereq: PHRM 413.

PHRM 515. Endocrine Pharmacology (3)
Seminar lecture course on regulation at the molecular level of selected interrelated endocrine systems. Prereq: Consent of instructor. Cross-listed as BIOC 515.

PHRM 520. Introduction to Cancer Biology and Chemotherapy (3)
Cancer influences the lives of one in three people in the United States. Cancer is multifaceted and a series of diseases within every organ of the body. Recent rapid advances in the fundamental causes, treatment, and prevention of cancer make research in this area important and interesting, not just to students interested in cancer, but to those interested in other fields, such as DNA Repair, Cell Cycle Regulation, Hormonal Regulation, Gene Regulation, Angiogenesis, and basic Molecular and Cellular Biology. This team-taught lecture/seminar course is an introduction to the genetics, prevention, and treatment of cancers. The course represents a survey covering: DNA damage and repair; cancer genetics; chemi-
cal carcinogenesis and prevention; signal transduction; cell cycle checkpoint regulation; hormonal regulation; chemotherapy and apoptosis. This course will also include an examination of the pathology of cancer and cancer epidemiology and biostatistics, in addition to the cellular and molecular biology of cancer. Prereq: Consent of instructor.

PHRM 523. Advanced NMR Spectroscopy in Structural Biology (3)
(See PHOL 523.) Cross-listed as PHOL 523.

PHRM 525. Topics in Cell and Molecular Pharmacology (3)
Individual library research project under the guidance of a pharmacology sponsor. Projects will reflect the research interest of the faculty sponsor, including molecular endocrinology, neuropharmacology, receptor activation and signal transduction, molecular mechanisms of enzyme action and metabolic regulation. Prereq: Consent of instructor.

PHRM 543. Developmental Pharmacology (3)
Principles of ontogeny related to drug sensitivity. Lecture, literature.

PHRM 601. Independent Study and Research (1-18)

PHRM 651. Thesis M.S. (1-18)

PHRM 701. Dissertation Ph.D. (1-18)

PHRM 702. Appointed Dissertation Fellow (9)

Department of Physiology and Biophysics
Room E-541 School of Medicine
Phone 216-368-5529
http://physiology.cwru.edu/

Graduate Programs
The Department of Physiology and Biophysics offers graduate training in contemporary physiology and biophysics and has three programs leading to the Ph.D. It also has two programs leading to master of science degrees, in exercise physiology and physiology.

The major goals of the Ph.D. programs are to provide students with a broad knowledge base in organ systems and integrated physiology and in-depth expertise and outstanding research potential in the fields of cellular and molecular physiology and molecular biophysics. These goals are accomplished by a series of foundation and advanced topic courses, skill development courses, laboratory rotations and thesis research.

The department offers four graduate-level programs, each of which use state-of-the-art biophysical instrumentation and experimental approaches that provide excellent training in these areas.

The Department of Physiology and Biophysics has expanded its faculty, defined a new research and educational focus, and completely renovated its facilities. The revitalization is part of the renaissance of the basic science departments in the School of Medicine at Case Western Reserve University, which has resulted in the formation of a major center of excellence in biomedical research and graduate and medical education.

Admission Requirements for the Ph.D. programs
Applications to the program are available from and should be submitted to the Department of Physiology and Biophysics. Typically, entering students will have a B.A., B.S. or M.Sc. degree in physical or life sciences. Requirements for admission:

• An appropriate undergraduate or master’s degree.
• Undergraduate/graduate transcripts.
• GRE scores (plus TOEFL for international students).
• Three letters of recommendation.

Status of admission to the program is determined by a committee of faculty members based on application information and (often) candidate interviews. Normally, students enter the program in the fall semester.

Students apply for financial assistance when they apply to the program. A majority of admitted students receive a stipend, health insurance and full tuition remission during the duration of their studies in the program.

Functional Description of the Ph.D. Programs
Entering students are advised by the program steering committee until they pass their Ph.D. qualifying exam (usually at the end of their second fall semester), at which point their progress is overseen by a pre-thesis/thesis committee in conjunction with a research preceptor.

The program consists of core and elective course requirements, laboratory rotations, attendance of seminar series, written and oral qualifying exams, and thesis research. Elective courses provide an opportunity for advanced study relevant to the student’s particular research interests.

Students are required to complete three laboratory rotations by the end of their first full year of study. These rotations enable the student to sample the diverse research areas represented in the program and assist the student in making a well-informed choice of thesis laboratory. Students also are required to attend the seminar series of either or both of the sponsoring departments throughout the duration of their studies to gain wide exposure to cutting-edge research.

Near the beginning of their second year of study, students in good standing (>3.1 GPA and a maximum of 1 “C”) choose their research preceptor and take their Ph.D. qualifying exam. The written portion of this exam is an NIH-format research grant proposal written by the student based on his or her choice from several faculty-provided topics. The proposal is evaluated by several faculty members and must receive an acceptable score for the student to advance to the oral stage of the examination. Students who do not pass the written portion are afforded one opportunity to revise and resubmit the proposal for re-evaluation.

The oral examination involves a brief presentation of the proposal by the student followed by a question/answer discussion between the student and the faculty reviewers, which will test the student’s general knowledge of cell physiology or systems physiology. In some cases, the qualifying exam committee may pass the student but make recommendations for additional course work to be completed to address areas of weakness in the student’s knowledge and expertise.

Following satisfactory completion of the qualifying exam, the student and his or her Ph.D. preceptor submit a list of four to six faculty to serve on the student’s pre-thesis/thesis advisory committee; this list is submitted to the director of the program for approval/revision in consultation with the steering committee of the program. The research progress of the student is then overseen by this committee through a series of periodic progress report meetings.

Specific requirements for graduation include satisfactory general knowledge in biophysics and bioengineering, specific expertise in the student’s chosen area of research, completion of dissertation, and completion by the student and acceptance by major peer-reviewed journals of two full first-authored research papers.

Ph.D. in Physiology and Biophysics
The Ph.D. in physiology and biophysics focuses on the major research areas represented in the department, such as cell physiology and molecular biophysics, with an emphasis on intracellular signaling. The research projects cover different levels of organization, ranging from the investigation of subcellular events to whole-organ physiology.

Ph.D. in Biophysics and Bioengineering
The Ph.D. program in biophysics and bioengineering is taught in conjunction with the Case School of Engineering. It draws on the
combined expertise of the faculty from the departments of physiology and biophysics and biomedical engineering.

**Master of Science in Exercise Physiology**

The master of science program in exercise physiology has been designed to meet the needs of today’s society in terms of the increased emphasis on fitness. It can serve as a terminal degree for those interested in a career in exercise physiology in a variety of settings; as an intermediate step to obtaining an advanced degree in physiology; or as a supplement to the education of medical students and resident physicians who wish to gain knowledge in the field of exercise physiology as an adjunct to their clinical training.

**Ph.D. in Cell Physiology**

One of the major research areas represented in the department is cell biology and cellular regulation, with a focus on membrane transport and intracellular signaling. The faculty of this program conduct very active research activities focused on the study of protein structure and function, functional genomics, control of cell metabolism, regulation of ionic and electrical gradients, and regulation of various cellular functions. Most of the experimental approaches use cell biology, protein chemistry, molecular biology and electrophysiologic tools.

Cell biology encompasses the study of membrane proteins, including receptors and ion channels, signaling pathways, protein phosphorylation, enzyme regulation, transport mechanisms, and gene expression. Research programs in this department are directed toward understanding specialized functions of a variety of cell types, including epithelial, mesodermal and neuronal cells, and cells of endocrine glands. Several investigators are attempting to understand mechanisms for the targeted transport of macromolecules along biosynthetic and endocytotic pathways, as well as across nuclear membranes. Studies also are under way to determine how cellular machinery might be utilized for therapeutic purposes, including receptor-mediated gene therapy.

Molecular biologic techniques are powerful tools for the study of biologic phenomena and also are the driving force behind the biotechnology industry. Many investigators in the Department of Physiology and Biophysics are using molecular genetic techniques in their research program. This work seeks to understand how transcription factors turn on specific genes at the appropriate time and in the appropriate tissue, how messenger RNA levels are regulated by RNA editing and splicing, how introducing mutant receptors and structural proteins into cultured cells and transgenic animal affects cell function and animal development, and how viral and cellular oncogenes perturb normal cell function and cause cancer. These studies are important for the understanding of critical events regulating cardiovascular development, skin differentiation, ion homeostasis, receptor signaling and cancer progression.

The research interests of several faculty in the Department of Physiology and Biophysics are directed at understanding the electrophysiologic properties of nerve, muscle and other tissues at a variety of different levels. This includes everything from investigating the structural basis of ion channel function to identifying the mechanism of cardiac arrhythmias. Several different molecular and biophysical approaches are used to address these questions. These approaches include the cloning and expression of ion channel proteins, reconstitution of channels in artificial lipid bilayers, and recording single-channel and whole-cell currents using various voltage-clamp techniques. Mathematical models and computer simulations also are used to describe and predict the electrical behavior of everything from single ion channels to whole organs.

**Planned Program of Study for Cell Physiology:**

**FIRST YEAR**

**Fall**

*Course (Credit Hours)*

PHOL 432 Cell Structure and Function (3)
PHOL 460 Introductory Molecular Biology (3)
PHOL 480 Physiology of Organ Systems (3)
PHOL 498-01 Physiology and Biophysics Seminar (1)
PHOL 505-01 Laboratory Research Rotation (3)

**Spring**

PHOL 456 Structure and Function of Proteins (3)
PHOL 465 Responsible Conduct in Scientific Research (1)
PHOL 466 Cell Signaling (3)
PHOL 468 Membrane Physiology (3)
PHOL 498-02 Physiology and Biophysics Departmental Seminar (1)
PHOL 505-02 Laboratory Research Rotation (3)
PHOL 505-03 Laboratory Research Rotation (3)

**Ph.D. in Systems Integrated Physiology**

The revolutionary advances in cell and molecular biology have provided spectacular insights into the understanding of structure and function of biologic systems. Integrative systems physiology is a discipline that embraces the concepts of cell/molecular physiology, biochemistry and allied sciences and applies the principles and experimental approaches to the study of human or animal organ systems. The major goal of the graduate program in systems integrated physiology is to provide trainees with intensive training in interdisciplinary sciences with an emphasis on integration of function of the cardio-respiratory systems at the molecular, cellular, organ and whole animal or human levels. Examples of specific areas of research include cardiac metabolism, transmitters and second messengers in control of cardio-respiratory systems, excitation-contraction coupling, sudden infant death syndrome, and computational biology. The faculty in this program use a vast repertoire of experimental approaches ranging from whole body physiology to organ and cellular and molecular physiology.

**Planned Program of Study for Systems Integrated Physiology:**

**FIRST YEAR**

**Fall**

*Course (Credit Hours)*

PHOL 432 Cell Structure and Function (3)
PHOL 460 Introductory Molecular Biology (3)
PHOL 480 Physiology of Organ Systems (3)
PHOL 498-01 Physiology and Biophysics Seminar (1)
PHOL 505-01 Laboratory Research Rotation (3)

**Spring**

EPBI 407 Basic Biostatistics for Medical Scientists (1)
PHOL 465 Responsible Conduct in Scientific Research (1)
PHOL 468 Membrane Physiology (3)
PHOL 514 Principles of Cardiovascular Research from Organ to Cellular Systems (3)
PHOL 518a Integrative Approaches - Cardiorespiratory Research (3)
PHOL 519 Integrative Approaches - Cardiorespiratory Research II
PHOL 498-02 Physiology and Biophysics Departmental Seminar (0)
PHOL 505-02 Laboratory Research Rotation (3)
PHOL 505-03 Laboratory Research Rotation (3)

**Ph.D. in Biophysics/Bioengineering**

The Biophysics and Bioengineering Program was formed in 1991 in response to (1) dramatic advances in computers and instrumentation; (2) spectacular progress in biochemistry and molecular biology; and (3) the realization that integrated systems/engineer-
These synergistic advances provide tremendous opportunities for researchers interested in biology who are equipped to take quantitative approaches. A spectacular example is found in the area of structural biology, where the number of high-resolution 3-D structures of biologic macromolecules solved and deposited into the Brookhaven Protein Databank has jumped from an average of 40 structures per year from 1975 to 1985 to 1,850 structures in 1997 alone. Another example is found in electrophysiology, where now it routinely is possible to measure transmembrane currents conducted by single ion channel protein molecules. Further, the tools of molecular biology now routinely are used to facilitate the large-scale preparation of proteins and nucleic acids, thereby providing access to a host of biomedically and biotechnologically important molecules that previously were unavailable in significant quantities.

The various genome projects are generating a staggering quantity of sequence data that will lay the basis for much of the biological and biomedical research of this new century. As a result of such advances and developments, new approaches to explaining, exploiting and controlling the components of biologic systems for basic science, biotechnologic, or medical reasons are both required and feasible.

The Biophysics and Bioengineering Program is an interdisciplinary Ph.D. program, co-sponsored by the Department of Physiology and Biophysics in the medical school and the Department of Biomedical Engineering. The program complements other graduate programs of those departments. The goals of the program are to provide students with the necessary knowledge base in cellular and molecular biology and with the quantitative biophysical and engineering skills required to perform studies that exploit and advance the cutting edge of advanced biophysics technologies. These goals are accomplished through a flexible curriculum that is tailored to the specific needs of the student and by providing a wide range of available faculty expertise and research opportunities.

The program has particular strengths in cellular/electrophysiology and biophysics, biologic imaging, biosensors, tissue engineering, modeling, biomaterials, and structural biology. Many of the participating faculty are affiliated with the Cleveland Center for Structural Biology, which includes state-of-the-art NMR and x-ray diffraction instrumentation. The program is overseen by a steering committee.

### Planned Program of Study for Biophysics & Bioengineering:

#### FIRST YEAR

**Fall**

- **Course (Credit Hours)**
- PHOL 432 Cell Structure and Function (3)
- PHOL 460 Introductory Molecular Biology (3)
- EBME 409 Systems and Signals (3)
- One of the following*:
  - PHOL 498 Physiology and Biophysics Departmental Seminar (1)
  - PHOL 499 Biophysics/Bioengineering (1)
- PHOL 505-1 Laboratory Research Rotation (3)

**Spring**

- PHOL 456 Structure and Function of Proteins (3)
- PHOL 465 Responsible Conduct of Scientific Research (1)
- PHOL 468 Membrane Transport (3)
- PHOL 498/99-2 Physiology and Biophysics Departmental Seminar* (1)
- PHOL 505-2 Laboratory Research Rotation (3)
- Elective (3)

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### Ph.D. Program for M.D.s

To address the need to train M.D.-scientists, the Department of Physiology and Biophysics has instituted an accelerated Ph.D. program specifically geared to physicians interested in research. The key features of the program are its selectivity in terms of admissions qualifications—it is open only to those holding medical degrees—and its accelerated nature based on a rigorous course of study and research training. The program is subdivided into advanced specialty courses (cell physiology electives) and hands-on research training and problem-solving (laboratory rotations, departmental seminars, qualifying examination, and thesis research). All students enrolled in the program must fulfill the general academic regulations for doctoral degrees as set forth by the School of Graduate Studies.

Application is open to any individual holding a medical degree or expecting to receive one before entry into the program. Selection for admission is based on the applicant’s potential for independent and innovative research as evidenced by an outstanding academic record in basic science disciplines, previous research experience, and three letters of recommendation. The full-time plan of study consists of a minimum of 22 semester hours of coursework and 18 semester hours of thesis research. The program can be linked to research-oriented residency programs such as the Clinical Investigator Pathway, approved by the American Board of Internal Medicine, and similar programs in pediatrics and surgery.

### Master of Science in Exercise Physiology

The Department of Physiology and Biophysics master’s program in exercise physiology offers not only a strong didactic component but also, unique within the existing programs at the master of science level, strong research training. This is a Plan A, thesis required, program. The solid basis for the program includes the department’s outstanding faculty and resources, along with faculty who are currently involved in the applied practice of exercise physiology. The didactic components include solid basic science, clinical science and practical applications.

The program has several goals. A primary goal is to serve as a terminal degree for graduates who will pursue careers in exercise physiology in a variety of settings, including counselors in health clubs, personal trainers, clinical technicians in performance function laboratories, and other careers. Another goal is to prepare students for additional advanced work in the field of physiology leading to the Ph.D. degree. A third goal is to supplement the education of medical students and resident physicians who wish to acquire additional knowledge and training in the field of exercise physiology as an adjunct to their clinical careers.

A unique feature of the program is the emphasis on research. All students are expected to complete two laboratory rotations, ultimately selecting a project that leads to a successful thesis. All students will select an advisor no later than the end of the first term of studies. For evaluation of the thesis, each student will select with his/her advisor two additional faculty members to serve as committee members. The thesis work must result in at least one major paper with the student as first author.

Students will take 19 hours of didactic course work, six hours of laboratory rotations and nine hours of thesis, thus meeting the requirements of the School of Graduate Studies.

An earned quality point average of B+ (3.1) or better is required to remain in good standing in the program.

### Admission Requirements for Exercise Physiology

All students must meet requirements for admission to the School of Graduate Studies of Case Western Reserve University. Additional requirements:
The general section of the Graduate Record Exam (GRE).
- The following courses: one year of biology; chemistry courses, including organic chemistry; and introductory physics.
- The following courses are recommended: biochemistry and statistics. A working knowledge of computers also is recommended.

Enrollment as full-time medical student in the School of Medicine at Case Western Reserve University or the previous obtainment of a medical degree may replace the above requirements.

Planned Program of Study for Exercise Physiology Students enrolled solely in the School of Graduate Studies:

Course (Credit hours)
ANAT 377/477 Human Musculoskeletal Anatomy (4)
BIOC 452 Nutritional Biochemistry (3)
PHOL 440 Integrative & Cellular Physiology of Exercise (3)
PHOL 444 Assessment of Human Performance Testing (3)
PHOL 446 Cardiovascular Training (2)
PHOL 465 Responsible Conduct in Scientific Research (1)
PHOL 480 Organ System Physiology (3)
PHOL 505 - 1 & -2 Laboratory Rotations (3 [x 2])
Minimum credit hours in course work: 25
PHOL 651 M.S. Thesis (minimum 9)

Students enrolled in the School of Medicine:

The requirements for organ system physiology and anatomy will be waived for these students because this material is covered in the medical school curriculum. These students still must achieve the minimum number of hours for the School of Graduate Studies.

Students apply for financial assistance when they apply to the program. A majority of students receive tuition remission and paid health insurance during the duration of their studies in the program.

Master of Science in Physiology and Biotechnology

The Department of Physiology and Biophysics' masters program in physiology offers a master of science degree for individuals interested in obtaining post-baccalaureate training in physiology and biomedical laboratory technology. This is a Plan A, thesis-requiring program. The program is geared to serve as a stepping-stone for individuals seeking preparation for later entry into biomedical Ph.D. or M.D. programs.

Uniqueness of the Program:

A unique feature of this program, relative to most master of science degree programs, is a significant emphasis on mentored independent research training, which includes both laboratory experience and formal course work in modern laboratory methodology and instrumentation. During the first year of the program, students enroll in a set of small-group classes that build a foundation of understanding that spans modern molecular biology, cell biology, protein biochemistry, and organs/whole systems physiology. “Hands-on” research experience is intermeshed with didactic course work to ensure that students have a working laboratory understanding of the methods and concepts presented in the classes. During the first year of the program, students are introduced to laboratory research methods by performing closely mentored projects that are introduced and supervised by postdoctoral fellows and faculty members. These projects provide students with in-depth exposure to an array of laboratory methods in a mentored environment and help students appreciate the array of methods and levels of study available within the department.

This experience helps students choose laboratories for their focused research projects performed in the second year.

Thesis Requirements:

In the standard program, the second year is devoted primarily to the development and completion of a research project in the chosen laboratory. Students take an advanced course in laboratory instrumentation and biotechniques; participate in advanced-level seminars, journal clubs, and lab meetings; and perform an independent, mentored research project. Upon completion of their projects, students submit written theses. The second-year research project is an important component of the program, typically leading to a publication in a peer-reviewed scientific journal.

The master in physiology program also can be pursued through an extended plan, in which the course load is tailored to allow current university employees in laboratory technical positions to fulfill the course work and thesis registration requirements over a span of three to four years. In the extended plan, technicians perform their thesis research projects in the context of the laboratories in which they are employed, with permission of their supervisors.

Other Academic Requirements:

- Course work requirements: minimum of 18 credit hours completed for the master of science degree programs.
- Dissertation requirement: minimum of 9 credit hours.
- Quality point requirement to maintain good standing: minimum cumulative grade point average of 3.10 in all courses taken for credit, excluding grades of satisfactory/unsatisfactory; a maximum of one “C” grade.
- Foreign language requirement: none.

Financial Aid:

A limited number of competitive fellowships may be available to qualified applicants in the standard plan of this master of science degree program.

Admission Requirements for Master in Physiology Program:

- All students must meet the requirements for admission to the School of Graduate Studies of Case Western Reserve University.
- Additional requirements:
  1. The general section of the Graduate Record Exam
  2. The following courses:
     a. one year of biology
     b. chemistry courses, including organic chemistry
     c. introductory physics
  3. The following courses are recommended:
     a. biochemistry
     b. statistics
  4. A working knowledge of computers
  5. Enrollment as a full-time medical student in the School of Medicine at Case Western Reserve University or the previous attainment of a medical degree can replace the above requirements

Standard Plan Program of Study for Masters in Physiology:

YEAR 1
Fall:
Course (Credit hours)
PHOL 460 Intro. to Molecular. Biology (3)
PHOL 432 Cell Structure and Function (3)
PHOL 480 Physiology of Organ Systems (3)
PHOL 498-1 Physiology Seminar (1)
PHOL 505 Laboratory Research (3)
PHOL 456 Structure and Function of Proteins (3)

PHOL 460 Intro. to Molecular Biology (3)

PHOL 466 Cell Signaling (3)

PHOL 468B. Membrane Physiology II (4)

PHOL 480 Physiology of Organ Systems (3)

PHOL 505 Laboratory Research (3)

YEAR 2

PHOL 530 Biotechnology and Instrumentation (3)

PHOL 561 M.S. Thesis (Minimum 9)

Minimum credit hours in course work: 25

In the Extended Plan Program, current University employees in laboratory technician positions may be able to pursue a tailored program that involves completion of one course per semester for three to four years, which will include:

PHOL 460 Intro. to Molecular Biology (3)

PHOL 432 Cell Structure and Function (3)

PHOL 480 Physiology of Organ Systems (3)

PHOL 456 Structure and Function of Proteins (3)

PHOL 466 Cell Signaling (3)

PHOL 530 Biotechnology and Instrumentation (3)

In addition to these 18 hours of course work, extended-plan students must take 1 credit of thesis research (PHOL 651) each spring and each fall, and students must take 3 credits of thesis research each summer semester. A minimum of 9 hours of thesis research is required for the degree. As in the standard plan, students must complete a written thesis as part of the program.

PHYSIOLOGY (PHOL)

Undergraduate Courses

PHOL 351. Independent Study (1-6)

This course is a guided program of study in physiology textbooks, reviews, and original articles. Guided laboratory projects to reproduce and extend classical physiological experiments are offered to the undergraduate science major. This course is being offered in conjunction with the Graduate level course PHOL 451. Students are required to consult with the faculty member whose work they have interest in and plan their individual experience.

PHOL 398. Physiology and Biophysics Departmental Seminar (1)

Weekly one-hour reviews from invited speakers describing their research. Students will present literature reviews or summaries of their research.

Graduate Courses

PHOL 432. Cell Structure and Function (3)

This course is designed to provide a base of knowledge regarding cell structure and function. The basic structure of the cell will be discussed, as will the various functional systems that are superimposed upon and interact with this structure. The course will discuss basic cell and organelle structure, materials movement inside cells, cell interaction with the external environment, energy generation, the role of membrane potential, regulation of cell cycle and cell death, and mechanisms of signal transduction and membrane transport. The major goals of this course are to provide students with a working knowledge of the cell, to facilitate understanding of the scientific literature, and to familiarize students with current techniques in cell biology.

PHOL 440. Integrative and Cellular Physiology of Exercise (3)

This course provides a thorough presentation of the physiological responses to exercise. Emphasis is placed on understanding both the acute and chronic adaptation of the musculoskeletal, endocrine, pulmonary, and cardiovascular systems to physical exercise from the cellular to the multi-organ level. Students will read and interpret the research literature in the field of exercise physiology. Clinical uses of exercise in the prevention, diagnosis, and treatment of disease will also be discussed.

PHOL 444. Assessment of Human Performance Fitness (3)

This course provides a detailed description of a broad range of methods for the assessment of human performance in normal and diseased populations. The student will learn how to perform tests and measure physiological variables, and process, analyze, and interpret the information collected during the test. Topics include assessment of aerobic and anaerobic power, pulmonary gas exchange, functional capacity in a clinical setting, measurement of human strength and body composition, and histological, biochemical, and functional examination of muscle. Some of the most recent techniques for studying muscle oxygenation and metabolism, as well as techniques of the assessment of physical activity or fitness in the field will also be covered.

PHOL 451. Independent Study (1-18)

Guided program of study using physiology textbooks, research reviews, and original research articles. An independent laboratory research project may also be included.

PHOL 456. Proteins: Structure and Function (3)

The goal of this course is to provide a basic working knowledge of protein structure, how proteins catalyze reactions, and how proteins are studied. The goal is to provide students with general knowledge of proteins that can be used in experimental work and facilitate understanding of the scientific literature. The course begins with a discussion of protein structure as a preamble to discussion of protein function. The course also presents fundamental methods of protein purification and characterization. Cross-listed as BIOL 457.

PHOL 460. Introduction to Molecular Biology (3)

This course focuses exclusively on technologies and concepts relating to the study of nucleic acids and the application of molecular technology. A major goal of this course is to provide students with the tools to read and understand molecular scientific literature, and to learn how to apply this technology for the study of physiological models. The first segment of the course is a basic review of the role of nucleic acids in cells. The second and third sections focus on molecular technology and its application in physiological systems. In these sessions the students are taught how to clone a gene and then how to use this tool (clone) in animal- and cell-based studies. Cross-listed as BIOL 460.

PHOL 465. Ethical Conduct in Science (1)

This lecture/discussion course discusses the ideals motivating scientific research, the problems resulting from the breakdown of these ideals, and how those entering scientific research can prepare themselves to deal with these issues. Issues and practices regarding the use of animals, chemicals, and isotopes will also be discussed.

PHOL 466. Cell Signaling (3)

This is an advanced lecture/journal/discussion format course that covers cell signaling mechanisms. Included are discussions of neurotransmitter-gated ion channels, growth factor receptor kinases, cytokine receptors, G protein-coupled receptors, steroid receptors, heterotrimeric G proteins, ras family GTases, second messenger cascades, protein kinase cascades, second messenger regulation of transcription factors, microtubule-based motility, actin/myosin-based motility, signals for regulation of cell cycle, signals for regulation of apoptosis. Cross-listed as CLBY 466.

PHOL 468A. Membrane Physiology I (3)

This lecture/discussion/journal course focuses on biological membranes. Topics discussed include thermodynamics and kinetics of membrane transport, oxidative phosphorylation and bioenergetics, electrophysiology of excitable membranes, and whole and single channel electrophysiology, homeostasis and pH regulation, volume and calcium regulation. Cross-listed as CLBY 468A.

PHOL 468B. Membrane Physiology II (4)

This lecture/discussion/journal course focuses on biological membranes. Topics discussed include thermodynamics and kinetics of membrane transport, oxidative phosphorylation and bioenergetics, electrophysiology of excitable membranes, and whole and single channel electrophysiology, homeostasis and pH regulation, volume and calcium regulation. This course is identical to PHOL468A except that it includes an extra hour of computer modeling. Prereq: Knowledge of thermodynamics and chemical kinetics.

PHOL 480. Physiology of Organ Systems (3)

This course presents an advanced introduction to the fundamental physiological principles governing the major organ systems in mammals. The function of the nervous, endocrine, digestive, muscle, circulatory, respiratory, and urinary systems are discussed. At the conclusion of the semes-
inter, integrative aspects of the major organ systems will be illustrated through consideration of exercise and high altitude physiology. Cross-listed as BIOL 480.

PHOL 498. Physiology and Biophysics Departmental Seminar (1)
Weekly one-hour reviews by invited speakers of their research. Students present literature reviews or summaries of their research.

PHOL 499. Biophysics/Biomedical Engineering Seminar (1)
Weekly one-hour reviews by faculty or invited speakers of their research. Students present literature reviews or summaries of their research.

PHOL 505. Laboratory Research Rotation (3)
One-semester experience in a selected faculty research laboratory designed to introduce the student to all aspects of modern laboratory research including the design, execution and analysis of original experimental work.

PHOL 514. Introduction to Cardiopulmonary Research (3)
The goal of this course is to provide students with a comprehensive introduction to the physiology of the heart, lungs, and vasculature. The course begins with description of gross and microscopic anatomy of the heart, as well embryological development of critical cardiac structures. Major topics covered include cardiac hemodynamics, electrophysiology, and metabolism, as well as pulmonary physiology. To enhance understanding of each topic and its relevance to pathophysiological state, hands-on experimental and clinical laboratory demonstrations are integrated with each series of lectures.

PHOL 518. Integrative Approach to Cardiorespiratory Research I (3)
This course is designed to integrate the biochemical and cellular aspects of the cardiorespiratory system with in vivo physiology and pathology. This course emphasizes cardiovascular aspects, while PHOL 519 emphasizes the pulmonary aspects of cardiopulmonary physiology. The course requires extensive student participation and a term paper is required.

PHOL 519. Integrative Approach to Cardiorespiratory Research II (3)
This course is designed to integrate the biochemical and cellular aspects of the cardiorespiratory system with in vivo physiology and pathology. This course emphasizes pulmonary aspects, while PHOL 518 emphasizes the cardiovascular aspects of cardiopulmonary physiology. The course requires extensive student participation and a term paper is required. Prereq: PHOL 518 or permission of instructor.

PHOL 522. Special Topics in Cardiac Electrophysiology (3)
Introduction to current topics in cellular cardiac electrophysiology and cardiac ion channel structure, function, and regulation. The format includes informal lectures as well as student presentations and class discussion of current literature.

PHOL 523. Advanced NMR Spectroscopy in Structural Biology (3)
An advanced course on NMR spectroscopy designed for advanced students interested in structural biology. Prereq: PHOL 430 or BIOC 312/412 or consent of instructor. Cross-listed as BIOC 523, CHEM 523, and PHRM 523.

PHOL 530. Technology in Physiological Sciences (3)
This lecture/discussion/journal course focuses on techniques in the physiological sciences. Topics include spectroscopy, microscopy, and electrophysiology. The theory and practice are covered with an emphasis on examples taken from the scientific literature. Prereq: CBIO 453 and CBIO 454.

PHOL 531. Transcription Factor Regulation of Gene Expression (2)
A reading and presentation course designed to expand knowledge of the mechanisms that regulate transcription factor activity and the mechanisms whereby transcription factors regulate gene expression. The major transcription factor classes are covered (i.e., API, Spl, NFkappaB, POU domain, etc). Students are required to summarize a group of manuscripts that focus on a particular transcription factor-associated signaling process and coherently present this information in class.
Frances Payne Bolton School of Nursing
Frances Payne Bolton School of Nursing

History
The Frances Payne Bolton School of Nursing has a proud heritage beginning with the Lakeside Hospital Training School for Nurses established in 1898. With a generous endowment from Frances Payne Bolton, who was the first woman congressman from Ohio, the school of nursing was established in 1923 as a school within Western Reserve University. In 1969, Western Reserve University and Case Institute of Technology merged forming the current university, Case Western Reserve University. Consistently, the Bolton school is ranked among the top ten schools in U.S. News and World Report and in funding from the National Institutes of Health. Graduate level specialty majors also are in the top five. Graduate level specialty majors also are in the top five. The Bolton school is noted for its innovation, leadership and excellence in education, research and practice. To support this mission, the school has eleven endowed chairs, the largest number in the world for a school of nursing. The Bolton school is a World Health Organization Collaborating Center in Home Care. The Sarah Cole Hirsh Center for Best Nursing Practices Based on Evidence was established in 1998 and is the only national center of its kind.

Strategic Vision

Mission
Within the mission of Case Western Reserve University, the Frances Payne Bolton School of Nursing builds on a tradition of innovation and a commitment to the highest standards of excellence to provide the very best nursing education, research, clinical scholarship, and professional service locally, nationally, and internationally.

Priorities
The Frances Payne Bolton School of Nursing is committed to global leadership in nursing. The discovery, transmission, and use of knowledge are at the core of our work. Knowledge of health and illness in individuals, families, groups, and communities, both locally and internationally, provides the context for our work. The ultimate test of the validity of our vision is the results, over time, of the contributions of our faculty and graduates.

Purpose
The Frances Payne Bolton School of Nursing is an integral component of Case Western Reserve University. The school assumes responsibility for the preparation of individuals committed to excellence and leadership in professional nursing. The faculty of the school accepts the responsibility for teaching and scholarly inquiry as integral parts of the educational process.

The purpose of the school is to provide an environment that permits individuals to develop their personal and professional capabilities, including the sense of responsibility for continued learning; to learn as efficiently and effectively as possible; to find enjoyment, excitement, and challenge in the pursuit of knowledge and its application; and to develop behaviors that enable them to function in a changing, complex society.

Philosophy
To accomplish the stated mission, the School of Nursing has set forth the following philosophy:

Nursing is an academic discipline and profession. Nursing as an academic discipline is a distinctive branch of human knowledge fundamental to nursing practice, nursing education, and nursing administration, and to the continuous development of the profession. The distinctive perspective of nursing includes a focus on the metaparadigm concepts of persons, environment and nursing. The specific conceptual focus within the Bolton School is the health-seeking mechanisms and behaviors of human beings. Some of those mechanisms and behaviors are innate; others are learned or developed and may be subject to the influence of nurses’ knowledgeable ministrations. The body of nursing knowledge is continuously advanced, structured, and restructured as a consequence of a range of methods including scientific inquiry, philosophic inquiry, historical inquiry, and clinical evaluation.

Scientific inquiry within nursing is designed to discover, advance, and clarify knowledge about determinants and correlates of optimal biological, psychological, and social functioning; physical, emotional and spiritual comfort; and individual and group attainment of health goals in multiple environments and under a variety of circumstances (including illness and injury) attendant to birth, living, development, decline, and death.

Philosophic inquiry is undertaken to clarify the values that underlie consumers’ and nurses’ responsibilities for human health promotion, the ethics of nursing practice, and the nature of the body of knowledge known as nursing.

Historical inquiry is undertaken to document significant influences (by events and individuals) on the development of nursing over time as a body of knowledge and as a profession.

Clinical evaluation is designed to test and verify the relative efficacy of strategies used in nursing administration, consultation, education, and practice, and the means employed to advance nursing knowledge.

Professional nurses have mastery over a body of scientific and humanistic knowledge that is fundamental to their particular kinds of practice; they selectively use this knowledge in the execution of their professional responsibilities and in the attainment of professional goals. Those involved in differentiated nursing practices employ nursing technologies (skills and approaches that represent the application of scientific knowledge), using artistry in the execution of their professional responsibilities. Their several, particular practices are guided by a code of professional ethics and also by knowledge about the individuals and groups whom they serve.

The nurse’s professional goal is to appraise accurately and to enhance effectively the health status, health assets, and health potentials of individuals, groups, families, and communities and to promote the initiative and independence of those they serve in the attainment of reasonable health goals, mutually agreed upon by consumers and by nurses as their health care providers.

Nursing practice includes assisting persons in the maintenance of health, detecting deviations from health, assisting persons in the restoration of health, and supporting persons during life. These responsibilities are accomplished through a systematic and deliberative process. Nursing practice includes independent and interdependent functions and nurses are an integral part of the health care system.

Other beliefs essential to nursing that are shared by the faculty are stated below.
Individuals and Groups
- Individuals have commonalities, but each person is unique and has worth.
- Individuals are in constant interaction with the environment.
- Individuals have a capacity to grow and develop.
- Human behavior is purposeful and involves choices that are directed toward meeting the individual’s needs.
- Individuals and groups have rights and responsibilities in relation to the promotion of optimal health.
- Individuals have the responsibility for making decisions about their health and have the potential to act on these decisions.
- Most individuals possess the capability for making appropriate decisions, although there are times when these abilities are diminished or absent.

Learning
- Individuals are capable of changing their behavior through the process of learning.
- The need and ability to learn continues throughout life.
- Learning is affected by interaction between the individual and the environment.
- Learning is enhanced when consideration is given to individual differences in cognitive styles.
- The responsibility for learning resides in the individual learner.
- The learning process is an individual endeavor; stimulation of the process is a joint responsibility of teacher and learner working toward common goals.

Health
- Health is a dynamic, ever-changing state.
- Health is influenced by an individual’s heredity, environment, and lifestyle.
- Individuals may manifest simultaneously states of health and illness.
- Individuals differ in the ways they value and define health.
- Individuals have the potential to grow as a result of an experience with illness.

Health Care
- Health care encompasses all activities necessary to promote optimal physiologic, psychological, and social functioning.
- Health care is rendered by the individual alone or in collaboration with health care providers, including nurses, and extends throughout the life span of the individual.
- Health care is complex and depends on the skills, resources, and cooperative efforts of consumers and health care providers.
- A recognized need exists in society to organize effectively the delivery of health care services.
- A variety of providers, each offering a unique and specific service, may be present in an organized health care system.
- The primary contribution of nursing to the health care system is to assist individuals and groups to attain, maintain, and regain optimal health.
- Health care professionals (including nurses) and consumers collaborate to define health; to identify factors inimical to health; to limit, reduce, or eliminate threats to health; to determine human and material resources necessary to provide health care services; and to evaluate and improve health services.
- Collaboration among health professionals and consumers can lead to the achievement of health care delivery systems that provide care that is available, accessible, feasible, acceptable, of optimal quality, sustained, and cost effective.

Conceptual Framework
The conceptual framework of the Bolton School of Nursing is consistent with the definition of nursing adopted by the faculty. “The science and art of enhancing, through the professional encounter, the health-seeking behaviors of individuals as they strive to attain, maintain or regain an optimal level of health within an environment of care.”

Relevant concepts include:
- **Optimal Level of Health**: Highest achievable level of function and security. This includes physiological function and environmental (physical security; psychosocial function and security); and personal growth.
- **Health-Seeking Behaviors**: The range of mental and physical activities (consciously) performed to maintain, attain or regain optimal level of health.
- **Environment of Care**: The “place” and phenomenal field where a nurse encounters clients who need assistance in maintaining, attaining, or regaining competence in striving for health and performs acts for clients to facilitate health-seeking behaviors.

Professional Encounter
A person’s competence in matters related to health is dynamic and is influenced by genetic endowment and life experiences. At times a person requires assistance in improving competence. At these times, the nurse may enter into a relationship with the person (client) to facilitate the client’s health-seeking behaviors as he/she strives toward an achievable level of health. The client and nurse may view this relationship differently.

- The professional encounter requires a reciprocal relationship in which the nurse, as a professional expert with the client’s assent, influences the behavior of the client. The client in turn evokes responses from the nurse.
- The professional encounter is the initiation of a relationship between a nurse and a person requiring nursing care. The relationship is reciprocal in nature and may be initiated by either the client or nurse. Through the relationship mutual goal setting regarding health attainment is sought. When a nurse and client interact within the professional relationship, each performs functions deriving from their positions within a particular social context. The context (human-physical environment) in which the encounter occurs will have varying influence on both the client and nurse based on the cognitive, perceptual and emotional capacities of both. Although the environment in it physical representation is essentially the same for both, the perceptions of the client and nurse are different. The attributes that they bring to the relationship are shaped by intervening variables.

Nursing Strategies
Nursing strategies can be categorized according to the function they serve in facilitating clients’ health-seeking behaviors. A tentative classification scheme according to the function strategies is set forth below. Within each category there are multiple behaviors from which the nurse can select depending on the nature of the clients’ assets and deficits. Also, each category is open to the discovery of more activities than are presently known. Each category focuses on facilitating health-seeking behaviors.

**Compensating**: Performing selected activities or measures (including monitoring) for clients when they are unable to do these activities.

**Teaching**: Performing actions intended to induce learning.

**Counseling**: Assisting clients to examine alternative course of action.

**Supporting**: Promoting clients’ ability to cope, adapt and change.
**Stimulating**: Promoting clients’ desire to perform health-seeking behaviors.

**Advocating**: Intervening on behalf of the client to overcome obstacles that are interfering with health-seeking behaviors.

**Comforting**: Providing an environment that promotes ease and well-being.

The choice of nursing strategies for enhancing client’s health-seeking behaviors is based on assessment of these behaviors and the intervening variables to determine the assets and deficits and potential for engaging in behaviors that are directed toward attaining, maintaining or regaining an optimal level of health.

**Sarah Cole Hirsh Institute for Best Nursing Practices Based on Evidence**

Established in 1998, the Sarah Cole Hirsh Institute for Best Nursing Practices Based on Evidence is building a repository of best nursing practices based on research findings.

Historically, nursing and medical practices have been based in part on expert opinion and tradition, creating variations in practice and often subjectivity in judgment. Through the integration of research and practice, the Hirsh Institute stimulates the use of best nursing practices based on evidence as a basis for delivering superior health care, shaping the next phase of nursing research, and providing standards for nursing education and practice.

The goals of the Hirsh Institute are to enhance nursing practice and health care delivery by:

- Building a repository of best nursing practices based on research findings.
- Disseminating current scientific evidence on best nursing practices to practicing nurses, educators, administrators, health care facilities, insurers, and policy makers.
- Guiding nursing research by identifying areas where scientific evidence is lacking.
- Conducting a certificate program in implementing best nursing practices based on evidence.
- Focusing attention on nursing excellence through its State of the Evidence Reviews with recommendations for practice.

**International Health Programs**

The Bolton School houses a World Health Organization Collaborating Center for Nursing, one of only nine in the United States. The focus of the Collaborating Center is home care nursing education and research. In addition, there are a variety of international health opportunities for students of all levels, including study abroad programs and short-term programs for international health experience.

**Learning Resource Center (LRC)**

The newly renovated LRC includes a Cyber Café, Center for Bioinformatics and Health Promotion, Multimedia Simulation Center and significant upgrades to the Clinical Teaching Center. An element of the Simulation Center is Cath-Sim, a computer unit and software program that stimulates the experience of inserting an intravenous catheter and drawing blood from various types of patients. The center includes two Cath-Sim units. The Cyber Café includes computers that students can use to access e-mail and the Internet, a network printer and Ethernet ports and wireless access points that students can use for their own laptops. Also included are a refrigerator, microwave and furnishings, including cable television. The Center for Bioinformatics and Health Promotion is a multi-enhanced classroom that has workstations for up to 24 students and an instructor, an application and CD/DVD server, an electronic whiteboard, document camera and digital projector.

The Clinical Teaching Center includes a variety of beds, a two-bed intensive care unit, a nursery and a variety of mannequins and electronic devices to allow for experimental learning and teaching assessment.

**Accreditation**

Bachelor of Science in Nursing and Master of Science in Nursing programs are accredited by the National League for Nursing Accreditation Council.

- **National League for Nursing Accreditation Council**
  - 61 Broadway-33rd Floor
  - New York, NY 10006
  - 212-363-5555 Ext. 153
  - [www.accrediting-comm-nlnac.org](http://www.accrediting-comm-nlnac.org)

The Council on Accreditation of Nurse Anesthesia Programs accredits the nurse anesthesia program.

- **American Association of Nurse Anesthetists**
  - 222 South Prospect Avenue
  - Park Ridge, Illinois 60068-4001
  - (847) 692-7050
  - info@aanrn.org

The midwifery program is accredited by the American College of Nurse Midwives.

- **American College of Nurse Midwives**
  - 818 Connecticut Ave. NW, Suite 900
  - Washington D.C. 20006
  - 202-728-9860
  - info@acnm.org

The School of Nursing is approved by the State of Ohio Board of Nursing and is a member of the Council of Baccalaureate and Higher Degree Programs of the National League of Nursing.

- **Ohio Board of Nursing**
  - 17 High Street
  - Suite 400 Columbus, OH 43215-3413
  - 614-466-3947
  - [www.state.oh.us/nur](http://www.state.oh.us/nur)

The North Central Association of Colleges and Schools, Commission on Institutions of Higher Education accredits the university.

- **North Central Association of Colleges and Schools**
  - Commission on Institutions of Higher Education
  - 30 N. LaSalle Street, Suite 2400
  - Chicago, IL 60602-2504
  - (800) 621-7440
  - info@ncacihe.org

**Instructional Facilities**

With a highly qualified faculty engaged in teaching, research, and community service, the Bolton school offers high quality academic programs. Instruction includes lectures, seminars, individual conferences and small groups discussions, and clinical experiences under the guidance of a preceptor. Modern research and educational facilities include computer and skills laboratories.

**Clinical Facilities**

Instructional facilities are abundant and varied. The University Hospitals of Cleveland is a 947-bed academic medical center and is a aggregate of specialized hospitals that includes Alfred and Normal Lerner Tower, Samuel Mather Pavilion and Lakeside Hospital for adult medical/surgical care; Rainbow Babies and Children’s Hospital; University MacDonald Women’s Hospital; University Ireland Cancer Center; and skilled nursing and rehabili-
tation services. University Hospitals is part of the University Hospitals Health System with services provided at 100 locations in 40 northern communities. The Cleveland Clinic Health System has 2,957 beds and is comprised of the Cleveland Clinic Foundation and Fairview Hospital, Health Hill Hospital for Children, Lakewood Hospital, Lutheran Hospital, Marymount Hospital, Euclid Hospital, Hillcrest Hospital, Huron Hospital, and South Pointe Hospital. MetroHealth Medical Center is a regional referral center with 690 beds for medical/surgical care to adults and children. It is a trauma I center with a burn center and 143-bed rehabilitation facility specializing in spinal cord injuries, only one of 19 in the nation. MetroHealth also has the Clement Center for Family Care, a neighborhood outpatient center, and a 291-bed. Skilled Nursing Care Center. These hospitals are major clinical resources.

Additional opportunities are available in a variety of health, social, and educational agencies. These include, for example, American Red Cross, Benjamin Rose Institute, Hospice of the Western Reserve, Cleveland Psychiatric Institute, Kenneth W. Clement Center for Family Health Care, Judson Park Retirement Community, Hospice of the Western Reserve, Visiting Nurses Association, Cleveland Public Health Department, the Ohio Permanente Medical Group and many others.

Libraries
The Kelvin Smith Library, a 144,000 square foot building, houses most of the collections of the University. The library enables users to integrate both traditional resources and state-of-the-art technology into teaching, research, and learning. CWRUnet (the fiber optic network) faceplate connections are at nearly every seat in the library. Two multi-media rooms include scanners, sound and video digitizers. Available are individual study spaces, meeting rooms, conference areas, and social gathering places. Compact shelving allows the library to keep most of the collection on-site for immediate access to print materials. The interface to the online catalog, databases, and other resources is self-explanatory as possible, allowing library staff to focus their attention on working in-depth with faculty and students.

In addition to the Kelvin Smith Library, students and faculty have access to the following libraries located on campus: the Cleveland Health Sciences Libraries, supporting programs in dentistry, medicine and nursing; the School of Law Library; the Lillian and Milford Harris Library in the Mandel School of Applied Social Sciences; the Kulas Music Library; and the Astronomy Library. Collections at the University libraries encompass more than 1.8 million volumes, nearly 14,000 serials and periodicals, and a wide range of electronic information resources, including a CD-ROM reference database that is accessible through CWRUnet. These include OhioLINK, a state-funded network that links libraries at 18 Ohio institutions and offers access to research databases and other information resources.

The Health Sciences Libraries, which consist of the Health Center Library and the Allen Memorial Library, serve as the major libraries for holdings related to nursing, medicine, dentistry, nutrition, and biology. The Health Center Library adjacent to the School of Nursing houses 345,072 volumes, 2780 current periodicals, and audiovisual materials. Approximately 8,800 volumes are specifically nursing texts, and 108 journals are nursing publications. The library also houses a historical collection of nursing materials. The most current and heavily used books are placed on reserve to insure their availability to students. Faculty also place materials on reserve for use in the library.

Computer Services
Case Western Reserve University constructed a fiber optic backbone for a computer network in 1990. Since that time the CWRUnet (the name for this fiber optic backbone) has served as a national prototype for education and research computing. In 1999, Yahoo named Case Western Reserve as the most wired campus in the nation. The CWRUnet supports full INTERNET services, including voice, video and data transmission. The University Web Server (http://www.cwru.edu) provides linkages to and from Case Western Reserve. The University Web Server also supports full Internet software and the other software packages can be accessed through CWRUnet. Email and INTERNET access are also available. Two support teams, Library and Information Technologies and the Information Network Services provide technical support. The Information Network Services Department oversees the University Web server as well as additional Novell and Macintosh file servers.

Computer laboratories and services are available campus-wide during weekday, evening and weekend hours. CWRUnet includes access to a multimedia system of communication, including the library system and the university mainframe computers. This access is possible through personal computer or any of the two large and several smaller computer centers on campus, libraries, resident halls or through the computer facilities on the second floor of the School of Nursing. In addition, 24-hour dial in access to CWRUnet is also available to students, faculty and staff.

Organizations

Student Organizations
All enrolled students are members of their respective Undergraduate or Graduate Student Organizations that promote colleagueship among students and provide social, cultural activities and educational. They are also members of the National Student Nurses' Association, and after paying dues, member of the Bolton School's chapter of this organization. Ph.D. students elect one member and one alternate to the Graduate Student Senate of the School of Graduate Studies. All minority undergraduate nursing students are automatically members of the Minority Student Nurses Association, which fosters colleagueship among minority students. The Nurses' Christian Fellowship is an affiliate of the Inter-Varsity Christian Fellowship. Selected by the student organizations, students also are members of some standing committees of the Bolton School. There are a variety of international student associations on campus as well.

Sigma Theta Tau
Sigma Theta Tau is a national professional honor society, and Alpha Mu is the chapter at the Bolton School. Members are selected from students enrolled in one of the school's nursing programs or nurses in the community with a B.S.N., M.S.N., Ph.D. or ND degree. Candidates are chosen based on superior scholastic achievement, potential for leadership and desirable personal qualities.

Alumni Association
Upon graduation, all nursing students are inducted into the Alumni Association. This begins a life-long membership and relationship with the School of Nursing. An elected board of directors and officers administer the association. Alumni are generous in their support of the school and provide funds for students and the Bolton school through the Annual Fund and other gifts and bequests. Activities of the alumni are reported in the Haelan (to heal) magazine published by the nursing school.
Administration
May L. Wykle, Ph.D., R.N., FAAN, FGSA (Case Western Reserve University)
  Dean of Nursing
  Director, Center on Aging and Health
Beverly L. Roberts, Ph.D., FAAN, FGSA (Case Western Reserve University)
  Associate Dean of Academic Programs
Shirley Moore, Ph.D. (Case Western Reserve University)
  Associate Dean for Research
Gail McCain, Ph.D., R.N., (Case Western Reserve University)
  Associate Dean for Community Affairs
Elizabeth Madigan, Ph.D. (Case Western Reserve University)
  Assistant Dean for International Health Programs
Kathleen Montgomery, M.S.N. (Case Western Reserve University)
  Assistant Dean for Student Services
Marilyn B. Lotas, Ph.D., RN (University of Michigan)
  Director, B.S.N. Program
Georgia Narsavage, Ph.D. (University of Pennsylvania)
  Director, M.S.N. Program
Theresa Standing, Ph.D. (Case Western Reserve University)
  Director, N.D. Program
Jaclene A. Zauszniewski, Ph.D. (Case Western Reserve University)
  Director, Ph.D. Program
Nora Hennessy, B.A. (Walsh University)
  Executive Director of Development and Alumni Relations
Susan Frey, M.Acc. (Cleveland State University)
  Director of Finance and Administration

Professors
Gene C. Anderson, Ph.D., FAAN (Wisconsin, Madison)
  Edward J. and Louise Melnn Professor of Nursing
Joyce J. Fitzpatrick, Ph.D., MBA, FAAN (New York University)
  Elizabeth Brooks Ford Professor of Nursing
Susan M. Ludington, Ph.D., C.N.M, FAAN (Texas Woman’s University)
  Carl W. & Margaret Davis Walter Professor of Pediatric Nursing
Beverly L. Roberts, Ph.D., FAAN, FGSA (Case Western Reserve University)
  Arline H. and Charles F. Garvin Professor of Nursing
May L. Wykle, Ph.D., FAAN, FGSA (Case Western Reserve University)
  Florence Cellar Professor of Nursing

Associate Professors
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  Associate Professor of Nursing
Claire M. Andrews, Ph.D., FAAN (Wayne State University)
  Associate Professor of Nursing
Mary K. Anthony, Ph.D. (Case Western Reserve University)
  Associate Professor of Nursing
John Clochesy, Ph.D., FAAN (Case Western Reserve University)
  Independence Foundation Professor of Nursing Education
Marion P. Good, Ph.D., R.N. (Case Western Reserve University)
  Associate Professor of Nursing
Barbara J. Daly, Ph.D., FAAN (Bowling Green University)
  Associate Professor of Nursing
Marjorie M. Heinz, Ph.D., R.N. (Case Western Reserve University)
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Elizabeth A. Madigan, Ph.D., R.N. (Case Western Reserve University)
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  Arline H. and Charles F. Garvin Professor of Nursing Excellence
Gail C. McCain, Ph.D., R.N., (Case Western Reserve University)
  Sarah C. Hirsh Professor of Nursing
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M. Linda Ann Workman, Ph.D., R.N. FAAN (University of Cincinnati)
  Gertrude Perkins Oliva Professor of Oncology Nursing
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  Associate Professor of Nursing
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  Assistant Professor of Nursing
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  Assistant Professor of Nursing
Jennifer M. Markowitz, N.D. (University of Colorado)
  Assistant Professor of Nursing

Assistance Professors
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  Assistant Professor of Nursing
Barbara Morrison, Ph.D., R.N.C., F.N.P., C.N.M. (University of Illinois)
  Assistant Professor of Nursing
Carol Savrin, M.S.N. (West Virginia University)
  Assistant Professor of Nursing
M. Jane Suresky, N.D., R.N., C.S. (Case Western Reserve University)
  Assistant Professor of Nursing

Instructors
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  Instructor of Nurse Anesthesia;
  Director Cleveland Clinic Foundation Nurse Anesthesia Program
Evelyn G. Duffy, M.S. (University of Wisconsin, Madison)
  Instructor of Nursing
Angela Geiser, M.S.N., C.R.N.A. (Case Western Reserve University)
  Instructor of Nurse Anesthesia
Patricia E. McDonald, Ph.D. (Case Western Reserve University)
  Instructor of Nursing

Assistant Professors
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  Assistant Professor of Nursing

Assistant Professors
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  Assistant Professor of Nursing

Instructors
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  Director, Frances Payne Bolton School of Nurse Anesthesia Program
Deborah Lindell, M.S.N. (University of Pennsylvania)
  Instructor of Nursing

Instructors
Rita McNulty, M.S.N. (Catholic University of America)
  Instructor of Nursing
Gretchen Mettler, M.S. (University of Minnesota)
  Instructor of Nursing

Instructors
Kathleen E. Montgomery, M.S.N. (Case Western Reserve University)
  Instructor of Nursing
Donna H. Myers, M.S.N. (Case Western Reserve University)
  Instructor of Nursing
Bachelor of Science in Nursing

The B.S.N. program emphasizes intensive and early clinical experience, a strong foundation in acute and critical care nursing and a commitment to service to our community. Our students begin their clinical experience in the first term of the freshman year and complete their program with a 300 hour clinical preceptorship in the senior year. Students graduate with 1620 hours of clinical experience, far exceeding that of other schools of nursing.

The student learning environment includes traditional classrooms and the new Learning Resource Center (LRC). The LRC consists of four activity centers: the Clinical Teaching Center; the Center for Bio-informatics and Health Promotion; the Multimedia Simulation Center; and, the Cyber Café. Clinical experiences occur in Cleveland’s nationally and internationally renown health care facilities including the University Hospitals of Cleveland, the Cleveland Clinic and the MetroHealth System.

The opportunities available to students are limitless. Students are encouraged to participate in interdisciplinary research projects with senior faculty. They have the opportunity to explore health issues in the global arena and to participate in international activities through the Bolton School’s World Health Organization (WHO) Collaborating Center.

Graduates have a foundation in the discipline of nursing, demonstrate leadership in clinical practice, use clinical inquiry to advance practice, become involved in research, and assume responsibility for their own professional development.

Characteristics of the Graduate

- Teaches and counsels individuals, families and other groups about health, illness and health seeking behaviors
- Critiques and applies research findings to clinical practice
- Provides direct patient care and assumes leadership role in directing nursing care to individuals, groups and families
- Participates and assumes beginning leadership roles
- Uses principles of ethics and the professional code as a framework for decision making
- Works effectively as a member of an interdisciplinary health care team
- Uses effective communication techniques with diverse clients, colleagues, and information systems
- Describes process of health care policy development

Admission Requirements

Freshman

- Application for undergraduate admission to the University
- Recommendation from secondary school report/counselor
- Secondary school transcript
- Writing sample
- SAT/ACT scores

Transfer

- Application for undergraduate admission to the University
- Secondary school transcript
- Teacher recommendation
- Statement of good standing
- College transcripts
- Personal statement
- SAT/ACT scores

Degree Requirements

Candidates for the Bachelor of Science in Nursing degree must complete the following:

1. Minimum of 124 hours as specified by the requirements with a 2.0 GPA
2. A minimum of C for all courses taken in nursing and science.
3. A minimum of 50 credit hours in 300 and 400 level courses
4. A modified core curriculum described in the Case Western Reserve University General Bulletin

Progression in the B.S.N. Program

Progression in the Bachelor of Science in Nursing program is contingent upon satisfactory academic achievement in all required courses. To maintain satisfactory academic standing, students must attain a GPA of 2.0 or above by the end of their junior year and must obtain a C or above in all nursing and science courses. Although the University accepts a D as a passing grade, the grading policy of the Bolton School is A, B, C, F. Students who receive two unsatisfactory grades (D or F) in nursing and/or natural and behavioral science courses will be subject to separation from the school of nursing. See the Undergraduate Student Handbook for a description of the criteria for academic standing.

Students who receive a grade of Incomplete (I), given at the discretion of the instructor for the course, must complete course requirements by the eleventh week of the following semester. It is the student’s responsibility to notify the instructor of the circumstances preventing completion of all assigned work. In the absence of notification or adequate justification, the instructor may give the student a final grade that assumes a failing grade for the missing work. If a student fails to submit the work required for removing the Incomplete by the date established or by the eleventh week of the following semester, the instructor will give a failing grade (F). The grade will convert from I to F when the deadline for making up incomplete grades from a previous semester has passed.

Students who receive an F for a nursing course must register for that course the next semester that it is offered. If the overall GPA falls below the required cumulative GPA, the student is placed on academic probation. If the GPA does not improve the next semester, the Academic Standing Committee of the University Undergraduate Faculty will review the student’s record to determine whether extenuating circumstances warrant an additional semester of probation or separation from the university.

Curriculum

This four-year generic program for high school graduates leads to a B.S.N. degree. Upon successful completion of the program, graduates will be eligible to sit for the examination for licensure as a registered nurse (RN). The School of Nursing has the right to determine a student’s readiness to sit for the NCLEX-RN examination and the right to restrict testing until the student demonstrates a readiness to pass this examination. This examination is given by State Boards of Nursing, and satisfactory completion of this examination enables the graduate to practice as a RN in the state for which the examination was written.
The B.S.N. program includes nursing, science and liberal arts courses. A minimum 124 credit hours, with at least 50 credits from upper division courses, are required for awarding of the B.S.N. degree. Students must meet the University requirements for graduation. The ratio of clinical hours to credit hours is 4 to 1, and for laboratory hours, it is 2 to 1. The program plan for entry-level students to the B.S.N. program is located on the next page.

Degree Requirements
Candidates for the Bachelor of Nursing Science degree must complete all required courses with a cumulative grade point average of 2.0 or above and passing grades of C or better in all nursing and science courses.

RN/B.S.N. Entry Option
Registered nurse graduates of an associate or diploma program in nursing can obtain their B.S.N. by fulfilling the core requirements of the University and the upper division nursing courses developed specifically for this program.

Admission Requirements
- Completion of an accredited associate degree or diploma program in nursing with a minimum GPA of 2.5
- Current RN licensure

Program Requirements
Based on passing the NCLEX examination for licensure, 30 semester hours of proficiency in clinical nursing will be granted.

Nursing Core Requirements
To satisfy University core requirements, 62 semester hours of course work must be completed in the following areas:
- English Composition
- Natural and Mathematical Sciences
- Arts and Humanities
- Social Sciences
- Global and Cultural Diversity
- Physical Education

Program Plan for Generic Baccalaureate Students

| Freshman Year | Fall | Hours | | Junior Year | Fall | Hours |
|---------------|------|-------| | | | |
|               | ENG 150 Expository Writing | 3 | | General Education Requirement | 3 |
|               | BIOL 114 Principles of Biology | 3 | | STAT 201 Basic Statistics | 3 |
|               | BIOL 119 Molecular View of Biology | 3 | | NURS 315 Parents & Neonates in Health & Illness | 4.5 |
|               | BIOL 346 Human Anatomy | 3 | | NURS 316 Children & Adolescents in Health & Illness | 4.5 |
|               | PHED Physical Education | 0 | | | 15 |
|               | NURS 110 Foundations of the Discipline | 1 | | | |
|               | NURS 111 Foundations of the Practice | 3 | | | |
|               | | 16 | | | |
|               | Spring | General Education Requirement | 3 | | General Education Requirement | 3 |
|               | BIOL 121 Chemical Biology | 3 | | STAT 201 Basic Statistics | 3 |
|               | BIOL 148 Physiology | 3 | | NURS 315 Parents & Neonates in Health & Illness | 4.5 |
|               | NURS 201 Nutrition | 3 | | NURS 316 Children & Adolescents in Health & Illness | 4.5 |
|               | NURS 122 Nursing Assessment | 3 | | | |
|               | NURS 120 Nursing Informatics: Introduction | 2 | | NURS 351 Acute Care II | 4.5 |
|               | PHED Physical Education | 0 | | | 17 |
|               | | 17 | | | |
|               | Sophomore Year | Fall | General Education Requirement | 6 | | General Education Requirement | 3 |
|               | | NURS 211 Pharmacology | 2 | | NURS 343 Issue and Ethics in Health Care | 2 |
|               | | NURS 250 Aging in Health and Illness | 3 | | NURS 346 Informatics IV | 2 |
|               | | NURS 230 Nursing Care of the Adult & Older Adult I | 5 | | NURS 344 Trends and Issues in Professional Nursing | 2 |
|               | | | 16 | | NURS xxx Health in the Global Community | 5.5 |
|               | | | 16.5 | | | |
|               | Spring | General Education Requirement | 3 | | NURS 341 Concepts of Management | 3 |
|               | | NURS 342 Medical Microbiology | 4 | | NURS 352 Acute Care III OR | 9 |
|               | | NURS 240 Nursing Care of the Adult& Older Adult II | 5 | | NURS 354 Critical Care: Adults OR | 9 |
|               | | NURS 317 Psych/Mental Health | 4.5 | | NURS 356 Critical Care: Children OR | 9 |
|               | | | 16.5 | | NURS 350 Concepts and Management in Geriatric Nursing | 9 |

- Natural & mathematical sciences: 17 semester hours
- Arts & humanities: 12 semester hours
- Global & cultural diversity: 3 semester hours
- Social sciences: 6 semester hours
- English composition: 3 semester hours
Upper Division Nursing Courses

NURS 318 Nursing in the Community ........................................ 4
NURS 320 Nursing Research ..................................................... 3
NURS 345 Nursing Informatics III ............................................. 2
NURS 346 Nursing Informatics IV ............................................. 2
NURS 391 Home Health Care Nursing ..................................... 5
NURS 392 Dynamics of Nursing Practice Management ............ 4
NURS 393 New Applications of Nursing Practice Management ... 4
NURS 443 Professionalism in Advanced Practice .................. 3
NURS 444 Health Care Delivery, Legal and Ethical Issues in Advanced Practice .................................................. 3

Total Semester Hours .............................................................. 30

Masters of Science in Nursing (M.S.N.)

The Master of Science in Nursing program prepares registered nurses for advanced practice specialization either as a nurse practitioner, clinical specialist, nurse midwife or nurse anesthetist. In addition, an M.S.N. in nursing informatics is offered. Dual degree programs are offered in bioethics (M.S.N./M.A.), anthropology (M.S.N./M.A.), business administration (M.S.N./M.B.A.), and public health (M.S.N./M.P.H.).

Characteristics of the Graduate

- Develops and teaches educational offerings and provides consultation with other professionals/populations and communities about health, illness and health-seeking behavior
- Identifies clinical research problems, initiates utilization of research and participates in scientific inquiry
- Assumes functions and role of the Advanced Practice Nurse
- Assumes leadership positions in organizations at the local/state/national level
- Applies ethical principals in Advanced Practice Nursing
- Initiates interdisciplinary teams to enhance practice
- Establishes effective communication systems among clients and colleagues
- Contributes to policy development through active participation in legislative processes

Entry Options

R.N. with National Certification in Advanced Nursing Practice

This M.S.N. completion program is designed to assist certified advanced practice nurses to complete a Masters of Science in Nursing degree. Registered nurse applicants must have a Bachelor in Nursing Science from an accredited nursing program. Applicants must have certification from a national accrediting organization as a nurse practitioner, clinical nurse specialist, nurse midwife, nurse anesthetist or AORN first assistant. The national certification in advanced nursing practice takes the place of the clinical course work in the specialty where the person holds certification. A Master of Science in Nursing can be obtained by completing 18 credits (6 courses) at the Bolton School of Nursing. These include the core courses in Inquiry, Professional Development and Advanced Practice.

Professional Development Core

NURS 443 Professionalism in Advanced Practice ....................... 3
NURS 444 Health Care Delivery, Legal and Ethical Issues in Advanced Practice .................................................. 3

Scientific Inquiry Core

NURS 405 Inquiry I .................................................................. 3
NURS 415 Inquiry II .................................................................. 4
NURS 503 Inquiry III .............................................................. 2

Advanced Practice Core

NURS 430 Pharmacology and Therapeutics .......................... 3

RN/M.S.N. Entry Option

Registered nurse graduates of an associate degree or diploma nursing program may enter the Masters of Nursing program after completing undergraduate pre-requisites for graduate level nursing courses.

Undergraduate Prerequisites to M.S.N. Courses

Fall Semester Weekend Classes

NURS 392 Dynamics of Nursing Practice Management ............ 4
NURS 393 New Applications of Nursing Practice Management ... 4
Total ...................................................................................... 8

January Intensive Classes

NURS 345 Nursing Informatics III ............................................ 2
NURS 318 Nursing in the Community ...................................... 4
Total ...................................................................................... 6

May Intensive Classes

NURS 346 Nursing Informatics IV ............................................ 2
NURS 320 Nursing Research .................................................... 3
Total ...................................................................................... 5

Total Semester Hours .............................................................. 9

RN with a B.S. or B.A. Degree

Applicants with a B.A. or B.S. degree from an accredited College or University in a field other than nursing and who have graduated from NLNAC or AACN accredited associate degree or diploma programs may submit a portfolio detailing professional accomplishments and experiences. If the portfolio is approved, the applicant may enter the Master of Science in Nursing program directly.

RN with B.S.N. Degree

Applicants with a B.S.N. degree from an AACN or NLNAC accredited nursing program are admitted directly into the Master of Science in Nursing program.

Admission Requirements

- Three professional recommendations
- Eligible for RN licensure in Ohio
- Satisfactory scores on the Miller Analogies Test (M.A.T) or the Graduate Record Examination (GRE).
- Completion of an accredited first professional degree program in nursing.
- Within 5 years of admission and prior to registering for NURS 415, satisfactory completion of a college or university statistics course with content comparable to Case Western Reserve’s STAT201 or Anthropology 319 (Statistics for M.S.N./M.A. Anthropology majors)
- Applicants who do not meet the above requirements may be referred to the M.S.N. Admissions Committee for special consideration, and may be required to fulfill additional prerequisites and demonstrate clinical nursing proficiency.
Program Requirements

Candidates for a Master of Science in Nursing with a B.S.N. degree or a Certificate in Professional Nursing must satisfactorily complete a minimum of 36 semester hours of graduate study or 18 credits if admitted in the master's completion option. Students seeking specialty certification as a nurse practitioner, clinical specialist, nurse midwife or nurse anesthetist must complete the specified Nursing Clinical courses. A maximum of 15 semester hours of credit in approved graduate courses, where a grade of B or above was attained, may be accepted from another accredited university. This credit will be evaluated for transfer upon receipt of the official transcript and syllabi for the courses to be reviewed. The clinical interests, learning needs and career goals of students are considered when the academic program is designed. Research experience forms an integral part of graduate study in nursing. Degree requirements must be completed within five years after initial enrollment in the School of Nursing. The ratio of clinical classroom hours is 8 to 1 and for lab experiences it is 2 to 1.

The general curriculum includes the following core requirements.

Clinical Nursing Core  Semester Hours
(See specific program majors)  .................................................. 12-22

Professional Development Core
NURS 443 Professionalism in Advanced Practice  .............. 3
NURS 444 Health Care Delivery, Legal and Ethical Issues in Advanced Practice  3

Scientific Inquiry Core
NURS 405 Inquiry I .......................................................... 3
NURS 415 Inquiry II .......................................................... 4
NURS 503 Inquiry III ......................................................... 2

Advanced Practice Core
NURS 450 Pharmacology and Therapeutics  ..................... 3
NURS 453 Advanced Physiology ...................................... 4
NURS 459 Advanced Assessment ...................................... 3

Community Engagement Focus
Selected courses for M.S.N. students at the Frances Payne Bolton School of Nursing incorporate projects with community agencies. These projects are designed to improve health care among underserved residents of Cleveland’s inner-city neighborhoods. Developed in collaboration with the community partners, these projects are a unique component of the Bolton School’s master’s curriculum. Community agencies that participate include but are not limited to the Hospice of the Western Reserve, The Heath Museum of Cleveland, the American Red Cross Greater Cleveland Chapter, Health CMHA (Cuyahoga Municipal Housing Authority), American Diabetes Association-Cleveland, and school districts in the Cleveland area.

Progression Requirements
Progression in the M.S.N. program is contingent on a cumulative GPA of 3.0 and passing grades in all courses (A, B, C, P or S). If the cumulative GPA falls below 3.0 during any semester, the student will be placed on academic probation. To be removed from probation, the student must have a cumulative GPA of 3.0 or higher in the next academic semester he/she is registered. If the student fails to be removed from academic probation at this time, he/she may be separated from the School of Nursing.

The grade of incomplete (I) will be given at the discretion of the instructor for work not completed in the semester. The “Arrangement to Resolve a Grade of Incomplete” form must be completed prior to the end of the semester or the instructor may assign a grade of U or F. A grade of I must be removed by the end of the semester following the one in which the course was taken or before the student enrolls in a course for which the initial course is a prerequisite. No credit is given for an I grade. The I will remain a permanent part of the transcript if the student fails to complete course requirements within the next semester, unless alternative arrangements are approved in writing.

A student who receives a grade of F or U for a required course must register for the course the next semester it is offered to continue in the M.S.N. program. If the grade of U or F is in a course that is not required for the M.S.N. program, the student may register for the same course or a substitute course and achieve a passing grade to continue in the M.S.N. program. If the student receives a grade of F or unsatisfactory performance (F, U & NP) in two courses, he/she will be excluded from the Bolton School.

Degree Requirements

The Master of Science in Nursing program requires a minimum of 36 semester hours of graduate credit for the student who enters with a B.S.N. degree. Other degree requirements must be fulfilled for those entering with the portfolio or RN/M.S.N. entry options. A maximum of 15 semester hours of credit in approved graduate courses, where the student obtained a grade of B or above, may be transferred to meet program requirements. To be awarded a M.S.N. degree, the student must have a cumulative GPA of 3.0 and received satisfactory grades in all nursing courses taken for credit as a M.S.N. student. Degree requirements must be completed within 5 years of initial enrollment.

Nurse Practitioner
Nurse practitioners promote optimal health, detect illness and facilitate restoration and maintenance of health. They often function independently in a variety of settings. Three specialties are available for acute care nurse practitioners and six specialties are available in primary care. These programs contain at least 500 hours of clinical experience. Graduates are eligible to sit for the national certification examinations for these specialties.

Acute Care Nurse Practitioners
There are practice requirements for these specialties. One year of experience in acute care is required for the Acute Care Nurse Practitioner. One year of experience in neonatal intensive care is required for the Neonatal Nurse Practitioner.

Acute Care Nurse Practitioner

Professional Development
NURS 443 ................................................................. 6
NURS 444 ................................................................. 3

Scientific Inquiry ............................................................. 9-11
NURS 405 ................................................................. 3
NURS 415 ................................................................. 4
NURS 503 OR NURS 500 ................................. 2-4

Advanced Practice Core
NURS 450 (Spring) ................................................ 3
NURS 453 (Fall) ....................................................... 4
NURS 459 ................................................................. 3

Clinical Nursing Courses .................................................. 14

Semester I (Fall)
NURS 438 Theoretical Foundations of Acute Care Nursing  4

Semester II (Spring)
NUNP 443 Acute Health Problems of the Adult II .......... 6

Semester III (Fall)
NUNP 444 Advanced Management of Acutely Ill Adults  4

Total Semester Hours .................................................. 39-41
The following courses may be taken in addition to complete a flight nurse concentration:
NURS 406 Flight Nursing Clinical Seminar I ......................... 1
NURS 407 Emergent Care of Children ................................. 2
NURS 404 Flight Nursing Clinical Seminar II ....................... 1
NURS 523 Advanced Internship in Flight Nursing ................. 1-5

**Neonatal Nurse Practitioner**

Professional Development .................................................. 6
  NURS 443 ........................................................................... 3
  NURS 444 ........................................................................... 3
Scientific Inquiry ................................................................. 9-11
  NURS 405 ........................................................................... 3
  NURS 415 ........................................................................... 4
  NURS 503 OR NURS 500 .................................................... 2-4
Advanced Practice Core ....................................................... 10
  NURS 430 (Spring) ............................................................. 3
  NURS 453 (Fall) ................................................................ 4
  NURS 459 ........................................................................... 3
Clinical Nursing Courses ....................................................... 15
  Semester I (Fall)
    NUNP 410 Neonatal Nurse Practitioner I ........................... 3
  Semester II (Spring)
    NUNP 412 Neonatal Nurse Practitioner II ........................ 4
  Semester III (Summer)
    NUNP 413 Neonatal Nurse Practitioner III ...................... 3
  Semester III (Fall)
    NUNP 414 Neonatal Nurse Practitioner IV ...................... 5

**Total Semester Hours** .................................................... 40-42

*Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. The Advanced Practice Core courses are co-requisite or pre-requisite for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.

**Primary Care Nurse Practitioner**

This major is now offered in distance format with only 8 trips to Cleveland if you are a full-time student.

**Adult Nurse Practitioner**

Professional Development .................................................. 6
  NURS 443 ........................................................................... 3
  NURS 444 ........................................................................... 3
Scientific Inquiry ................................................................. 9-11
  NURS 405 ........................................................................... 3
  NURS 415 ........................................................................... 4
  NURS 503 OR NURS 500 .................................................... 2-4
Advanced Practice Core ....................................................... 10
  NURS 430 (Spring) ............................................................. 3
  NURS 453 (Fall) ................................................................ 4
  NURS 459 ........................................................................... 3
Clinical Nursing Courses ....................................................... 16
  Semester I (Fall)
    NUNP 410 Health Promotion Across the Lifespan ............ 2
  Semester II (Spring)
    NUNP 432 Common and Acute Health Problems in the Adult I ......................................................... 5
  Semester III (Summer)
    NUNP 433 Common and Acute Health Problems in the Adult II ......................................................... 4
  Semester IV (Fall)
    NUNP 434 Advanced Management in Adult Primary Care .... 5

**Total Semester Hours** .................................................... 41-43

**Family Nurse Practitioner**

This major is now offered in distance format with only 8 trips to Cleveland if you are a full-time student.

Professional Development .................................................. 6
  NURS 443 ........................................................................... 3
  NURS 444 ........................................................................... 3
Scientific Inquiry ................................................................. 9-11
  NURS 405 ........................................................................... 3
  NURS 415 ........................................................................... 4
  NURS 503 OR NURS 500 .................................................... 2-4
Advanced Practice Core ....................................................... 10
  NURS 430 (Spring) ............................................................. 3
  NURS 453 (Fall) ................................................................ 4
  NURS 459 ........................................................................... 3
Clinical Nursing Courses ....................................................... 15
  Semester I (Fall)
    NUNP 410 Health Promotion Across the Lifespan ............ 2
  Semester II (Spring)
    NUNP 419 Family Health Nursing: Health of Adults and Older Adults .................................................. 5
  Semester III (Summer)
    NUNP 429 Family Health Nursing: Health of the Family During Childbearing Years ......................... 4
  Semester IV (Fall)
    NUNP 459 Family Health Nursing: Health of Children and Adolescents ............................................. 4

**Total Semester Hours** .................................................... 40-42

*Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. The Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.

**Gerontological Nurse Practitioner**

Professional Development .................................................. 6
  NURS 443 ........................................................................... 3
  NURS 444 ........................................................................... 3
Scientific Inquiry ................................................................. 9-11
  NURS 405 ........................................................................... 3
  NURS 415 ........................................................................... 4
  NURS 503 OR NURS 500 .................................................... 2-4
Advanced Practice Core ....................................................... 10
  NURS 430 (Spring) ............................................................. 3
  NURS 453 (Fall) ................................................................ 4
  NURS 459 ........................................................................... 3
Clinical Nursing Courses ....................................................... 19
  Semester I (Fall)
    NUNP 410 Health Promotion Across the Lifespan ............ 2
    NURS 441 Mental Health for Older Adults 1
  Semester II (Spring)
    NUNP 419 Family Health Nursing: Health of Adults and Older Adults .................................................. 5
    NURS 479 Public Policy and Aging 3
  Semester III (Summer)
    NUNP 449 Primary Care of the Older Adult .................... 3
  Semester IV (Fall)
    NUNP 454 Management of Complex Problems in the Older Adult ......................................................... 4
    NURS 442 Mental Health Interventions with Older Adults ................................................................. 1

**Total Semester Hours** .................................................... 44-46
For those wishing dual certification as GNP and Gerontological CNS, add the following to the GNP major:

**NURS 460 Practicum and Supervision of the**

**Role of the Clinician** .......................................................... 3

**NURS 446 Collaboration and Administration in Health Care Delivery** .......................................................... 3

**NURS 448 Mental Health Practicum with Older Adults** .......................................................... 3

*Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. The Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.*

**Pediatric Nurse Practitioner**

**Professional Development** .................................................... 6

**NURS 443** ........................................................................ 3

**NURS 444** ........................................................................ 3

**Scientific Inquiry** .................................................................. 9-11

**NURS 405** ........................................................................ 3

**NURS 415** ........................................................................ 4

**NURS 503 OR NURS 500** .................................................... 2-4

**Advanced Practice Core** ......................................................... 10

**NURS 430 (Spring)** ................................................................. 3

**NURS 453 (Fall)** ....................................................................... 4

**NURS 459** ........................................................................ 3

**Clinical Nursing Courses** ......................................................... 15

**Semester I (Fall)**

**NUNP 410 Health Promotion Across the Lifespan** ................... 2

**NUNP 401 Health Promotion of Children** ................................. 2

**Semester III (Spring)**

**NUNP 402 Common and Acute Health Problems of Children** .......................... 6

**Semester IV (Fall)**

**NUNP 403 Advanced Management in Pediatric Primary Care** .......... 5

**Total Semester Hours** ......................................................... 40-42

*Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. The Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.*

**Psychiatric Mental Health Nurse Practitioner**

**Professional Development** .................................................... 6

**NURS 443** ........................................................................ 3

**NURS 444** ........................................................................ 3

**Scientific Inquiry** .................................................................. 9-11

**NURS 405** ........................................................................ 3

**NURS 415** ........................................................................ 4

**NURS 503 OR NURS 500** .................................................... 2-4

**Advanced Practice Core** ......................................................... 10

**NURS 430 (Spring)** ................................................................. 3

**NURS 453 (Fall)** ....................................................................... 4

**NURS 459** ........................................................................ 3

**Clinical Nursing Courses** ......................................................... 15

**Semester I (Fall)**

**NURS 460 Theoretical Basis of Individual Therapy** ............... 2

**NURS 461 Practicum and Supervision of Individual Therapy** .......... 1

**SSBT 548 Adult Psychopathology OR PSCL 524 Advanced Psychopathology** .......................... 3

**Semester II (Spring)**

**NURS 462 Practicum and Supervision of Group and Family Therapy** ........................................ 2

**NURS 467 Theories of Family and Group Modalities** ................. 2

**NURS 463 Theoretical Basis of Practicum and Supervision in Consultation and Mental Health Education** ........................................ 2

**NURS 466 Practicum and Supervision of the Role of Clinician** .......... 3

**Total Semester Hours** ......................................................... 40-42

**Women's Health Nurse Practitioner**

**Professional Development** .................................................... 6

**NURS 443** ........................................................................ 3

**NURS 444** ........................................................................ 3

**Scientific Inquiry** .................................................................. 9-11

**NURS 405** ........................................................................ 3

**NURS 415** ........................................................................ 4

**NURS 503 OR NURS 500** .................................................... 2-4

**Advanced Practice Core** ......................................................... 10

**NURS 430 (Spring)** ................................................................. 3

**NURS 453 (Fall)** ....................................................................... 4

**NURS 459** ........................................................................ 3

**Clinical Nursing Courses** ......................................................... 14

**Semester I (Fall)**

**NURS 454 Well Woman Health Care** .................................... 3

**Semester II (Spring)**

**NURS 455 The Childbearing Family** ....................................... 4

**Semester IV (Fall)**

**NUNP 410 Health Promotion Across the Lifespan** ................... 2

**NUNP 559 Advanced Practice in Nursing Care of Women** .......... 5

**Total Semester Hours** ......................................................... 39-41

*Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. The Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.*

**Nurse Anesthesia**

Nurse anesthesia focuses on preoperative evaluation, intraoperative management and postoperative evaluation of patient anestheisia care. Nurse anesthetists are primarily responsible for direct patient care and are prepared as expert clinicians.

Clinical courses provide students with opportunity to give direct patient care, participate in staff education programs and identify clinical topics for research. Students work one-on-one with a clinical preceptor with expertise in nurse anesthesia. The student will take part in administering general and regional anesthesia in persons of all ages. The management of emergency operations, obstetrics, pediatrics and neurosurgery are an integral part of the clinical experience. Graduates will be eligible to take the certification examination administered by the Council on Certification of Nurse Anesthetists.

All applicants must have at least one year of recent experience in one of the following acute care settings: recovery room, emergency room, or medical, surgical, neonatal or pediatric intensive care. Applicants will be reviewed as files are completed and to be considered all files must be completed by January 15 of the expected year of enrollment.
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### Clinical Nurse Specialist

Two specialties are in the clinical nurse specialist track in the masters program. Medical-surgical nursing focuses on the care of patients recovering from illness and living with chronic illness. The student selects a specialty in critical care, oncology, or other specialty adult medical-surgical areas. The student then does clinical practicum in these areas. The focus of the Community Health program is on mobilizing and empowering the community to act on its own behalf in matters affecting health and well being. Interventions are designed in collaboration with the community and interdisciplinary personnel. A concentration in infection may be taken along with the community health courses. Graduates of these tracks are eligible to sit for certification examinations as a clinical nurse specialist.

### Medical-Surgical Nursing

- **Professional Development**
  - NURS 443: 3
  - NURS 444: 3
- **Scientific Inquiry**
  - NURS 405: 3
  - NURS 415: 4
- **Advanced Practice Core**
  - NURS 438: 4
  - NURS 453: 4
  - NURS 459: 3
  - NURS 457: 7
  - NURS 410: 2
  - NURS 503: 2
  - NURS 500: 2
  - NURS 491: 2

### Community Health Nursing

- **Professional Development**
  - NURS 443: 3
  - NURS 444: 4
- **Scientific Inquiry**
  - NURS 405: 3
  - NURS 415: 4
- **Clinical Nursing Courses**
  - NURS 491: 4
  - NURS 480: 3
  - NURS 410: 2
Semester II (Spring)
NURS 495 Community Health Nursing Program Planning ............ 4
NURS 496 Community Health Nursing Leadership ..................... 4
NUND 485 Health Care Policy and Planning and
Information Management Systems .......................................... 3

Relevant Courses .................................................................... 6
NURS 471 Organizational Theories ........................................... 3
NURS 446 Collaboration and Administration in
the Health Delivery System (Fall) ........................................... 3

OR
Select two courses in the following areas:
Anthropology, Demography, Biostatistics, Epidemiology

Total Credits ........................................................................ 41-43

A concentration in infection control can be completed with the
addition of the following classes:
EPBI 490 Epidemiology: Introduction to Theory/Method ........... 3
NURS 445 Infection Control Nursing I ........................................ 3
EPBI 494 Infectious Disease Epidemiology ............................... 3
NURS 450 Infection Control Nursing II ....................................... 3
NURS 524 Infection Control Practicum ..................................... 1

*Note: Courses listed under the area of Professional Develop-
ment, Scientific Inquiry and Advanced Practice Core may be taken
alone or with Clinical Nursing Courses, and may be taken during
any semester offered. The Advanced Practice Core courses are
requisites or pre-requisites for the clinical nursing courses. Clinical
Nursing Courses must be taken in the semester and sequence
listed above. Clinical course availability is based upon enrollment.

Nursing Informatics

The M.S.N. major in Nursing Informatics emphasizes the
preparation of graduates who can analyze nursing information
requirements, design systems, manage information and its
technological requirements, identify system implementation
strategies, implement user training strategies, and evaluate system
effectiveness in clinical, educational, administrative, and research
venues. Students in the Nursing Informatics major will specialize
in an area of interest within Nursing Informatics. These areas
include but are not limited to: systems analysis and design,
emerging technologies, database management, and organizational
implementation of information systems. An internship of one
semester will provide an opportunity for the student to obtain
practical experience as a Nursing Informatics Specialist (NIS) in a
variety of clinical, educational, research and administrative
settings. The program includes 500 hours that may be credited
toward the required 2000 hours for certification as a Nursing
Informatics Specialist through the ANCC.

Professional Development .................................................... 6
NURS 443 .............................................................................. 3
NURS 444 .............................................................................. 3

Scientific Inquiry ................................................................... 9-11
NURS 405 .............................................................................. 3
NURS 415 .............................................................................. 4
NURS 503 OR NURS 500 ..................................................... 2-4

Informatics Nursing Core .................................................... 22
Semester I (Fall)

NUNI 421 Theoretical Foundations of
Nursing Informatics .............................................................. 4
MIDS 409 Introduction to Management
Information Systems .............................................................. 3
NURS 471 Organizational Theory ............................................ 3
Semester II (Spring)

NUNI 431 Advanced Nursing Informatics .............................. 4

Semester III (Fall)

NUNI 499 Internship in Nursing Informatics ........................... 5
MIDS 432 Health Care Information Systems ............................ 3

Total Credits ....................................................................... 37-39

*Note: Courses listed under the area of Professional Develop-
ment and Scientific Inquiry may be taken alone or with
Informatics Nursing Core Courses, and may be taken during any
semester offered. The Informatics Nursing Core courses must be
taken in the semester and sequence listed above. Informatics
Nursing Core courses availability is based upon enrollment.

M.S.N./M.A. (Anthropology) Joint Degree

The Master of Science in Nursing/Master of Arts in Anthropology
joint degree provides students with the unique combination of
cross-cultural expertise in medical anthropology and clinical
expertise in nursing. Students must complete a minimum of 19
credits in nursing core courses, 12 to 22 credits in clinical major
courses, and a minimum of 18 credits in anthropology courses,
distributed as indicated below. The actual number of credits
depends upon the major selected. This curriculum plan reflects
clinical nursing majors other than nurse anesthesia and community
health. Choice of electives should guarantee that minimum credit
requirements are met. All students must pass the Masters Qualify-
ing Examination in Anthropology.

Required Nursing Courses .................................................. 12-22
Clinical Major Courses and Prerequisites
NURS 443 Professionalism in Advanced Practice Nursing .......... 3
NURS 444 Health Care Delivery, Legal and Ethical Issues .......... 3
NURS 453 Physiological Foundations ................................. .......................... 4
NURS 459 Integrated Assessment ........................................... 3
NURS 430 Pharmacology and Therapeutics .............................. 3
NURS 405 Inquiry I ............................................................... 3

Total .................................................................................. 31-41

Required Anthropology Courses

ANTH 480 Anthropology of Health & Illness Part I .................. 3
ANTH 481 Anthropology of Health and Illness Part II ............... 3
ANTH 462 Contemporary Theory in Anthropology ................. 3
Anthropology Electives (health-related) ................................... 6-9

Total .................................................................................. 15-18

Required Research Courses

NURS 415 Inquiry II ............................................................... 4
NURS 503 Inquiry III ............................................................. 2

Total .................................................................................. 6

Or

ANTH 504 Advanced Methods in Medical and
Gerontological Anthropology ................................................. 3
and either of the following:
ANTH 444 Urban Health/Cultural Competence Practicum .. 3
Or
ANTH 447 Qualitative Methods in Medical Anthropology .... 3

Total .................................................................................. 6

Required Elective

Approved elective course in Anthropology OR Nursing ....... 3

TOTAL SEMESTER HOURS .................................................. 55-68

M.S.N./M.A. (Bioethics) Joint Degree

The Master of Science in Nursing/Master of Art in Bioethics joint
degree program is designed to provide nurses with the concepts
essential to ethics and ethical decision-making. This program is
relevant for nurses who are family advocates within health care
systems. The total M.S.N./M.A. degree requirements are 53-63
credits.
### M.S.N./M.B.A. Joint Degree

The Masters of Science in Nursing/Masters in Business Administration joint degree program is designed for nurses with managerial and organizational skills needed to manage patient care environments or health programs and to participate in the strategic and operational leadership of health care agencies. This program integrates nursing and management courses taken concurrently. A nine-hour practicum must be taken in one semester.

Orientation and Statistics Preparation Workshops begin week before Fall courses

<table>
<thead>
<tr>
<th>Semester I (Fall)</th>
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<tbody>
<tr>
<td>MBAC 410 Management Assessment and Development</td>
<td>1.2</td>
</tr>
<tr>
<td>MBAC 410 (Lab) Team Development Seminars</td>
<td>1</td>
</tr>
<tr>
<td>MBAC 411 Strategic Issues and Applications I</td>
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<tr>
<td>MBAC 412 Career Management Seminars</td>
<td>1</td>
</tr>
<tr>
<td>MBAC 414 Statistics and Decision Modeling</td>
<td>3</td>
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<tr>
<td>MBAC 415 Financial Reporting and Control</td>
<td>3</td>
</tr>
<tr>
<td>MBAC 416 Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>NURS 405 Inquiry I</td>
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<th>Semester II (Spring)</th>
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<tr>
<td>MBAC 413 Human Values in Organizations</td>
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<tr>
<td>MBAC 413 (Lab) Negotiations and Collaboration</td>
<td>1</td>
</tr>
<tr>
<td>MBAC 421 Strategic Issues and Applications II</td>
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<tr>
<td>MBAC 423 Marketing</td>
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<td>NURS 415 Inquiry II</td>
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<tr>
<td>NUND 483 Health Care Policy and Planning and Information Management Systems</td>
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<thead>
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<th>Semester III (Fall)</th>
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<tbody>
<tr>
<td>MIDS 409 Information Design &amp; Management</td>
<td>3</td>
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<tr>
<td>OPMT 405 Operations Management</td>
<td>3</td>
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<tr>
<td>NURS 468 Continuous Improvement in Health Care (recommended)</td>
<td>3</td>
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<tr>
<td>ECON 405 Economics</td>
<td>3</td>
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<tr>
<td>NURS 503 Inquiry III</td>
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<table>
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<tr>
<th>Semester IV (Spring) Hours</th>
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<tr>
<td>Open elective (WSOM)</td>
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<tr>
<td>NURS 456 Issues in Health Care Management OR HSMC 456</td>
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<tr>
<td>NURS 577 Nursing Practicum</td>
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<th>Semester V (Fall)</th>
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<td>NURS 491 Community Health Nursing Assessment</td>
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<td>NURS 503 Inquiry III</td>
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<tr>
<td>MPH 429 Environmental and Occupational Health</td>
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<td><strong>Total</strong></td>
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</table>

**TOTAL SEMESTER HOURS 78**

*Note: This program may be done part time. See advisor for details.*

## M.S.N./M.P.H. Degree

The focus of the M.S.N. clinical specialization is on the development of skills necessary for the comprehensive assessment and diagnosis of the health status of communities and populations. The use of program planning models for development of community or population need based programs is emphasized and thorough program evaluation techniques are stressed. The Master of Public Health Program, operated by the School of Medicine and the School of Graduate Studies, prepares students for the broad mission of public health, defined as “enhancing health in human populations through organized community effort” utilizing education, research and community service. The dual degree program will not only prepare nurses to sit for the American Nurses Credentialing Center (ANCC) clinical specialty exam in Community Health Nursing, but also will prepare nurses to assume leadership roles in the overall planning, organizing, and delivery of care to populations and communities. Students pursuing the combined M.S.N./MPH degree will take 30 credits of MPH course work and 29 M.S.N. credits.
Joint Programs with Frontier Nursing Service

M.S.N./CNEP
The Community-Based Nurse-Midwifery Education Program (CNEP) is a distance education program leading to a certificate in nurse-midwifery. Students complete course and clinical work in their communities. CNEP is housed in the Frontier School of Midwifery and Family Nursing in Hyden, Kentucky. The program is administered by a Certified Nurse-Midwife with over 40 Certified Nurse-Midwifery faculty members. Through an innovative affiliation agreement, students attending CNEP receive full course credit towards a Master’s Degree in Nursing from Case Western Reserve University. Degree requirements must be completed within 5 years of completion of CNEP.

Course of Study for M.S.N./CNEP Curriculum

<table>
<thead>
<tr>
<th>Semester (Fall)</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 405 Inquiry I</td>
<td>3</td>
</tr>
<tr>
<td>NURS 415 Inquiry II</td>
<td>4</td>
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<tr>
<td>NURS 503 Inquiry III</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
</tr>
</tbody>
</table>

M.S.N./CFNP
The Community-Based Family Nurse Education Program is an innovative joint degree program with the Frances Payne Bolton School of Nursing at Case Western Reserve University. The program is designed for aspiring family nurse practitioners who complete course and clinical work in their communities. The program is designed with a 24 month full-time or a 36 month part-time option. The Master’s degree is awarded by Case Western Reserve University. Degree requirements must be completed within 5 years of completion of CFNP courses at Frontier Nursing Service. For more information, contact:
- Case Western Reserve University
- Frances Bolton Payne School of Nursing
- Student Services
- 10900 Euclid Avenue
- Cleveland, Ohio 44106
- Frontier School of Midwifery and Family Nursing
- www.frontierfnp.org

Course of Study for M.S.N./CFNP Curriculum

<table>
<thead>
<tr>
<th>Semester (Fall)</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 405 Inquiry I</td>
<td>3</td>
</tr>
<tr>
<td>NURS 415 Inquiry II</td>
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<td>NURS 503 Inquiry III</td>
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</tr>
<tr>
<td>Total</td>
<td>9</td>
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</tbody>
</table>

Doctor of Nursing
The Doctor of Nursing Program (N.D.) is an innovative academic program designed to prepare leaders in nursing. This is a four-year program leading to both a Masters of Science in Nursing and Nursing Doctorate degrees. The Doctor of Nursing program is designed with multiple entry points to accommodate students with diverse prior educational backgrounds. The sixteen month prelicensure portion is designed for baccalaureate prepared college graduates from a variety of disciplines ranging from the social and natural sciences to the humanities and arts. The post licensure portion is designed for entry of B.S.N. and M.S.N. prepared nurses and prepares advanced practice nurses. The Doctor of Nursing program is characterized by educational depth and emphasis on advanced practice, nursing inquiry, management, and policy required for clinical leadership in nursing. Upon successful completion of the prelicensure portion of the N.D. program, the student receives a Certificate of Professional Nursing that qualifies them to sit for the professional nursing licensing examination (NCLEX-RN). A Masters of Science in Nursing and a Nursing Doctorate are awarded after successful completion of the post licensure portion of the N.D. program.

Characteristics of the Graduate
- Initiates and develops educational offerings and provides consultation with other professions/populations and communities about health, illness and health seeking behavior
- Initiates, designs, conducts, directs and reports clinical research studies
- Assumes functions and role of Advanced Practice Nurse and evaluates system-wide processes and directs changes in outcomes
- Assumes leadership positions of increasing complexity at the local/state/national levels
- Analyzes ethical issues in generating policy and practice recommendations
- Develops systems to establish and promote interdisciplinary teams
- Evaluates communication systems and generates new models to effect system change
- Analyzes impact of health care policy on delivery systems and implements changes

Entry Options

Prelicensure Portion of the N.D. Program
- Graduates from an accredited college or university with a baccalaureate degree in a non-nursing field.
- Students currently enrolled in a four-year baccalaureate program at a participating accredited liberal arts college after three years of study. The student earns a B.A. or B.S. from the liberal arts college upon successful completion of one year of the N.D. prelicensure level. (Senior Year in Professional Studies)

Post Licensure Portion of the N.D. Program
- RNs with an associate or diploma degree
- RNs with a B.S. or B.A. in a discipline other than nursing
- RNs with a B.S.N. degree
- RNs with M.S.N. degree

Progression in the N.D. Program

Academic Performance
Progression in the Doctor of Nursing degree program is contingent upon satisfactory academic achievement in all required courses. To maintain satisfactory academic standing, students enrolled for the prelicensure component of the N.D. degree must attain a grade point average of 2.5 or above. C, the lowest passing grade is regarded as borderline performance. If a student’s semester grade point average is less than 2.5, the student will be placed on probation for the following semester and will be given guidance. If the student on probation receives a grade point average of 2.5 or higher for that semester, the student will be removed from probation. If the student achieves a grad point average of less than 2.5 for two semesters, the student’s record will be reviewed by the Executive Committee to determine whether extenuating circumstances warrant an additional
responded to questions during the examination and the written
of the committee members agree that the student successfully
students, but the chair determines whether the defense is open to
standards. The thesis defense is open to University faculty and
nation with their thesis committee members who are also
approval and implementation of the thesis.

permissible. The procedures and written thesis must conform to
must be a significant contribution to existing nursing knowledge
approved by the Associate Dean of Academic Programs and
student in collaboration with a 3-member thesis committee
N.D. degree. Students who enter the Doctor of Nursing Program at the
postlicensure level must achieve a cumulative grade point
of 2.75 or above in all courses taken for credit as a N.D. student at the
Frances Payne Bolton School of Nursing to be awarded the N.D. degree. Students who enter the Doctor of Nursing Program at the
prelicensure level must achieve a cumulative grade point
average of 3.0 or above in all courses taken for credit as a N.D. student at the Frances Payne Bolton School of Nursing to be
awarded the N.D. degree.

When a student receives a grade of F for a required course, the
student must register for that course the next semester in which
the course is available. Doctor of Nursing degree students who
receive two failing grades indicating unsatisfactory performance
(F, NP, or U) in required courses will be excluded from the School of Nursing.

The grade of incomplete (I) will be given at the discretion of the
instructor for work not completed in the semester. A grade of I
must be removed by the end of the semester following the one in
which the course was taken or before the student enrolls in a
course for which the initial course is a prerequisite. No credit is
given for an I grade. The I will remain a permanent part of the
transcript if the student fails to complete course requirements
within the next semester.

N.D. students must complete degree requirements within seven
years from the prelicensure level, five years from Level III, and
four years from Level IV.

Thesis Defense
The thesis is an independent research study designed by the
student in collaboration with a 3-member thesis committee
approved by the Associate Dean of Academic Programs and
Associate Dean of Research of the School of Nursing. The thesis
must be a significant contribution to existing nursing knowledge
and suitable for publication in a peer reviewed journal or a book.
Students must prepare their own thesis, and joint theses are not
permissible. The procedures and written thesis must conform to
the regulations of the Bolton School of Nursing. The student must
pass a formal proposal approval process before applying for IRB
approval and implementation of the thesis.

Students must successfully defend their thesis in an oral exami-
nation with their thesis committee members who are also
responsible for certifying that it meets acceptable scholarly
standards. The thesis defense is open to University faculty and
students, but the chair determines whether the defense is open to
others outside of the University.

The thesis committee determines the adequacy of the oral
examination and written thesis. A student will pass if two or more
of the committee members agree that the student successfully
responded to questions during the examination and the written
thesis met scholarly standards.

Degree Requirements
Candidates for the Doctor of Nursing degree must complete all
required courses, including the courses required in their master
level clinical major. Post licensure students will be awarded a
Master of Science in Nursing if they meet the degree requirements
for this degree. However, if the student completes NUR520 and
NUR521, they do not need to complete NUR503 to be awarded
M.S.N.

Non-nurses enrolled in the N.D. program must complete the
program within 7 years of initial enrollment. B.S.N. graduates must
complete the post licensure portion of the program in 5 years.
M.S.N. graduates must complete the program within 4 years. If not
completed, the student’s record will be re-evaluated in terms of
the curriculum in effect at the time of review. The student may be
required to take additional course work to graduate.

Students entering the N.D. program in the prelicensure portion,
must achieve a cumulative GPA of 2.75 in all courses taken for
credit as a N.D. student at the Bolton School. Students who enter
the program at the post licensure portion of the N.D. program
must achieve a GPA of 3.0 or above in all courses taken for credit
as an N.D. student at the Bolton School. In addition, the student
must successfully pass the thesis defense.

N.D. Prelicensure Program
The first two years of the Nursing Doctorate Program is the
prelicensure portion that includes all course work required to sit
for the professional nursing licensing examination (NCLEX-RN)
required to practice nursing. During this portion of the program,
the student receives instruction in nursing theory, clinical skills,
and the nursing sciences. At the successful completion of this
portion of the Nursing Doctorate program, students receive a
Certificate of Professional Nursing. After passing the NCLEX,
the student may practice as a registered nurse (RN) while completing
the post licensure portion of the N.D. program.

Entry Options
- Graduates from an accredited college or university with a
  baccalaureate degree in a non-nursing field.
- Students currently enrolled in a four-year baccalaureate program
  at a participating accredited liberal arts college after three years
  of study. The student earns a B.A. or B.S. from the liberal arts
  college upon successful completion of one year of the N.D.
  prelicensure level. (Senior Year in Professional Studies)

Admission Requirements
- Graduated from an accredited college or university with at least
  a baccalaureate degree in non-nursing field.
- Overall GPA of 2.75 (in a 4 point system)
- Undergraduate education must include a sound background in
  the social/behavioral and natural sciences with a minimum
  grade point average of 2.5 (4 point system) or higher in the
  sciences.
- Satisfactory scores on the Graduate Record Examination (GRE).
- Three recommendations about academic competence, personal
  adjustment, prediction of contribution to the nursing profes-
  sion, and success as a doctoral student.
- An interview with faculty to discuss career goals, either by
  telephone or in person. Personal interviews are preferred.
- For more specific requirements, refer to N.D. Program bro-
  chure.

Senior Year in Professional Studies
A student in a college with a formal arrangement with the Bolton
School may enroll in the Senior Year in Professional Studies.
Students whose undergraduate institutions do not have an agreement with the Bolton School may arrange a Senior Year in Professional Studies on an individual basis. Information about arranging this program is available from the Office of Student Services. Students earn a B.A. or B.S. from the participating college or university upon successful completion of the first year of the N.D. program.

Students at Case Western Reserve University must apply through the undergraduate dean of their respective schools at the beginning of their junior year. To be awarded a B.S. or B.A. degree at the end of the successful completion of the first year of the N.D. program, the following must be met:

- Completion of the Case Western Reserve University Core Curriculum and two semesters of physical education, unless excused from the latter.
- Completion of three quarters of the major and minor concentration requirements.
- Completed at least 90 semester hours of academic credit of which the final 60 hours being while in residence with no more than 6 semester hours earned in courses taken in another institution, either by cross-registration or by approved transfer of credit.

N.D. Prelicensure Plan of Study

Semester I (Fall) Hours
NUND 230 Foundations of Nursing Practice ........................................ 2
NUND 410 Health Assessment .............................................................. 2
NUND 342 Microbiology ................................................................. 3
NUND 412 Anatomy and Physiology .................................................. 6
NUND 233 Growth and Development ................................................ 1
NUND 213 Nursing Strategies and Interventions .................................... 4
Total................................................................................................. 18

Semester II (Spring)
NUND 224 Acute Care: Adults .............................................................. 9
NUND 220 Altered Human Functioning ................................................. 3
NUND 211 Pharmacology .................................................................... 2
NUND 223 Health and Aging ............................................................... 2
NUND 234 Genetics ........................................................................... 1
Total................................................................................................. 17

Successful completion of STAT 201, Basic Statistics for the Social and Life Sciences I (or a comparable course), is a prerequisite to enrolling in Level II of the program.

Semester III (Summer)
NUND 315 Parents & Neonates ............................................................. 4
NURS 405 Inquiry I ............................................................................ 3
NUND 316 Children & Adolescents .................................................... 4
Total................................................................................................. 11

Semester IV (Fall)
NUND 317 Psych Mental Health .......................................................... 4
NUND 319 Public Health Nursing ....................................................... 4
NURS 415 Inquiry II ........................................................................... 4
NUND 322 Nursing Informatics II ....................................................... 1
NUND 341 Concepts of Management ................................................ 2
NUND 343 Issues and Ethics in Healthcare .......................................... 2
Total................................................................................................. 17

Progression from one semester to the next in the Prelicensure Component of the N.D. Program is contingent upon passing grades in all courses taken in the preceding semester.

Note: Successful completion of all prelicensure courses is necessary to sit for the Professional Nursing Licensing Examination (NCLEX-RN). The School of Nursing has the right to determine a student’s readiness to sit for the NCLEX-RN examination and the right to restrict testing until the student demonstrates a readiness to pass this examination.

N.D. Post Licensure Program

After completing the prelicensure portion of the N.D. program, students select an advanced practice specialty. Students with a B.S.N. or a M.S.N. enter in this portion of the N.D. program. For those entering with a B.S.N., course work consists of master level courses in the chosen specialty, N.D. core courses and a N.D. thesis. For those entering with a M.S.N., course work consists of N.D. core courses and N.D. thesis. After successful completion of the course requirements for masters clinical track, the student receives a Masters of Science in Nursing degree and is eligible to sit for national certification examinations in advanced nursing practice. The Acute Care Nurse Practitioner, Acute Care Pediatric Nurse Practitioner, Neonatal Nurse Practitioner and Nurse Anesthetist specialties have requirements for clinical experience before entering these clinical tracks (See descriptions of each specialty requirements in the Master of Science of Nursing section). The N.D. core requirements prepare the student in specialty requirements in the Master of Science of Nursing program. The N.D. core requirements prepare the student in nursing management and nursing inquiry, and an independent research study, N.D. thesis, is a component of the post licensure portion of the program.

Entry Options

- RN with a diploma or associate degree in nursing from an accredited school (See RN/M.S.N. program described under the masters program)
- RN with a B.S. or B.A. degree in a discipline other than nursing (See portfolio option described under the masters program)
- Nurse with a B.S.N. degree
- Nurse with a M.S.N. degree

Admission Requirements

RN with Diploma and Associate Degree

- See the description of the RN-M.S.N. program described under the masters of nursing program.
- Satisfactory completion of undergraduate pre-requisites for the masters of nursing program.
- Written statement of academic and career objectives and research interest.
- The Graduate Record Examination, including verbal, quantitative and analytical sections.

RN with B.S. or B.A. Other than Nursing

- See the description of the portfolio option described under the masters of nursing program.
- Written statement of academic and career objectives and research interest.
- The Graduate Record Examination, including verbal, quantitative and analytical sections.

RN with a B.S.N.

- Graduated from an accredited college or university with a baccalaureate degree in nursing with an overall GPA of 2.75 (on a 4 point system) or above is required. The Graduate Record Examination, including verbal, quantitative and analytical sections.
- Transcripts from all colleges and universities where academic work was done
- Interview with faculty to discuss career plans. This can be done by phone.
- Additional evidence of academic ability may be required.
• Undergraduate records will be reviewed for comparability to the prelicensure portion of the N.D. program. Additional course work may be required.
• Written statement of academic and career objectives and research interest
• Students must complete the M.S.N. level inquiry courses before beginning the upper level N.D. theory and research courses.

**RN with a M.S.N.**
- Graduated from an accredited college or university with a masters degree in nursing with an overall GPA of 2.75 (in a 4 point system) or above is required.
- The Graduate Record Examination, including verbal, quantitative, and analytical sections.
- Transcripts from all colleges and universities where academic work was done
- Interview with faculty to discuss career plans. This can be done by phone.
- Written statement of academic and career objectives and research interest
- Nationally certified or qualified to sit for a national certification exam in advanced practice nursing.

**N.D. Program of Study for Students with a M.S.N.**

**Prerequisite for Research Strand:**

<table>
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<tr>
<th>Course</th>
<th>Hours</th>
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<td>STAT 301 (or approved equivalent)</td>
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**Semester I (Fall)**

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<tr>
<td>NURS 504 Nursing Theory</td>
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<tr>
<td>NURS 520 Advanced Nursing Research</td>
<td>3</td>
</tr>
<tr>
<td>NUND 471 Organizational Theories</td>
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**Semester II (Spring)**

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<tr>
<td>NURS 521 Advanced Nursing Research II</td>
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</tr>
<tr>
<td>NUND 483 Health Policy Planning and Management Systems</td>
<td>3</td>
</tr>
<tr>
<td>NUND 441 Management in Advanced Practice</td>
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**Semester III & IV**

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<th>Course</th>
<th>Hours</th>
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<tbody>
<tr>
<td>NUND 500 N.D. Thesis</td>
<td>Minimum 6</td>
</tr>
</tbody>
</table>

**Total Semester Hours**

Minimum 24

**Nurse Practitioners**

Nurse practitioners promote optimal health, detect illness and facilitate restoration and maintenance of health. They often function independently in a variety of settings. One specialty is available for acute care nurse practitioners and six specialties are available in primary care. One year of experience in acute care is required for the Acute Care Nurse Practitioner (Adult) and one year of experience in neonatal intensive care is required for the Neonatal Nurse Practitioner. These programs contain at least 500 hours of clinical experience. Graduates are eligible to sit for the national certification examines for these specialties.

**Acute Care Nurse Practitioner**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 443</td>
<td>3</td>
</tr>
<tr>
<td>NURS 444</td>
<td>3</td>
</tr>
</tbody>
</table>

**Scientific Inquiry**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 405*</td>
<td>15-19</td>
</tr>
<tr>
<td>NURS 415*</td>
<td>3</td>
</tr>
<tr>
<td>NURS 520</td>
<td>4</td>
</tr>
<tr>
<td>NURS 521</td>
<td>3</td>
</tr>
<tr>
<td>NURS 504</td>
<td>3</td>
</tr>
<tr>
<td>STAT 301</td>
<td>3</td>
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</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUND 493</td>
<td>3</td>
</tr>
<tr>
<td>NUND 441</td>
<td>3</td>
</tr>
<tr>
<td>NURS 471</td>
<td>3</td>
</tr>
</tbody>
</table>

**Advanced Practice Core**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 430 (Spring)</td>
<td>3</td>
</tr>
<tr>
<td>NURS 453 (Fall)</td>
<td>4</td>
</tr>
<tr>
<td>NURS 459</td>
<td>3</td>
</tr>
</tbody>
</table>

**Clinical Nursing Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 438 Theoretical Foundations of Acute Care Nursing</td>
<td>4</td>
</tr>
<tr>
<td>NURS 523 Advanced Internship in Flight Nursing</td>
<td>1-5</td>
</tr>
</tbody>
</table>

*Prelicensure students take these during the prelicensure portion of the N.D. program.

Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Advanced Practice Core courses are corequisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 406 Flight Nursing Clinical Seminar I</td>
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</tr>
<tr>
<td>NURS 407 Emergent Care of Children</td>
<td>2</td>
</tr>
<tr>
<td>NURS 404 Flight Nursing Clinical Seminar II</td>
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</tr>
<tr>
<td>NURS 412 Neonatal Nurse Practitioner II</td>
<td>3</td>
</tr>
<tr>
<td>NURS 413 Neonatal Nurse Practitioner III</td>
<td>3</td>
</tr>
<tr>
<td>NURS 414 Neonatal Nurse Practitioner IV</td>
<td>5</td>
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</tbody>
</table>

**Total Semester Hours**

Minimum 65
Adult Nurse Practitioner

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Development</td>
</tr>
<tr>
<td>NURS 443</td>
</tr>
<tr>
<td>NURS 444</td>
</tr>
<tr>
<td>Scientific Inquiry</td>
</tr>
<tr>
<td>NURS 405*</td>
</tr>
<tr>
<td>NURS 415*</td>
</tr>
<tr>
<td>NURS520</td>
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<tr>
<td>NURS521</td>
</tr>
<tr>
<td>NURS 504</td>
</tr>
<tr>
<td>STAT 301</td>
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<tr>
<td>N.D. Thesis (NURS 500)</td>
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<tr>
<td>N.D. Management</td>
</tr>
<tr>
<td>NUND 485</td>
</tr>
<tr>
<td>NUND 441</td>
</tr>
<tr>
<td>NURS 471</td>
</tr>
<tr>
<td>Advanced Practice Core</td>
</tr>
<tr>
<td>NURS 430 (Spring)</td>
</tr>
<tr>
<td>NURS 453 (Fall)</td>
</tr>
<tr>
<td>NURS 459</td>
</tr>
<tr>
<td>Clinical Nursing Courses</td>
</tr>
<tr>
<td>Semester I (Fall)</td>
</tr>
<tr>
<td>NUNP 410 Health Promotion Across the Lifespan</td>
</tr>
<tr>
<td>Semester II (Spring)</td>
</tr>
<tr>
<td>NUNP 452 Common and Acute Health Problems in the Adult I</td>
</tr>
<tr>
<td>Semester III (Summer)</td>
</tr>
<tr>
<td>NUNP 453 Common and Acute Health Problems in the Adult II</td>
</tr>
<tr>
<td>Semester IV (Fall)</td>
</tr>
<tr>
<td>NUNP 454 Advanced Management in Adult Primary Care</td>
</tr>
<tr>
<td>Total Semester Hours</td>
</tr>
</tbody>
</table>

*Prelicensure students take these during the prelicensure portion of the N.D. program.

Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.

Family Nurse Practitioner

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Development</td>
</tr>
<tr>
<td>NURS 443</td>
</tr>
<tr>
<td>NURS 444</td>
</tr>
<tr>
<td>Scientific Inquiry</td>
</tr>
<tr>
<td>NURS 405*</td>
</tr>
<tr>
<td>NURS 415*</td>
</tr>
<tr>
<td>NURS520</td>
</tr>
<tr>
<td>NURS521</td>
</tr>
<tr>
<td>NURS 504</td>
</tr>
<tr>
<td>STAT 301</td>
</tr>
<tr>
<td>N.D. Thesis (NURS 500)</td>
</tr>
<tr>
<td>N.D. Management</td>
</tr>
<tr>
<td>NUND 485</td>
</tr>
<tr>
<td>NUND 441</td>
</tr>
<tr>
<td>NURS 471</td>
</tr>
<tr>
<td>Advanced Practice Core</td>
</tr>
<tr>
<td>NURS 430 (Spring)</td>
</tr>
<tr>
<td>NURS 453 (Fall)</td>
</tr>
<tr>
<td>NURS 459</td>
</tr>
<tr>
<td>Clinical Nursing Courses</td>
</tr>
<tr>
<td>Semester I (Fall)</td>
</tr>
<tr>
<td>NUNP 410 Health Promotion Across the Lifespan</td>
</tr>
<tr>
<td>Semester II (Spring)</td>
</tr>
<tr>
<td>NUNP 441 Mental Health for Older Adults</td>
</tr>
<tr>
<td>Semester III (Summer)</td>
</tr>
<tr>
<td>NUNP 449 Primary Care of the Older Adult</td>
</tr>
<tr>
<td>Semester IV (Fall)</td>
</tr>
<tr>
<td>NUNP 454 Management of Complex Problems in the Older Adult</td>
</tr>
<tr>
<td>NURS 442 Mental Health Interventions with Older Adults</td>
</tr>
<tr>
<td>Total Semester Hours</td>
</tr>
</tbody>
</table>

*Prelicensure students take these during the prelicensure portion of the N.D. program.

Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.
### Pediatric Nurse Practitioner

**Professional Development** .......................................................... 6  
NURS 443 .................................................................................. 3  
NURS 444 .................................................................................. 3  

**Scientific Inquiry** ................................................................. 19  
NURS 405* ................................................................................. 3  
NURS 415* ................................................................................. 4  
NURS 420 .................................................................................. 3  
NURS 421 .................................................................................. 3  
NURS 504 .................................................................................. 3  
STAT 301 .................................................................................. 3  

N.D. Thesis (NURS 500) ............................................................... Minimum 6  
N.D. Management ..................................................................... 9  
NUND 483 ................................................................................ 3  
NUND 441 ................................................................................ 3  
NURS 471 .................................................................................. 3  

**Advanced Practice Core** ......................................................... 10  
NURS 430 (Spring) .................................................................... 3  
NURS 453 (Fall) ........................................................................ 4  
NURS 459 .................................................................................. 3  

**Clinical Nursing Courses** ....................................................... 15  
Semester I (Fall)  
NUNP 410 Health Promotion Across the Lifespan .................. 2  
NUNP 401 Health Promotion of Children ............................. 2  
Semester III (Spring)  
NUNP 402 Common and Acute Health Problems of Children 6  
Semester IV (Fall)  
NUNP 403 Advanced Management in Pediatric Primary Care 5  

**Total Semester Hours** ........................................................... Minimum 65  
*Prelicensure students take these during the prelicensure portion of the N.D. program.  
Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.

### Psychiatric Mental Health Nurse Practitioner

**Professional Development** .......................................................... 6  
NURS 443 .................................................................................. 3  
NURS 444 .................................................................................. 3  

**Scientific Inquiry** ................................................................. 15-19  
NURS 405* ................................................................................. 3  
NURS 415* ................................................................................. 4  
NURS 420 .................................................................................. 3  
NURS 421 .................................................................................. 3  
NURS 504 .................................................................................. 3  
STAT 301 .................................................................................. 3  

N.D. Thesis (NURS 500) ............................................................... Minimum 6  
N.D. Management ..................................................................... 9  
NUND 483 ................................................................................ 3  
NUND 441 ................................................................................ 3  
NURS 471 .................................................................................. 3  

**Advanced Practice Core** ......................................................... 10  
NURS 430 (Spring) .................................................................... 3  
NURS 453 (Fall) ........................................................................ 4  
NURS 459 .................................................................................. 3  

**Clinical Nursing Courses** ....................................................... 15  
Semester I (Fall)  
NURS 460 Theoretical Basis of Individual Therapy .................. 2  
NURS 461 Practicum and Supervision of Individual Therapy .... 1  
SSBT 548 Adult Psychopathology OR  
PSCL 524 Advanced Psychopathology .................................. 3  
Semester II (Spring)  
NURS 462 Practicum and Supervision of Group and Family Therapy . 2  
NURS 467 Theories of Family and Group Modalities ............. 2  
Semester III (Fall)  
NURS 463 Theoretical Basis of Practicum and Supervision in Consultation and Mental Health Education 2  
NURS 466 Practicum and Supervision of the Role of Clinician 3  

**Total Semester Hours** ........................................................... Minimum 60  
*Prelicensure students take these during the prelicensure portion of the N.D. program.  
Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Advanced Practice Core courses are co-requisites or pre-requisite for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.
Nurse Midwifery

Nurse-midwifery focuses on the clinical and scientific areas of women's health maintenance. A nurse-midwife is primarily responsible for direct care in the areas of gynecologic health, antepartum, intrapartum, postpartum, family planning and parent education. Students work one-on-one with a clinical preceptor and select and work in birth centers, health maintenance organizations and private practices. Graduates are eligible to sit for the certification examination for nurse midwifery from the American College of Nurse Midwives.

Professional Development ................................................. 6
   NURS 443 ................................................................. 3
   NURS 444 ................................................................. 3
Scientific Inquiry ......................................................... 15-19
   NURS 405* ............................................................. 3
   NURS 415* ............................................................. 4
   NURS 520 ............................................................... 3
   NURS 521 ............................................................... 3
   NURS 504 ............................................................... 3
   STAT 301 .............................................................. 3
N.D. Thesis (NURS 500) .................................................... Minimum 6
N.D. Management ......................................................... 9
   NUND 483 ............................................................ 3
   NUND 441 ............................................................ 3
   NURS 471 ............................................................ 3
Advanced Practice Core .................................................. 10
   NURS 430 (Spring) ............................................... 3
   NURS 453 (Fall) .................................................... 4
   NURS 459 ............................................................ 3
Clinical Nursing Courses .................................................. 20
   Semester I (Fall)
      NURS 454 Well Woman Health Care ....................... 3
   Semester II (Spring)
      NURS 455 The Childbearing Family ......................... 4
   Semester III (Fall)
      NURS 457 Labor and Birth .................................... 7
      NUND 410 Health Promotion Across the Lifespan ...... 2
   Semester IV (Spring)
      NURS 557 Advanced Nurse-Midwifery .................... 6
Total Semester Hours .................................................... 68

*Prelicensure students take these during the prelicensure portion of the N.D. program.

Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.

Clinical Nurse Specialist

Two specialties are in the clinical nurse specialist track in the masters program. Medical-surgical nursing focuses on the care of patients recovering from illness and living with chronic illness. The student selects a specialty in critical care, oncology, or other specialty adult medical-surgical areas. The student then does clinical practicum in these areas. The focus of the Community Health program is on mobilizing and empowering the community to act on its own behalf in matters affecting health and well being. Interventions are designed in collaboration with the community and interdisciplinary personnel. A concentration in infection may be taken along with the community health courses. Graduates of these tracks are eligible to sit for certification examinations as a clinical nurse specialist.

Medical-Surgical Nursing

Professional Development ................................................. 6
   NURS 443 ................................................................. 3
   NURS 444 ................................................................. 3
Scientific Inquiry ......................................................... 15-19
   NURS 405* ............................................................. 3
   NURS 415* ............................................................. 4
   NURS 520 ............................................................... 3
   NURS 521 ............................................................... 3
   NURS 504 ............................................................... 3
   STAT 301 .............................................................. 3
N.D. Thesis (NURS 500) .................................................... Minimum 6
N.D. Management ......................................................... 9
   NUND 483 ............................................................ 3
   NUND 441 ............................................................ 3
   NURS 471 ............................................................ 3
Advanced Practice Core .................................................. 10
   NURS 450 (Spring) ............................................... 3
   NURS 455 (Fall) .................................................... 4
   NURS 459 ............................................................ 3
Clinical Nursing Courses .................................................. 12
   Semester I (Fall)
      NURS 458 Theoretical Foundations of Acute Care Nursing ... 4
   Semester II (Spring)
      NURS 424 Theoretical Basis for Medical-Surgical Nursing ... 5
   Semester III (Fall)
      NURS 446 Collaboration and Administration in the Health Care Delivery System ...... 3
Total Semester Hours .................................................... Minimum 58

*Prelicensure students take these during the prelicensure portion of the N.D. program.

Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Advanced Practice Core courses are co-requisites or pre-requisites for the clinical nursing courses. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.

Community Health Nursing

Professional Development ................................................. 6
   NURS 443 ................................................................. 3
   NURS 444 ................................................................. 3
Scientific Inquiry ......................................................... 19
   NURS 405* ............................................................. 3
   NURS 415* ............................................................. 4
   NURS 520 ............................................................... 3
   NURS 521 ............................................................... 3
   NURS 504 ............................................................... 3
   STAT 301 .............................................................. 3
N.D. Thesis (NURS 500) .................................................... Minimum 6
N.D. Management ......................................................... 3
   NUND 483** ......................................................... 3
   NUND 441 ............................................................ 3
   NURS 471** .......................................................... 3
Clinical Nursing Courses .................................................. 20
   Semester I (Fall) ..................................................... Hours
      NURS 491 Community Health Nursing Assessment ........ 4
      NURS 480 Public Health Epidemiology ..................... 3
      NUND 410 Health Promotion Across the Lifespan ...... 2
   Semester II (Spring)
      NURS 495 Community Health Nursing Program Planning ... 4
      NURS 496 Community Health Nursing Leadership ........ 4
Ph.D. Statistics ....................................................................... 6

NURS 630 Advanced Statistics for Nursing Research: Linear Models ........................................... 3
Statistics elective ........................................................................... 3

Ph.D. Related Courses ............................................................. 3-6
NURS 609 Health Policy .......................................................... 3
Substantive elective .................................................................... 0-3

Ph.D. Nursing Science: Theory & Research .................. 15-18
NURS 506 Nursing Epistemology ........................................... 3
NURS 511 Strategies for Theory Development ................. 3
NURS 615 Topical Seminar in Nursing ................................. 6-9
NURS 670 Proposal Development ......................................... 3

Dissertation (NURS 701) .................................................... minimum 18

Total...................................................................................... 54

To register for NURS 701, the academic advisor and Associate Dean of Academic Programs must provide written permission that is submitted to the School of Graduate Studies. Students who have

### Program Requirements

#### Course Requirements

The Ph.D. program is a post baccalaureate program, and course requirements provide a foundation for a dissertation. Programs are individually planned so that applicants with a M.S.N. degree with a clinical nursing major with supervised practice can build on their prior masters education. Students entering with only a B.S.N. degree will be required to take NURS 507 Clinical Knowledge and NURS 508 Context of Care. A minimum of 54 semester credits in core requirements is required, and courses are listed below.

Additional course work may be required and will be determined by the faculty advisor.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ph.D. Research Methods</td>
<td>9</td>
</tr>
<tr>
<td>NURS 530 Advanced Nursing Research I</td>
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</tr>
<tr>
<td>NURS 531 Advanced Nursing Research II</td>
<td>3</td>
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<tr>
<td>Methods elective</td>
<td>3</td>
</tr>
<tr>
<td>Ph.D. Statistics</td>
<td>6</td>
</tr>
<tr>
<td>NURS 630 Advanced Statistics for Nursing Research: Linear Models</td>
<td>3</td>
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<tr>
<td>Statistics elective</td>
<td>3</td>
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<tr>
<td>Ph.D. Related Courses</td>
<td>3-6</td>
</tr>
<tr>
<td>NURS 609 Health Policy</td>
<td>3</td>
</tr>
<tr>
<td>Substantive elective</td>
<td>0-3</td>
</tr>
</tbody>
</table>

To register for NURS 701, the academic advisor and Associate Dean of Academic Programs must provide written permission that is submitted to the School of Graduate Studies. Students who have
Academic Performance and Progression

A student who receives a grade of F for a required course must register for the course the next semester it is offered. If the student receives a grade of F or unsatisfactory performance (F, U & NP) in two courses, he/she will be separated from the Bolton School.

Grade of incomplete (I) will be assigned only for extenuating circumstances, and only when a student fails to complete a small segment of the course. All work for the Incomplete grade must be made up, and the change of grade recorded in the Office of the University Registrar, by the date specified by the Instructor, but no later than the 11th week of the session following the one in which the I was received. Unresolved Incomplete grades will remain permanently on the student’s academic record, if the work is not made up by the designated deadline. A student who has a permanent Incomplete for a required course must retake the course in a later term. If the student cannot complete the work for the Incomplete by the specified deadline, he or she must petition for an extension which must be endorsed by the instructor, and explain the reasons why the work has not been completed, and include a new date for completion. Students are allowed only one extension of no more than one additional semester to complete the work.

A cumulative GPA of 3.0 must be maintained. If the cumulative GPA falls below 3.0, the student will be placed on academic probation. If the student does not raise the GPA to 3.0 or above in the next semester enrolled, the student will be separated from the University.

Students must maintain continuous registration throughout their degree programs unless granted a leave of absence. Students who do not register for an academic term will be automatically withdrawn from the program. They must then petition for reinstatement to continue graduate study. The Director of the Ph.D. Program and the Dean of Graduate Studies must approve the petition before students may register for further course work. In each case of readmission with full standing, the student will receive a letter stating the terms of readmission, including future time limits for the degree program and the past course work that will be credited toward the degree. If more than 24 months have elapsed since the last registration, the Office of Graduate Studies may request more information.

Advancement to Candidate Status

To advance to candidate status, Ph.D. students must pass an oral candidacy examination and provide a written research proposal at the time of the examination. The examination and proposal are evidence of the student’s knowledge and ability to synthesize and apply research methodologies and existing knowledge. The oral examination focuses on the nursing discipline, research methods, statistics, and substantive knowledge. The candidacy committee consists of three doctorally prepared Bolton School faculty members.

The student works with the candidacy committee to develop a research proposal. During this time, the student enrolls in NURS 670 “Proposal Development”. A minimum of 5 credits of NURS 670 is required, and the student may be required to take up to 12 credits of this course, if needed, to complete the proposal. Prior to scheduling the candidacy examination, the student must have completed the research practicum and all course requirements with a cumulative GPA of 3.0.
The candidacy committee determines the adequacy of responses to the oral examination and the research proposal presented at the time of the examination. A student who fails the candidacy examination may be permitted within one year of the failing the examination to retake it, provide a written response to questions from the committee or submit a revision of the proposal. The committee may also require additional course work. A student who fails the examination a second time will be separated from the Bolton School of Nursing.

A student who is not advanced to candidacy may not undertake further study for credit towards a Ph.D. within the Bolton School. With the approval of Ph.D. Council and the School of Graduate Studies, the student may take additional course work to complete a masters degree or enter the graduate program of another University academic department.

Proposal Defense

The purpose of the proposal defense is for students to demonstrate their synthesis and application of substantive knowledge and research methods and statistics. Students defend their dissertation proposal to their dissertation committee comprised of three doctoral prepared nursing faculty members and another doctoral prepared member from another department within the University. Additional voting or non-voting members may be included. The written dissertation proposal is presented to the committee three weeks prior to the proposal defense. The dissertation committee determines the adequacy of the responses to questions and the dissertation proposal. A student not passing the proposal defense may be required to repeat the defense, revise the proposal or provide written responses to questions. The student must pass the proposal defense before implementing the dissertation.

Dissertation Defense

Students must successfully defend their dissertation in an oral examination with the dissertation committee who are also responsible for certifying that it meets acceptable scholarly standards.

The student must provide a copy of the dissertation to committee members at least 10 days before the defense. The dissertation defense must be scheduled with the School of Graduate Studies three weeks prior to the defense. The time and place of the dissertation defense must be announced within the University. The dissertation defense is open to University faculty and students, but the dissertation chair determines whether the defense is open to others outside of the University.

The dissertation committee determines the adequacy of the oral examination and written dissertation. A student will pass if no more than one voting member dissents.

Degree Requirements

A student will be awarded a Ph.D. degree upon completion of all required course work in their curriculum as detailed in their Program of Study. All students must complete 36 semester hours of course work at the University. A cumulative GPA of 3.0 or above in all courses taken for credit (excluding grades of S) as a Ph.D. student at the University is required for awarding the Ph.D. degree.

Graduate students are considered to be in residence when they are fully engaged in academic work. Ph.D. students must be registered for a minimum of six consecutive academic terms (fall, spring and/or summer) from matriculation to a period not exceeding five years after the first credited hour(s) of dissertation research (701). The time period in which a leave of absence is taken does not count towards the residency requirement. Within the context of continuity of registration, departments may enact other restrictions. In such instances, the departmental requirements take precedence and must formally be disclosed to the student at matriculation. Continuous registration is mandatory for all graduate students unless on an approved leave from the School of Graduate Studies.

All requirements for the Ph.D. degree must be completed within five years from the first time a student registers for dissertation credit (NURS 701), including leaves of absences. If the student fails to complete the degree requirements within this 5-year time period, including leaves, they may request a 1-year extension approved by the advisor, Director of the Ph.D. Program and the dean of the School of Graduate Studies. If the degree requirements are still not met during this extension or an extension was never approved, the student will be separated from the School of Nursing. They may reapply to the Ph.D. program to continue to study using an abbreviated application process. After a review of the application and the student’s academic record, the Ph.D. Admissions Committee makes recommendations about admission and additional course work that may be required to the Director of the Ph.D. program.

Other Student Categories

Non-Degree Students

An applicant with basic preparation in nursing may apply to register as a non-degree student for up to 9 credits. The application form is available in the Nursing School Registrar’s Office for M.S.N. and N.D. programs and the Office of Graduate Studies for the Ph.D. program. The applicant must obtain written permission from the faculty teaching the course, and the Associate Dean for Academic Programs in the Bolton School for those taking Ph.D. courses. Clinical courses may NOT be taken as a non-degree student. Continuation of this status is at the discretion of the administrative officer of the Bolton School. Status as non-degree student does not imply acceptance into the Bolton School. If the non-degree student applies for admission to the Bolton School, course work completed as a non-degree student will be evaluated on an individual basis for its applicability to degree requirements within the time frame for the degree.

Special Students

Special students are those who take a specified course of study designed to meet an individual’s needs. They must meet the admission requirements for the program where the majority of class work will be done. Their status and satisfactory performance will be reviewed after one year. Students completing M.S.N. courses to obtain a certificate in any advanced practice nursing major will be admitted as special students.

If a special student decides to pursue a graduate degree, the approval of the Associate Dean of Academic Programs must be obtained. Entrance into the degree program will be considered the date when the student enrolled in the first course work as a special student. These courses must have been taken within the last five years. If more than five years have elapsed since the course work as special student was done, the student must meet the current academic requirements for the major selected.

International Students

International students may enroll in the masters, nursing doctorate and Ph.D. programs. They must meet the admission requirements for the program that they select. In addition,
application should be submitted approximately one year before the desired date of enrollment. English translations of transcripts are required.

1. Each applicant must document the ability to speak, read and write English as evidenced by satisfactory performance on the Test of English as a Foreign Language (TOEFL). The Educational Testing Service administers the test. Write to the following to arrange to take the test.

   Educational Testing Service (ETS)
   TOEFL/TSE
   PO Box 6151
   Princeton, NJ 08541-6151
   609-951-1100
   www.toefl.org

   Students whose native language is English are exempt. For those whose native language is not English, a score of 550 on the paper test or 213 for the computer test is desired. Students must take English courses at the English Language Services Center (ELS) at the University and students must complete English courses through the 109 level or its equivalent. Students who demonstrate English language proficiency may request to be exempt from these courses.

2. Present evidence of adequate financial resources to meet the expenses of full time study and travel expenses to and from Cleveland. Financial assistance is not available from the Bolton School. The student must arrange for a sponsor who will provide full financial support. The sponsor must document their ability to financially support the student, including costs of tuition and fees, room and meals, books, incidentals and travel expenses.

3. Students applying to clinical programs must be eligible for licensure as a registered nurse (RN) before any clinical courses are taken. To obtain RN licensure, the student can either 1) obtain licensure in a state other than Ohio and apply for reciprocity in Ohio, or; 2) sit for the licensure examination (NCLEX-RN) in Ohio. For information on how to become licensed in any state, you must obtain information from the specific state where you wish to become licensed. For the individual addresses of each State Board of Nursing, go to the National Council of State Boards of Nursing website at www.ncsbn.org and then go to “Click here to access the Boards of Nursing contact information and Websites.” You may also write to:

   National Council of
   State Boards of Nursing
   676 N. St. Clair Street
   Suite 550
   Chicago, Illinois, 60611-2921
   Telephone: (312) 787-6555.

   Once admitted to the Bolton School, an application form for a student visa will be sent to the student. Upon enrollment at the university, the student must subscribe to the Student Medical Insurance Plan that is required by the University Health Service.

Financial Assistance

The following is a brief description of the financial aid opportunities available to students at the Bolton School of Nursing. Undergraduate students can find a more detailed description of undergraduate aid in the pamphlet, Financial Aid at Case Western Reserve, obtained from the University Financial Aid Office. Some types of aid are not available to all students, and the awarding of some grants and scholarships may make you ineligible to receive other grants or scholarships. If you have questions or would like more information, contact either The Bolton School of Nursing or Case Western Reserve University Financial Aid Offices.

Undergraduate

Undergraduate students, those enrolled in the B.S.N. and RN-B.S.N. programs have a variety of financial assistance available, including federal and state need-based aid, and merit-based grants and scholarships.

The Bolton Scholarship

All full-time students in the B.S.N. or RN-B.S.N. programs are awarded the Bolton Scholarship. The scholarship is for at least 40% tuition and may be renewed each year (maximum of eight semesters for B.S.N. students and 4 semesters for RN-B.S.N. students) that the student remains full-time in the B.S.N. or RN-B.S.N. programs. An amount in addition to the 40% may be awarded on a financial-need basis.

Merit-Based Aid

The University offers several full and partial-tuition merit-based scholarships. These are generally renewable for all four years of study if high academic performance is maintained. To be eligible for University scholarships, students apply by February 1st and submit SAT I or ACT scores and be admitted to the University. Contact the University Financial Aid Office for more information.

Need-Based Aid

For all need-based aid, students are encouraged to complete the Free Application for Federal Student Aid (FAFSA) and register with the Financial Aid Profile Service (FAP) by February 15th (or as soon after as possible). From this information, and the CWRU Financial Aid Application, a student’s family contribution is determined. This is calculated solely on the financial circumstances of the student’s family, and does not take cost of tuition into consideration. Once the family contribution is calculated, it is subtracted from the estimated cost of attendance (tuition, room, board, fees, books, transportation and miscellaneous expenses) to calculate the student’s financial need. The financial need is the amount that may be covered by University’s financial aid programs. A student’s financial aid award or “package” may consist of up to three different components: grants, loans and employment.

Graduate

Graduate programs at the Bolton School of Nursing are the M.S.N., N.D., Ph.D., RN-M.S.N., and the joint degree programs (M.S.N./M.B.A., M.S.N./M.P.H., and M.S.N./M.A.).

Full- and Half-Time Students

Full-time enrollment is at least 9 credit hours Fall and Spring semesters, and at least 6 credit hours, Summer semesters. Half-time enrollment is 5-8 credit hours Fall and Spring semesters, and 3-5 credit hours Summer semester. To be eligible for financial aid for summer semesters, the student must also be eligible for aid in the following Fall and/or Spring semesters.

Federal Loans

All students are encouraged to complete the Free Application for Federal Student Aid (FAFSA). Information from this form and the CWRU Financial Aid application will be used to determine the student’s financial need, and the amount of loan for which they are eligible. The majority of students receive enough loans to cover the estimated cost of tuition and expenses.

There are two basic types of federal loans: subsidized and unsubsidized. Both types of loan repayments do not begin until a student’s enrollment falls below half-time or six months after
graduating, whichever comes first. Students may begin repayments earlier if they choose.

Subsidized loans do not accrue interest until after you graduate or fall below half-time enrollment. Unsubsidized loans begin accruing interest immediately, although it does not need to be paid until repayments begin.

Private Loans
For those students who do not receive federal loans or wish to borrow more money than is provided by federal loans, private lenders may be an option.

Part-Time Students
Students enrolled in less than 5 credit hours Fall and Spring Semesters, and less than 3 credit hours Summer Semesters are NOT eligible for federal aid. However, some private lending agencies do give loans to part-time students. Contact the Bolton School of Nursing Financial Aid Office for more information.

Intensive Students
Students enrolled only in intensive courses are NOT eligible for federal aid because regulations require enrollment in courses that span at least a ten-week period, but students may receive loans from some private lending agencies. Contact the Bolton School of Nursing Financial Aid Office for more information.

Scholarships and Grants
Some of the following grants, scholarships and assistantships are given directly by the Bolton School of Nursing, while others are outside sources of assistance. Students should seek other sources of assistance on their own. Direct questions regarding the following grants and scholarships to the Bolton School of Nursing Financial Aid Office.

Professional Nurse Traineeship Grant
This Department of Health and Human Services grant, awarded to the Bolton School of Nursing, is distributed to full-time M.S.N. students and post-licensure N.D. students seeking the M.S.N.. To be eligible, the student must be enrolled full-time (on a continuing basis) for two or more semesters and have the Statement of Appointment of Trainee and Statement of Acceptance of Traineeship forms on file in the Bolton School of Nursing Financial Aid Office.

National Health Service Corps Scholarship
This is an excellent opportunity for full-time students in the Family Nurse Practitioner and Nurse Midwifery programs. Awarded from the Bureau of Primary Health Care (BPHC), National Health Service Corps (NHSC) Scholarship Program, the scholarship includes full tuition and a monthly stipend. There is a one-year work commitment (minimum of two years) for each year or partial year the scholarship is awarded. To fulfill the work commitment, awardees must obtain employment in an underserved public or private facility approved by the National Health Service Corps. Employment is not necessarily with the federal government. Employment opportunities can be found across the United States in urban, suburban and rural settings. This Scholarship is very competitive and seeks applicants who are dedicated to the mission of the BPHC. Applications are available from the Bolton School of Nursing Financial Aid Office, in late February. Application deadline is in late March.

The N.D. Student Grant
Pre-licensure N.D. students may receive this Bolton School of Nursing Grant. Based on financial need, $1,000 - $3,000 is an award for each year of the pre-licensure component of the N.D. program.

Other Grants
Some advanced practice majors have additional financial assistance available. Please contact the Bolton School of Nursing Financial Aid Office.

Employment
Many employers of health care professionals offer tuition assistance of varying levels. While you should not expect that the assistance would cover your entire tuition, it is often a significant amount. Check with your employer for more information.
Student employment may be available at the Bolton School of Nursing or at other campus locations. Also, part-time employment may be available at local hospitals or other health care agencies.

Other Resources
There are many private scholarships, grants and loans available to undergraduate and graduate students. Students should check local organizations (i.e. churches, parents' employers, students' employers and service organizations). Public libraries have books on scholarships, and the Internet is another good source of information. When searching or applying for scholarships always be alert for scams. While most scholarships are legitimate, there are some that are not.

Searching on the World Wide Web
FASTWEB (www.fastweb.com) is a free search service. After completing a profile, this services searches through its database to identify scholarships that may meet student’s eligibility.
Since the database is continually updated, check back often. Also, complete numerous profiles that cover all of the student’s qualifications and interests because different profiles may produce different results.
FINAID (www.finaid.com) is a financial aid information page. It covers a wide variety of financial aid topics, including sources of aid, private loans and links to several free scholarship search services.

Information from the University
Bolton School of Nursing
Website: http://fpb.cwru.edu/
Charlene Quinn, Registrar/Financial Aid Director:
Direct: 216-368-2183
Toll free: 800-825-2540 ext. 2183
e-mail: cfp@po.cwru.edu
University Financial Aid Office
Website: http://fpb.cwru.edu/
Submit questions via the website, and a financial aid counselor will respond by e-mail in the order that questions are received.
Phone: 216-368-453

Professional Courses

Nursing Anesthesia
NUAN 449. Chemical and Physical Properties of Anesthesia (2)
Introduction and elaboration of basic chemical and physical principles as they relate to clinical nurse anesthesia practice. An in-depth study of organic and biochemical principles, structure/activity, relationships and their significance in pharmacology. Emphasis will be on the integration and practical application of these principles to clinical nurse anesthesia practice. Prereq: Admission to program.
NUAN 450. Pharmacological Strategies in Anesthesia Practice (2)
Application of pharmaco-kinetic and pharmaco-dynamic principles as they relate to specific anesthetic and adjunct drugs used in anesthesia practice. Integration of this information into clinical area regarding anes-
thetic uses, dosages, and side effects of these classes of drugs is emphasized. Prereq: NUAN 449.

NUAN 551. Physiological Variables and Responses I: Respiratory System (2)
A detailed study of the anatomic structures and related physiochemical mechanisms governing respiratory function in health and disease. Assess the functional integrity of this system utilizing all pertinent objective and subjective data. Consider the impact of anesthetic agents and techniques on this system and how one can plan anesthetic to facilitate health-seeking behaviors as a patient attempts to attain, maintain, or regain optimal health. Implications for all types of surgery in view of effect of anesthesia on respiratory system, however, special attention on surgery involving this specific system. Prereq: NUAN 449.

NUAN 552. Nurse Anesthesia: Advanced Practice II (1)
The continuation of advanced, independent clinical nurse anesthesia administration. Emphasis is on management of higher risk patients for more difficult procedures, performing total anesthetic care with minimum of anesthesiologist supervision, and readiness for transition from student to graduate status. Prereq: NUAN 551A and NUAN 551B and NUAN 551C.

Nursing

NUND 211. Pharmacology (2)
This course introduces basic principles of pharmacology and pharmacotherapeutics. A survey of characteristics and uses of major drug groups with an emphasis on nursing implications is presented. Prereq: NUND 342.

NUND 213. Nursing Strategies and Interventions for Alterations in Human Function (4)
An introduction to specific nursing strategies and interventions designed to support the maximum health potential of the adult patient. The fundamentals of nursing care are incorporated into a laboratory setting and practiced in an acute care medical-surgical facility. Particular emphasis is placed on the nursing strategies and interventions. Evaluation of the effectiveness of interventions is integrated throughout the course. Prereq: Admission to N.D. program.

NUND 220. Altered Human Functioning (3)
Introduction to basic pathophysiologic outcomes of selected intervening variables that alter human physiologic and cognitive functioning. This course builds on the student’s foundation of normal anatomy and physiology. Prereq: NUND 412 and completion of first semester of N.D. program.

NUND 222. Nursing Informatics II: Biostatistics (1)
This course focuses on advanced concepts in quantitative methods for nursing, including application to nursing problems, and solution strategies using computer software.

NUND 223. Aging in Health and Illness (2)
This course will explore the concept of aging in health and illness with an emphasis on the older adult as an individual with the capacity to grow and develop. Content will include theories of aging, physiology of aging, geriatric syndromes and interventions, implication for policy and health care services. Prereq: NUND 213, NUND 253, NUND 410, and NUND 412.

NUND 224. Acute Care Nursing I - Adult and Older Adult (10)
The focus of this course is the integration of nursing process and clinical practice. Human response to significant life events and health alterations will be analyzed. Application of relevant physiology, psychosocial dimensions, and pharmacology will be included. Particular emphasis is placed on nursing strategies and interventions and the evaluation of their effectiveness. Prereq: NUND 213 and completion of first semester of N.D. curriculum.

NUND 230. Foundations of Nursing Practice (2)
This course introduces the discipline of nursing and its attributes for clinical practice. Critical historical, societal, and philosophical influences that have affected nursing as a profession will be critiqued. Nursing theories are introduced. The individual, the group, the family, and the community as clients of the nurse are introduced. Nursing strategies to promote therapeutic communication are emphasized.

NUND 233. Human Growth and Development (1)
Introduction to the theories and concepts relevant to structure, function, transmission, and expression of human genetic material.
NUND 315. Parents and Neonates in Health and Illness (4)
The study of parents and neonates and their health-seeking behaviors from a developmental perspective. Nursing knowledge and skills related to assessment of health status of parents and neonates, and nursing strategies focused on interventions to promote, restore, and maintain health are discussed. Strategies are based on understanding growth and development of individuals, families, and other relevant groups in response to change inherent in the childbearing process, within the context of intervening variables such as high risk perinatal designation. Prereq: NUND 224.

NUND 316. Infants, Children, and Adolescents in Health and Illness (4)
The study of infants, children, and adolescents and their health-seeking behaviors from a developmental perspective. Emphasis is on healthy infants, children, and adolescents as well as infants, children, and adolescents with common, acute, and chronic illness within the context of their family environment. Nursing strategies focus on interventions to promote, restore, and maintain health and foster growth and development. These strategies are based on understanding advanced concepts of children's and adolescents' responses in acute health/illness states. Prereq: NUND 213.

NUND 317. Psychiatric-Mental Health Nursing (4)
The course is designed to address health-seeking behavior patterns within the context of psychiatric and mental health nursing concepts. The focus is on clients with acute psychiatric disorders and their mental health. Nursing strategies that are appropriate for assessment and intervention with individuals, families, and groups to facilitate optimal mental health will be discussed and practiced. Prereq: NUND 224.

NUND 319. Public Health Nursing (4)
This course focuses on factors influencing the health of groups, communities, and populations. The student will examine relevant concepts, theories, research, and emerging public health issues. Principles of epidemiology will be addressed. Strategies for public health nursing interventions will be designed and implemented. Prereq: Completion of two semesters of N.D. program.

NUND 322. Nursing Informatics (1)
The focus of this course is the integration of information management concepts into health care delivery. Conceptual and functional components of informatics will be introduced as well as the use of the components in managing information in clinical practice, education, research, and administration. The course is designed to build an understanding of basic information technologies and the ways nurses can manage the information to support the delivery of client care.

NUND 341. Concepts of Management (3)
Study of basic concepts relative to leadership and working with groups of people in providing nursing care. Concepts include: decision making, power, authority, roles, teaching-learning, evaluation, leader behaviors, work groups, legal aspects, change.

NUND 342. Medical Microbiology, Immunology, and Infectious Diseases (3)
Microbial structure, growth, genetics, and metabolic control function and dysfunction of the human immune response. Manifestations of infectious disease and review of selected infectious diseases.

NUND 343. Issues and Ethics in Health Care (2)
Designed to introduce the students to the principles underlying ethical issues and methods of rational decision making. Fundamental theories will be reviewed and opportunity provided, using case analysis, to apply the theories in addressing ethical dilemmas common to modern health care.

NUND 400. Guided Study (1-6)
Selected topics in basic nursing. May include clinical experiences.

NUND 410. Health Assessment (2)
Comprehensive introduction to the assessment skills required for a successful nursing practice. Basic skills, such as vital signs, are taught along with a system by system approach to physical examination. Taking a health and psychosocial history is integrated into the course. The course is taught concurrently with anatomy and physiology, concepts of nursing practice, and strategies and interventions for alterations in functioning.

NUND 412. Anatomy, Physiology, and Metabolic Function of the Human Body (6)
This course provides a review of the normal embryologic development, anatomy and physiology of the major body systems. Basic biochemical and cellular control mechanisms will be reviewed with emphasis on their impact on normal and compensatory physiologic function. An observational laboratory of human cadaver dissection is included.

NUND 441. Management in Advanced Practice (3)
This course focuses on management issues and concepts related to those who will be practicing nursing as advanced practitioners. Seminars will focus on integrating legal, fiscal, quality improvement, informatic concepts and other intervening variables that affect environments of care. As an integrating part of the course, students will design and develop a nursing practice organization project that pertains to their clinical or management interests.

NUND 483. Health Care Planning and Policy and Information Management Systems (3)
An exploration of the nurse's role in health care policy and planning and information systems. Overview of issues in health care policy and planning, including the socio-political and economic context of health and health-seeking behaviors. Health care policy and planning at the local, state, and federal levels will be explored. Ethical dimensions of public policy formulations and implementation will be highlighted. The application of computer technology in health care and nursing will be explored. Following an introduction to hardware and software, special consideration will be given to clinical and administrative applications of information technology. Prereq: Graduate standing in Nursing or consent of instructor.

NUND 493. Population-Based Maternal-Child Nursing: Issues, Research, Policy & Inter (3)
This course focuses on broadening the knowledge base of pediatric and family nurse practitioner students to include aggregate-based health assessment and policy issues. This course is designed to build upon the students' previously acquired knowledge of the nurse's role in health policy analysis and planning, and the community health. Emphasis will be placed on the assessment of women's health and children's health at the community level, and the development of programmatic interventions to address identified needs. Students are expected to extend their expertise with policy analysis through development of a proposal to implement policy changes specific to needs identified within the population of women and children. Coreq: NUND 483 or permission of instructor.

NUND 500. N.D. Thesis (1-3)
Systematic investigation of a clinically based research problem selected by the student for independent study. Includes proposal refinement and acceptance, data analysis and thesis completion under thesis committee supervision. Prereq: NURS 520, NURS 521, and STAT 401.

Nurse Practitioner

NUNI 421. Theoretical Foundations of Nursing Informatics (4)
This course focuses on the practice of Nursing Informatics through the examination of concepts, theories, models, and phenomena relevant to the discipline. Conceptual and functional components of information management will be discussed along with their application within the health care setting. Nursing language concepts will be discussed including the Nursing Minimum Data Set, NIC, NOC, NANDA, as well as various specialized data sets used in health care. Prereq: Admission to the M.S.N. program.

NUNI 431. Advanced Nursing Informatics (4)
This course emphasizes the information needs of clinical users and the flow of information within the health care environment. General systems theory concepts and their applicability to health care information systems will be discussed. Diagnosis of information management problems, formulation of user-friendly solutions, implementation of those solutions, and their subsequent evaluation will be emphasized. Evolving/emerging information technologies will be discussed as well as the role of human-technology interactions in health care. Prereq: NUNI 421, MIDS 409, NURS 471.
NUNI 499. Internship in Nursing Informatics (5)
This capstone experience consists of four components: the precepted inter-
ternship in an external health care setting, an outline discussion experi-
ence, a leadership seminar, and a comprehensive program examination.
This internship is designed to provide the Nursing Informatics student
with the opportunity to apply the knowledge and skills acquired through
the program to the management of health care information activities.
Prereq: Completion of first year of M.S.N.

NUNP 401. Health Promotion in Children and Adolescents (2)
This course introduces the concepts of pediatric primary health care
from a developmental perspective. Concepts and theories from nursing
and other related disciplines associated with the assessment and care of
well children and their families are explored. Clinical application of theo-
ries and nursing strategies to optimize the health of children and their
families are emphasized in the professional role development of students.
Coreq: NUNP 410.

NUNP 402. Common and Acute Health Problems of Children (6)
This course introduces the common and acute health problems occurring
in infancy through adolescence using a bio/psycho/social/cultural ap-
proach. Pathophysiology, assessment and diagnostic strategies specific to
acute and common problems in children will be emphasized. Nursing
strategies used to enhance, maintain and restore health will be discussed.
Prereq: NURS 453, NURS 450, NUNP 410, and NURS 430. Coreq: NURS
430.

NUNP 404. Advanced Management in Pediatric Primary Care (5)
This course focuses on the primary rehabilitative health care concepts
specific to the management of complex, multidimensional health prob-
lems experienced by infants, children and adolescents within the context
of their family and community environments. Pathophysiology, assess-
ment and diagnostic strategies specific to complex health problems in
children are emphasized. The selection of clinical interventions, clinical
decision making and evaluation of strategies used to enhance the health
outcomes of children and their families will be stressed. Emphasis will be
placed on the consultation and referral processes within interdisciplinary
and multidisciplinary teams. Prereq: NUNP 402.

NUNP 405. Neonatal Nurse Practitioner I (3)
This course introduces the role of the Neonatal Nurse Practitioner and
concepts relevant to the management of the well or ill neonate. Analysis
of nursing strategies to optimize health-seeking behaviors in families with
well or ill neonates is highlighted. Prereq or Coreq: NUNP 416.

NUNP 410. Health Promotion Across the Life Span (2)
This course introduces health promotion fundamental to advanced prac-
tice nursing. Epidemiological principles and international, national and
local health promotion goals are examined with emphasis on cultural and
environmental principles, individual assessment and evidence based prac-
tice. Diagnostic reasoning and intervention strategies to optimize health-
seeking behaviors in clients and to foster therapeutic relationships are
examined.

NUNP 412. Neonatal Nurse Practitioner II (4)
This course focuses on the health problems of the high-risk neonate in
the context of family, culture, and community. Nursing strategies that en-
hance, maintain, and restore health in ill neonates and their families. Prin-
ciples identified for advanced diagnostic and therapeutic approaches spec-
cific to the neonate, including pharmacology, are emphasized. Prereq:
NUNP 405.

NUNP 413. Neonatal Nurse Practitioner III (3)
Pathophysiology, assessment, and diagnostic approaches specific to neo-
states with acute problems will be examined. Concepts related to dis-
charge planning collaboration and long-term follow-up will be intro-
duced. Prereq: NUNP 412.

NUNP 414. Neonatal Nurse Practitioner IV (5)
This course focuses on the primary and habilitative care specific to the
management of neonates with complex health problems. Pathophysiol-
ogy, assessment, and diagnostic approaches specific to complex health
problems of preterm neonates; infants with chromosomal aberrations;
and infants with multi-dimensional health problems will be emphasized
within the context of their family and community environments. Empha-
sis will be placed on the consultation and referral processes within inter-
disciplinary and multidisciplinary teams. Clinical application of the theo-
ries, as well as application, of nursing strategies to optimize health-seeking
behaviors for infants and their families are emphasized. Prereq: NUNP
413.

NUNP 416. Integrated Assessment of the Neonate (3)
This course introduces concepts fundamental to the integrated assess-
ment of the neonate. It stresses perinatal history taking, gestational age
assessment, and physical assessment skills. The course provides the basis
for problem identification, decision making, advanced therapeutics, and

NUNP 419. Family Health Nursing: Health of Adults and Older
Adults (5)
This course introduces the student to the practice of primary health care
of adults and older adults. The course includes the principles of growth
and development, health promotion, disease prevention, and manage-
ment of common acute and chronic health problems. Emphasis is placed
on the biological, psychological, social and cultural aspects of care.
Pathophysiology, assessment and diagnostic techniques specific to the
acute and common problems are stressed. Nursing strategies related to
health problems used to enhance, maintain, and restore health are em-
phazized; health-seeking behaviors and the impact on family are stressed.
Prereq: NURS 430, NURS 453, NURS 459, and NUNP 410. Coreq: NURS
430.

NUNP 429. Family Health Nursing: Health of the Family During
Childbearing Years (4)
This course introduces the influence of family dynamics on the care of
women and their families before pregnancy, during pregnancy and
within the interconceptional period. Assessment of physical and psycho-
social health and deviations is central to the course. Content also in-
cludes principles of education for childbearing, parenting and concep-
tion control. Nursing strategies to optimize health-seeking behaviors of
the family during the childbearing years are emphasized. Prereq: NUNP
410 or NUNP 419.

NUNP 432. Common and Acute Health Problems of the Adult I (5)
This course introduces the common and acute health problems occurring
across the adult life span. A body system approach is used with emphasis
on the biological, psychological, social and cultural aspects of care.
Pathophysiology, assessment and diagnostic strategies specific to the
acute and common problems of adults and adolescents will be stressed.
Nursing strategies used to enhance, maintain and restore health will be
emphasized. Prereq: NURS 450, NURS 453, NURS 459, and NUNP 410.
Coreq: NURS 430.

NUNP 433. Common and Acute Health Problems of the Adult II (3)
This course is a continuation of NUNP 432. Emphasis is on the patho-
physiology, assessment and diagnostic approaches specific to the adoles-
cent and adult client. Health-seeking behaviors will be stressed within
the context of the family and community.

NUNP 434. Advanced Management in Adult Primary Care (5)
This course focuses on the health care concepts specific to the manage-
ment of complex, multidimensional health problems experienced by ado-
lescents and adults within the context of their family and community en-
vironments. Pathophysiology, assessment and diagnostic strategies spe-
cific to complex health problems in adults are emphasized. The selection
of clinical interventions, clinical decision making, and evaluation of strat-
egies used to enhance the health outcomes of adults will be stressed.
Prereq: NUNP 453.

NUNP 439. Family Health Nursing: Health of Children and
Adolescents (4)
This course introduces the influence of family dynamics and the informa-
tion necessary for the practice of primary health care of children and
adolescents. The course includes application of the principles of growth
and development, disease prevention, and management of common
acute and chronic health problems. The impact of the family on child
and adolescent development and health is explored. Clinical application
of nursing strategies to optimize health-seeking behaviors is emphasized.
Prereq: NUNP 429.

NUNP 443. Acute Health Problems of the Adult (6)
Emphasis is on the pathophysiology, assessment, and diagnostic ap-
proaches specific to acute health problems of adults. The clinical labora-
NURS 110. Foundations of the Discipline (1)
The course is designed to introduce the student to the practice, profession and discipline of nursing. A futuristic perspective will provide a framework for discussion of the foundation of contemporary nursing practice within a variety of health care settings. Critical historical influences that affected the development of contemporary nursing will be discussed. Selected trends and issues that will guide future nursing practice will conclude this course.

NURS 111. Foundations of Practice (3)
This course is designed as a foundation for clinical nursing practice in relation to the concepts of communication, safety and comfort. The three concepts will be applied to the application of fundamental nursing care. The basic components of the nursing process are presented as a framework for beginning clinical practice.

NURS 120. Nursing Informatics I: Introduction (2)
This course focuses on the application of mathematics for nursing, including algebra and statistics. Microcomputer, word processing and information concepts for nursing practice will be introduced.

NURS 122. Nursing Assessment (3)
The focus of the course is on psychosocial and physical assessment of patients in a variety of settings. Data collection essential to the nursing process will focus on the adult and geriatric populations. Prereq: C or higher in BIOL 346.

NURS 201. Applied Diet Through Health and Disease (3)
This course builds upon the student’s previous knowledge base regarding human physiology and metabolism. Energy requirements changes related to lifespan changes are addressed. Dietary modulation as a therapeutic strategy to manage intervening variables is emphasized.

NURS 211. Introduction to Pharmacology (2)
Introduction to basic principles of pharmacology and pharmacotherapeutics. Review of characteristics and use of major drug groups with emphasis on nursing implications. Prereq: NURS 122, BIOL 148 or equivalent.

NURS 222. Nursing Informatics II: Biostatistics (1)
This course focuses on advanced concepts in quantitative methods for nursing, including application to nursing problems, and solution strategies using computer software. Prereq: NURS 120.

NURS 230. Nursing Care of the Adult I (5)
This is the first part of a two part series of courses focusing on the application of the nursing process in various settings to the adult experiencing alterations in human functioning. Assessment strategies and diagnostic testing, with emphasis on nursing interventions are integrated into the nursing process. Prereq: NURS 122, BIOL 114, BIOL 119, BIOL 121, BIOL 148, and BIOL 346.

NURS 240. Nursing Care of the Adult II (5)
This is a continuation of NURS 230. The focus continues to be the application of the nursing process in various settings to the adult experiencing alterations in human functioning. Assessment strategies and diagnostic testing, with emphasis on nursing interventions, are integrated into the nursing process. Prereq: NURS 230, NURS 211.

NURS 250. Aging in Health and Illness (3)
This course will explore the concept of aging as a healthy developmental process with a particular focus on the elderly as active, independent, and contributing members of the community. Content will include the physiology of aging, health problems common to the elderly, the psychological, emotional, and sociological aspects of the aging process, and policy issues. Prereq: NURS 122, BIOL 114, BIOL 119, BIOL 121, BIOL 148, and BIOL 346.

NURS 295. Advanced Management of Complex Problems in the Older Adult (4)
This course focuses on the management of complex multidimensional health problems experienced by older adults and their families in multiple environments of care. Pathophysiology, assessment, and diagnostic strategies specific to complex health problems in older adults are emphasized. Evidence-based management strategies used to enhance the outcomes in older adults to promote health and prevent disability will be stressed. The role of the GNP on care giving teams will be included. Prereq: NUNP 419. Coreq: NURS 442.

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NURS 10. Foundational Concepts (1)
The introduction to the study of the nurse's role in health care delivery systems, including the history of nursing as a profession, the development of nursing education, the legal, ethical, and regulatory environment in which nursing occurs, and the role of nursing in the delivery of health care. Prereq: MAT 105.

NURS 11. Foundations of Practice (3)
This course is designed as a foundation for clinical nursing practice in relation to the concepts of communication, safety and comfort. The three concepts will be applied to the application of fundamental nursing care. The basic components of the nursing process are presented as a framework for beginning clinical practice.

NURS 12. Nursing Assessment (3)
The focus of the course is on psychosocial and physical assessment of patients in a variety of settings. Data collection essential to the nursing process will focus on the adult and geriatric populations. Prereq: C or higher in BIOL 346.

NURS 201. Applied Diet Through Health and Disease (3)
This course builds upon the student’s previous knowledge base regarding human physiology and metabolism. Energy requirements changes related to lifespan changes are addressed. Dietary modulation as a therapeutic strategy to manage intervening variables is emphasized.

NURS 211. Introduction to Pharmacology (2)
Introduction to basic principles of pharmacology and pharmacotherapeutics. Review of characteristics and use of major drug groups with emphasis on nursing implications. Prereq: NURS 122, BIOL 148 or equivalent.

NURS 222. Nursing Informatics II: Biostatistics (1)
This course focuses on advanced concepts in quantitative methods for nursing, including application to nursing problems, and solution strategies using computer software. Prereq: NURS 120.

NURS 230. Nursing Care of the Adult I (5)
This is the first part of a two part series of courses focusing on the application of the nursing process in various settings to the adult experiencing alterations in human functioning. Assessment strategies and diagnostic testing, with emphasis on nursing interventions are integrated into the nursing process. Prereq: NURS 122, BIOL 114, BIOL 119, BIOL 121, BIOL 148, and BIOL 346.

NURS 240. Nursing Care of the Adult II (5)
This is a continuation of NURS 230. The focus continues to be the application of the nursing process in various settings to the adult experiencing alterations in human functioning. Assessment strategies and diagnostic testing, with emphasis on nursing interventions, are integrated into the nursing process. Prereq: NURS 230, NURS 211.

NURS 250. Aging in Health and Illness (3)
This course will explore the concept of aging as a healthy developmental process with a particular focus on the elderly as active, independent, and contributing members of the community. Content will include the physiology of aging, health problems common to the elderly, the psychological, emotional, and sociological aspects of the aging process, and policy issues. Prereq: NURS 122, BIOL 114, BIOL 119, BIOL 121, BIOL 148, and BIOL 346.

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tious disease and review of selected infectious diseases. Prereq: Completion of three semesters of B.S.N. program.

**NURS 343. Issues and Ethics in Health Care (2)**
This course is designed to introduce the student to the principles underlying ethical issues and methods of rational decision making. Fundamental theories will be reviewed and opportunity provided, using case analysis, to apply the theories in addressing ethical dilemmas common to modern health care.

**NURS 344. Trends and Issues in Professional Nursing (2)**
Influences of social, political, religious, and economic forces on the development of nursing and on nursing practice in present-day society. Examination of issues from historical and current viewpoints with projections for the future.

**NURS 345. Nursing Informatics III: Clinical NIS (2)**
The focus of this course is directed toward the understanding and use of information technologies and systems that support decision making in nursing practice, administration, research and education. Tools such as listservs, the World Wide Web, e-mail and databases may be used to augment the knowledge base in the course. Prereq: NURS 240 or RN license.

**NURS 346. Nursing Informatics IV: Applications (2)**
The focus of this course is directed toward the advanced informatics concepts and the implementation of selected applications within the health care setting. Systems analyzed and implemented may range from those used for patient care within the inpatient environment to those used in community or outpatient environments. Affected users of the systems may be clients, families, nursing or other health care professionals. Prereq: NURS 345 or seven semesters in B.S.N. program.

**NURS 350. Concepts and Management in Geriatric Nursing (9)**
This course will introduce concepts of rehabilitation, family nursing, geriatric nursing, and geriatric mental health and assist students in applying these concepts in a long-term care setting. Content will focus on assessment and intervention strategies for health problems common in the older adult. This will include a focus on developmental issues in the elderly, the assessment and management of depression. The course will also include content on assessment and intervention to improve the physical and functional capacities of the elderly, exercise interventions to improve cardiovascular and muscular capacity required for daily activities. Prereq: NURS 351 and NURS 353.

**NURS 351. Acute Care II: Management of Care (4.5)**
Application of management concepts in providing nursing care to individuals and groups of patients. Learning opportunities include experiences with members of the multidisciplinary health care team in planning, implementing, and evaluating patient outcomes. Prereq: NURS 315 and NURS 316 and NURS 317 and NURS 318.

**NURS 352. Acute Care III (9)**
This course focuses on the knowledge and skills necessary to provide nursing care for patients with complex problems. Emphasis is on nursing strategies designed to provide comprehensive care to patients and their families affected by acute illness. Clinical practice is directed toward the care of acutely ill adults. Prereq: NURS 520, NURS 345, NURS 351, and NURS 353.

**NURS 353. Principles of Critical Care I (4.5)**
This course provides the knowledge and technical skills foundational to the care of critically ill patients. Clinical practice is directed towards the care of the critically ill patient with a focus on patient assessment, use of biomedical technology, development of psychomotor skills, and planning basic care. Prereq: NURS 315 and NURS 316 and NURS 317 and NURS 318.

**NURS 354. Nursing Care of Critically Ill Adults (9)**
This course focuses on the integration of knowledge and skills to provide effective and efficient nursing care to critically ill adults. Emphasis is on nursing strategies directed towards the care of the critically ill patient with a focus on use of biomedical technology, planning and managing patient care, and beginning care of patients with complex care needs. Prereq: Grade of B or higher in NURS 353. Consent of instructor.

**NURS 356. Nursing Care of Critically Ill Neonates, Infants, and Children (9)**
This course focuses on the knowledge and skills necessary for beginning practice in the nursing care of critically ill neonates, infants and children. Emphasis is on nursing strategies directed toward the application of basic principles of critical care nursing with attention to special needs of critically ill neonates, infants and children and their families. Prereq: Grade of B or higher in NURS 316. Consent of instructor.

**NURS 391. Home Health Care Nursing (5)**
This course focuses on the knowledge and skills necessary to provide nursing care in home health settings for clients with complex problems. Emphasis is on nursing strategies designed to provide comprehensive nursing care to clients and their families. Clinical practice is directed toward the care of client/family in the home.

**NURS 392. Dynamics of Nursing Practice Management (4)**
Analysis of management and leadership concepts in complex situations and their applications to nursing practice, usually as it involves working with groups of people in providing nursing care. This course introduces the topics of strategic planning, resource management and the use of information technology in the clinical setting.

**NURS 393. New Applications in Nursing Practice Management (4)**
Application of management and leadership concepts in a clinical practicum that is individualized for the students on the basis of their previous experiences and goals. Students will be expected to apply concepts of strategic planning and resource management to promote health-seeking behaviors of clients.

**NURS 399. Independent Study (1-12)**
Independent guided study for undergraduate students with special needs or interests. Prereq: Permission of the program director.

**NURS 400. Guided Study in Nursing (1-18)**
Independent study for students with special needs and interests.

**NURS 404. Emergent Care of the Child (2)**
This course incorporates biological, developmental, psychological, emotional, social, and cultural aspects of care. The emphasis is on pathophysiology, assessment, diagnostic approaches, and interventions specific to emergent care of infants, children, and adolescents. Advanced therapeutics are introduced. Prereq: Certification in PALS and neonatal resuscitation. Prereq or Coreq: NUNP 444.

**NURS 405. Inquiry I (3)**
Introduction to theoretical thinking in nursing. Study of knowledge development in nursing, conceptual structures and their uses, relationship of theory to research process as a basis for nursing practice, and the process of critical thinking in nursing.

**NURS 406. Flight Nursing Seminar I (1)**
This seminar program provides a forum for preparing students to care for patients requiring air transfer to specialty care facilities. Special emphasis is placed on advanced procedures, flight physiology, and environmental influences on the clinical approach in order to apply acute care competencies to flight nursing practice. Prereq or Coreq: NUNP 443.

**NURS 407. Flight Nursing Seminar II (1)**
This seminar continues to prepare students to care for patients requiring air transfer to specialty care facilities. Special emphasis is placed on clinical approaches to patient management across the lifespan. Prereq: ACLS, PALS, and neonatal resuscitation certification. Prereq or Coreq: NUNP 444, NURS 406, NURS 404.

**NURS 415. Inquiry II (4)**
Introduction to scientific inquiry. Study of research process, particularly design, sampling, data collection and analysis, and interpretation and reporting of findings. Experience in writing a proposal for nursing research. Prereq: NURS 405.

**NURS 424. Theoretical Basis of Medical/Surgical Nursing II (5)**
This course provides the opportunity to explore complex health problems of patients requiring a variety of health care services and support systems. Nursing strategies requiring independent, interdependent, and collaborative activities are evaluated for their efficacy in supporting and assisting the patient’s progress toward health. Clinical experiences are individualized to promote implementation of the Clinical Nurse Specialist role and build upon the student’s expertise.
NURS 430. Pharmacology and Therapeutics (3)
Examination of the major categories of pharmacologic agents and application of pharmacologic concepts in the clinical setting. Emphasis is placed on understanding the physiologic action of the drugs, expected patient responses, and major side effects. Major-specific seminars integrate knowledge of pharmacology into clinical practice. Prereq: NURS 453 recommended.

NURS 438. Theoretical Foundations of Acute Care Nursing (2-4)
This course focuses on advanced practice by examining common health and illness phenomena in the acute care setting. Concepts, theories, and phenomena will be analyzed for their relevance in planning and evaluating nursing care strategies and modalities. Individualized clinical experience in the acute care setting with a selected patient population is part of the advanced practicum. Prereq or Coreq: NURS 453 and NURS 459.

NURS 441. Mental Health of Older Adults (1)
This course focuses on discussion of the consultative, investigatory, and planning skills to meet the special mental health needs of the elderly. Concepts of mental health promotion, mental illness prevention, knowledge development, implementation, and evaluation of psychotherapeutic nursing strategies are examined. The examination of diverse mental health disorders in the aged mental health service delivery are included.

NURS 442. Mental Health Interventions with Older Adults (1)
This course focuses on the theoretical basis of psychosocial assessment and intervention with older adults and their families, with an emphasis on individual, group, and family interventions. Concepts from individual, family, and group modalities and the process of consultation and education are examined. Students will also learn the components of individual and family assessment in “well elders” and the identification of mental disorders, including problems with memory and cognition. This knowledge base serves as the foundation for developing and applying interventions in practice to meet the mental health needs of older adults. Prereq: NURS 441.

NURS 443. Professionalism in Advanced Practice (3)
Study of the multiple roles integrated into advanced practice nursing in order to assist individuals, families, groups and communities to attain, maintain and regain optimal health. Principles of education, management, leadership, consultation and collaboration will be discussed.

NURS 444. Health Care Delivery: Legal and Ethical Issues in Advanced Practice (3)
Study of multiple factors that influence the health care delivery system and those factors that particularly affect the advanced practice nurse. The focus of the course is critical analysis and discussion of health policy, legal and ethical issues. Application of nursing informatics concepts will be integrated throughout the course.

NURS 445. Infection Control I (3)
Examination of the principles of pathogenicity, transmission, diagnosis, immunization, and therapy of select infectious disease agents and methods of prevention and control of these agents in the community and health care settings. Introduction to application of infection control policies and procedures in a variety of community and clinical settings.

NURS 446. Collaboration and Administration in the Health Care Delivery System (3)
Examination of the influence of the health care delivery environment on the delivery of care and the role of the Advanced Practice Nurse as collaborator within the health care structure. Clinical practice and seminars will focus on the role of the manager in planning, organizing, staffing, directing, and controlling the health care environment for the purpose of improving patient care, facilitating collaborative activities with other health care professionals, and identifying mechanisms to affect change within the health care system. Clinical practice 8 hours per week.

NURS 448. Mental Health Practicum with Older Adults (1)
This course focuses on the application and development of psychosocial assessment and intervention with older adults and their families, with an emphasis on individual, group, and family interventions. Concepts from individual, family, and group modalities and the process of consultation will be applied. The components of individual and family assessment will be applied in “well elders” as well as those with identified mental disorders. Prereq: NURS 441, NURS 442.

NURS 450. Infection Control II (3)
Examination and application of an infection control program in a community or clinical setting. Content related to bioterrorism or natural disaster situations will be included. Prereq: NURS 495 and NURS 496 or their equivalents, EPBI 494, NURS 445.

NURS 453. Physiologic Foundations for Advanced Practice Nursing (4)
This course is designed to build upon the student’s preexisting knowledge of basic human anatomy, physiology, and nursing science. Selected body systems are examined in order to provide in-depth integration of normal physiologic functions with specific intervening variables and pathologic mechanisms associated with life span development and dysfunction.

NURS 454. Well Woman Health Care (3)
Study of selected theoretical formulations and models applied by professional nurses in the promotion of growth and wellness in adolescent and adult women. Emphasis on conception, decision making, sexuality and health teaching. Acquisition of knowledge and skill related to physical and psychosocial health assessment of pregnant and nonpregnant clients. Individually planned experiences with nurse faculty who are serving as primary care givers in maternity, family planning and gynecologic care settings. Prereq or Coreq: NURS 453 and NURS 459.

NURS 455. The Childbearing Family (4)
This course will focus on analysis and applications of the nursing strategies to enhance health-seeking behaviors of the pregnant family during the maternity cycle and on the education of parents about the childbearing year. The normal aspects of the pregnant woman and the identification of any deviations from the normal are central to the content. The course will also emphasize the enhancement of the pregnant family’s childbirth experience through utilization of the teaching-learning process. The student will learn to evaluate and apply techniques relative to childbirth education. Clinical experiences will be planned in antepartum, neonatal, childbirth education and home settings. Prereq: NURS 454. Coreq: NURS 430.

NURS 456. Health Policy and Management Decisions (3)
(See HSME 456.) Cross-listed as HSME 456.

NURS 457. Labor and Birth (7)
The focus of this course is the application of nursing theory, practice and research by advanced practice nurses in the promotion of health and wellness of women, newborns and their families during intrapartum and the immediate postpartum period. Emphasis is placed on the health-seeking behaviors of the mother and her family using a holistic approach emphasizing cultural, ethnic and racial diversity in the provision and evaluation of care. Supervised clinical experience includes anticipating and identifying complications and participating in consultations, referrals and collaborative management. Prereq: NURS 455.

NURS 459. Integrated Assessment for Advanced Nursing Practice (3)
This course introduces concepts fundamental to the role of the Advanced Practice Nurse. It stresses health assessment, history taking, interviewing, and physical assessment skills, and provides the basis for decision making, advanced therapeutics and case management.

NURS 460. Theoretical Basis of Nursing Interventions with Individuals (2)
Study of the theoretical basis of individual work with persons experiencing emotional crises and disturbances. The nurse therapist enhances the health-seeking behaviors of individuals as they strive to attain, maintain or regain optimal health. Emphasis on theories, psychotherapy, and crisis intervention. Prereq: Graduate standing in Nursing.

NURS 461. Practicum and Supervision of Individual Therapy (1-2)
Direct care experience. Focus on therapeutic process with persons experiencing psychosocial disturbances. Use of nursing strategies to enhance health-seeking behaviors. Examination of genesis of psychopathology; emphasis on methods of assessment, goal setting, intervention, and evaluation. Group and individual supervision. Prereq: NURS 460.

NURS 462. Practicum and Supervision of Group and Family Therapy (2-3)
Direct care experience, formal group and family experience focusing on process, content and leader behavior. The nurse-therapist employs nurs-
ing strategies to enhance health-seeking behaviors of family and group. Use of concepts from psychiatry and behavioral and social sciences related to the promotion of mental health and treatment of psychosocial distress in groups and families. Group and individual supervision of clinical experience. Focus of supervision is on judgment, family and group intervention skills, and application of theory from analysis and interpretation of data. Prereq: NURS 467.

NURS 463. Theoretical Basis of Practice & Supervision in Consultation & Mental H (1-3)
Indirect care experience. Theories of consultation. Adult education. Exploration of issues related to the role of the clinician in the enhancement of health-seeking behaviors of individuals and communities as they strive to achieve optimal levels of health. Examination of the consultative, administrative and educational processes in the practice of consultation and community education. Seminars, group, and individual supervision. Prereq: NURS 460 and NURS 462, and graduate standing or consent of instructor.

NURS 466. Practicum and Supervision in Role of Clinician (3)
The professional encounter between the psychiatric mental health clinical nurse specialist, staff and agency personnel providing mental health services, and clients receiving services in the context of an environment of care is emphasized. Intrapersonal, interpersonal and extrapersonal variables that influence the health-seeking behaviors of individuals, families and groups as they seek to attain, maintain or regain optimal levels of mental health are employed.

NURS 467. Theory of Family and Group Modalities (2-3)
The professional encounter between nurse therapist and the group or group members and the family or family members occurs within the context of an environment of care. The nurse therapist enhances health-seeking behaviors of individuals, families and groups. The nurse therapist employs nursing strategies cognizant of interviewing variables, to facilitate health-seeking behaviors of family and group members. Concepts from family and group theory, family and group literature, and research in family and small group dynamics are selected to provide an eclectic approach to treatment.

NURS 468. The Continual Improvement of Healthcare: An Interdisciplinary Course (3)
The goal of this course is to equip health professions students (medicine, nursing, and health administration) with the ability and confidence to contribute to continual improvement in health care. Through seminar and field experiences students will be given the opportunity to learn the philosophy, knowledge and skills of continuous quality improvement teamwork and interdisciplinary work. The focus is on collaborative work for the benefit of patients and communities. Prereq: Consent of instructor. Cross-listed as EPBI 468.

NURS 471. Organizational Theories (3)
Examination of intervening variables which affect health care organizations including structure, dynamics and processes of change.

NURS 479. Public Policy and Aging (3)
(See EPBI 408.) Cross-listed as EPBI 408.

NURS 480. Public Health and Epidemiology (3)
Study of health care problems within the larger social/environmental context. Epidemiology as a method of reasoning leading to the making of casual inferences. Principles underlying epidemiology as a method of study and the scope, potentialities and limitations of this approach. Prereq or Coreq: Statistics or consent of instructor.

NURS 481. Curriculum and Instruction (3)
Study of the role of the nurse as an educator and the contributions of nursing education to knowledge development and transmission. Concepts related to curriculum development and their use in determining philosophy and objectives of nursing curricula, new developments in planning and organizing nursing curricula, determining program objectives and course objectives and selecting and organizing appropriate learning experiences to meet objectives. Introduction of strategies and methods to evaluate components of a nursing curriculum. Prereq: One semester of graduate study in a nursing specialty or consent of instructor.

NURS 482. Teaching and Evaluation in Nursing Education (3)
Roles and functions of the teacher of nursing. Principles of learning applied in the classroom and clinical setting through lectures, seminars, and guided clinical teaching practice. Concepts related to selection, development and use of appropriate evaluation procedures as applied to clinical and classroom teaching will be studied.

NURS 491. Community Health Nursing I (4)
This is the first course in the Community Health Nursing major. It is designed to introduce students to the specialist practice of community health nursing and emphasizes the importance of population based practice. A population or a geopolitical community focus will be identified by the student, and a comprehensive appraisal of its health status conducted. Priority health concerns and strategies to enhance health-seeking behaviors and mechanisms will be identified. Prereq: Undergraduate Community Health Nursing courses; graduate standing in nursing.

NURS 495. Community Health Nursing II (4)
In this course students will design a feasible plan to address the identified priority concern for a selected population or geopolitical community. Program planning models will be examined, and a model useful to address the priority concern selected. Evaluation techniques will be identified and included in the program design. Interventions to enhance health-seeking behaviors based on primary, secondary and tertiary prevention strategies will be implemented in the clinical component of the course. Prereq: NURS 491.

NURS 496. Community Health Nursing III (4)
This course completes the Community Health Nursing major. Based on work successfully completed during the previous two courses the student will conclude program implementation and conduct a summative evaluation of overall program effectiveness. As part of the leadership experience, the student, in partnership with the community or population, will explore external funding for program continuation. Issues influencing health care delivery and community health nursing practice will be examined. Prereq: NURS 491 and NURS 495.

NURS 499. The Nurse Executive-Personal & Professional Challenges in Health Care (3)
Offered toward end of the M.S.N./M.B.A. program and prepares the graduate for entry into a nurse management role. The focus will be on contemporary role demands in nursing management, ranging from head nurses to vice presidents of nursing to heads of community health and mental health agencies, and taking account of all regions of the U.S. Emphasis will be placed on exploring knowledge and skill requirements of nursing management, current developments (such as nursing values, goals, and tasks), and the strategic and operational configuration of hospitals and other health care agencies.

NURS 500. Master's Thesis (1-4)
Systematic investigation of a research problem selected by the student for independent study. Prereq: NURS 415.

NURS 501. Special Topics in Nursing (1-3)
Use of theory and research to examine selected topics and issues in nursing. Prereq: Ph.D. standing in Nursing and written consent of instructor.

NURS 503. Inquiry III (2)
Development of competencies in scientific inquiry. Experience in either (a) pilot study of aspect of Inquiry II proposal; (b) in depth paper on aspect of Inquiry II proposal; or (c) involvement in facility research project and written report of experience. Prereq: NURS 415.

NURS 504. Nursing Theory (3)
Theory development in nursing, issues in theory development, and uses of theory. Seminar discussions. Prereq: One year of graduate study in Nursing or consent of instructor.

NURS 506. Nursing Epistemology (3)
This course involves the study of knowledge shared among members of the discipline, the patterns of knowing and knowledge development, and criteria for evaluating knowledge claims. The course is a search and discussion experience aimed at enabling graduate students to become knowledgeable about approaches to the study of disciplines and scientific knowledge development. Forces affecting the development of knowledge, the origins of key terms and concepts, and identification of major themes in nursing will be explored.

NURS 507. Clinical Knowledge (3)
This course is structured to allow students to develop clinical knowledge about their area of interest and to begin the process of identifying clinical research questions. Supervision for this experience will be twofold. Stu-
NURS 508. Context of Care (3)
This course is designed to allow students to explore the social, political, economic, and health care issues that form the context for their clinical phenomena of interest. The intent of this course is for the student to become knowledgeable about the broader forces that affect their clinical problem. Topics might include current research in their field, as well as health policy related to their phenomena, political entities that affect funding, and the regulation of practice in their area of interest. The student will need a content expert to help them plan and coordinate their practicum experiences, which should be multiple and varied, and include exposure to both local and state level entities. Prereq: NURS 508 or equivalent.

NURS 511. Strategies for Theory Development (3)
This course examines the nature of theory and strategies for theory development in nursing. Students will explore a variety of strategies and select an approach for beginning theory development that addresses nursing phenomena in their area of interest.

NURS 518. Qualitative Nursing Research (3)
This course is a study of qualitative research approaches directed toward the development of nursing knowledge. This course will include methods and issues in data collection, analysis, and critique of research findings. It will focus on the philosophical and epistemological foundations of qualitative research, present an overview of various methodological approaches, examine in depth the criteria for rigor, and analyze ethical issues in qualitative methodologies.

NURS 520. Advanced Nursing Research I (3)
The development of research questions within a nursing framework and related research designs will be studied. The focus of this course will be problem formulation, selected research designs and sampling. Prereq: STAT 401 and consent of instructor.

NURS 521. Advanced Nursing Research II (3)
The discussion of research designs and their rationale for use will continue. Principles of methodology, measurement and data analysis will be discussed. The development of a research proposal will be the expected outcome of this two-semester sequence. Prereq: NURS 520 and consent of instructor.

NURS 523. Advanced Internship in Flight Nursing (1.5)
This internship is designed to provide the Master's prepared ACNP-flight nurse concentration graduate with experience needed to qualify for the Certification Examination in Flight Nursing. This experience consists of a 600 hour preceptorship internship in a flight nursing setting. Prereq: Completion of M.S.N. program focus in Flight Nursing and ACNP certification, certification in ACLS, PALS, and neonatal resuscitation.

NURS 524. Advanced Practicum in Infection Control (1.5)
This practicum experience consists of up to 600 hours of a precepted experience in an infection control program setting. This practicum is designed to provide the student with experience needed to qualify for the Certification Examination in Infection Control administered by the Certification Board of Infection Control and Epidemiology to receive CIC certification. The student may choose among a public health, acute care, long-term care, or international setting. Prereq: NURS 450.

NURS 530. Advanced Research I (3)
This is the first in a two-course sequence in research methods. The course focuses on sampling, measurement, and data collection strategies as well as survey, quasi-experimental and qualitative designs. The emphasis is on the application of these strategies while encouraging flexibility in conceptualizing a study using different research methods. Develop a research study using methodologies consistent with theoretical and empirical knowledge and the nursing perspective.

NURS 531. Advanced Research II (3)
This course is the second in a two-course sequence of research methods. It focuses on power analysis, data management, experimental and epideimiologic designs and designs to assess change and multiple comparisons. Included is a discussion of ethics and concerns regarding human subjects. The emphasis is on the application of research strategies while encouraging flexibility in conceptualizing a study using different methods. The development of a research proposal is the outcome of this two-semester sequence. Prereq: NURS 530.

NURS 537. Advanced Midwifery (6)
In consultation with faculty, students select a midwifery service area where they assume the responsibilities of beginning practitioner for a minimum of 10 weeks of intensive supervised clinical practice. Synthesis of the midwifery management process while providing continuity of care integrating all core competency areas is emphasized. Students explore the professional aspects of midwifery practice. Historical development of the profession is used as a framework for understanding current issues related to nurse-midwifery education and practice in the United States. Prereq: NURS 457.

NURS 559. Advanced Practice in Nursing Care of Women (2-5)
Integration of concepts, theories, conceptual, and theoretical models, focused on supporting the health-seeking of women and their families as they contend with intervening factors. Emphasis on psychosomatic, acute and long-term illnesses and their interplay with psychosocial problems encountered by women. Clinical practice and seminars will include providing nursing care to women and their families in all stages of life cycle. Prereq: NURS 455.

NURS 577. M.S.N./M.B.A. Management Practicum (9)
The student will enter the M.S.N./M.B.A. program with a minimum of two years of recent clinical nursing experience, and may or may not have had any management experience. This practicum is designed to provide a guided experience in a management context. NURS 577 will be offered in the spring semester of the second year of the M.S.N./M.B.A. program, after the student has completed nearly all basic courses in both schools. The management practicum will provide on-site experience in management activities. Most practicum sites will be area health care agencies. In some cases, students may alternate opportunities addressing health-related policies in area businesses or corporations. Practical experience will engage students in management projects, special assignments and/or research. Students are expected to use current management and nursing knowledge and will often use the research process in completing the practicum experience. They will work closely with nurse executives and managers within their organizations.

NURS 579. Public Policy and Aging (3)
(See EPBI 408.) Cross-listed as EPBI 408.

NURS 601. Special Problems (1-12)
NURS 609. Health Policy Seminar (3)
Seminar offers a formal introduction to the role of research in the formulation of health policy. Students will participate in a seminar designed to illuminate the policy components and implications of clinical nursing research. Special emphasis is placed on selected national health policy issues that form the socio-political context of nursing research and practice. Prereq: Matriculated to Ph.D. or written consent of instructor.

NURS 615. Topical Seminars in Nursing Research (3)
Variety of topical seminars are offered in rotation and students select seminars most closely related to their own area of research. All courses provide in-depth knowledge of research and research issues in a given area and opportunities to apply this knowledge in further development of their research interests and ideas.

NURS 630. Advanced Statistics for Nursing Research (3)
This course is one of a two-part series focused on advanced procedures for data analysis and statistical inference in nursing and health research. The course is devoted to discussion of linear models, including simple and multiple regression, factor analysis and causal modeling. The role of assumptions and theory in guiding the analysis plan is emphasized through lecture, readings and critical evaluation of published research in the student’s area of interest. Prereq: NURS 530 and NURS 531.
NURS 670. Guided Study in Proposal Development (3-12)
Provides an opportunity for guided development of a candidacy proposal through planned contact with a designated committee of faculty members. The aim is to assist the student in the development of a refined proposal with strong scientific merit. The course should be utilized only by those with a candidacy proposal statement. Prereq: NURS 506 and NURS 531.

NURS 701. Dissertation Ph.D. (1-18)
NURS 702. Appointed Dissertation Fellow (9)
NURS 703. Dissertation Fellowship (1-8)
Guide to Abbreviations
## Course Identification Codes

The following four-letter course identification codes are used at Case Western Reserve University. They must be used when entering courses on the schedule form during registration (e.g., English 150 would be listed as ENGL 150).

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## Program Codes

This is a list of all coding used for academic programs of study at the University. It does not imply that the program is currently available as a major. Some of these codes are for concentrations, minors and for majors no longer offered. It is necessary to maintain this list in its entirety for purposes of maintaining historical records.

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<td>LAP</td>
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<td>ABBREVIATIONS CWRU GENERAL BULLETIN 2002-2004</td>
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University Abbreviations

The following abbreviations are used at Case Western Reserve University and appear in this publication.

AACSAB ... American Assembly of Collegiate Schools of Business
AADSAS ... American Association of Dental Schools
AAAMC ... American Association of Medical Colleges
ACT ... American College Testing Program
ALA ... American Library Association
ALAS ... Auxiliary Loan to Assist Students
AMCAS ... American Medical Colleges Application Service
ANA ... American Nurses' Association, Inc.
ARJCC ... Andrew R. Jennings Computer Center
CIA ... Cleveland Institute of Art
CIM ... Cleveland Institute of Music
CLEP ... College Level Examination Program
CMD ... Center for Management Development
CPA ... Certified Public Accountant
CSS ... College Scholarship Service
DAT ... Dental Admissions Test
EDI ... Enterprise Development, Inc.
EDP ... Extended Degree Program
ETS ... Educational Testing Service
EXAP ... External Academic Program
FERPA ... Family Educational Rights and Privacy Act
FPB ... Frances Payne Bolton School of Nursing
GAPSFAS ... Graduate and Professional School Financial Aid Statement
GMAT ... Graduate Management Admission Test
GMC ... General Military Course
GRE ... Graduate Record Examination
GSL ... Guaranteed Student Loan
HEAL ... Health Education Assistance Loan
HPSL ... Health Professions Student Loan
HSMC ... Health Systems Management Center
IGS ... Integrated Graduate Studies
IRS ... Internal Revenue Service
ITN ... Instructional Television Network
LSAT ... Law School Admissions Test
LSDAS ... Law School Data Assembly Service
MAT ... Miller Analogies Test
MCAT ... Medical College Admission Test
MEIOP ... Minority Engineers Industrial Opportunity Program
MSASS ... Mandel School of Applied Social Sciences
NERB ... Northeast Regional Board
NLN ... National League for Nursing
NSNA ... National Student Nurses Association
OCLC ... On-line Computer Library Center
OIG ... Ohio Instructional Grant
PAT ... Perceptual Ability Test
POC ... Professional Officer Course
PLUS ... Parent Loan for Undergraduate Students
REI ... Center for Regional Economic Issues
ROTC ... Reserve Officers Training Corps
RPT ... Repeat of a Course Previously Taken (Undergraduate Only)
SAT ... Scholastic Aptitude Test
SEOG ... Supplemental Educational Opportunity Grants
SLS ... Supplemental Loans for Students
SPPSHS ... Special Program for Students in the Health Sciences
TOEFL ... Test of English as a Foreign Language
UPB ... University Program Board
USG ... University Student Government
WSOM ... Weatherhead School of Management
How to Reach the University
How to Reach the University

The University is about five miles east of downtown Cleveland on Euclid Avenue (U.S. Routes 6, 20, and 322). Most road maps of Ohio have the University clearly indicated.

By Car
If you are coming from the east via Interstate 90, exit at Martin Luther King Jr. Boulevard. Proceed south for about a mile to the East 105th traffic light, cross over East 105th and bear right over the traffic circle, continuing along Martin Luther King Jr. Boulevard to Euclid Avenue. Turn left onto Euclid and watch for the Information Booth at the right.

If you are coming from the east via Interstate 80 (Ohio Turnpike), remain on the Turnpike until you reach Interchange 13. Exit there and proceed north on Interstate 480, which merges with Interstate 271. Exit I-271 at Cedar Road and follow it westbound toward Cleveland. Where Cedar starts down a steep hill and lane-switching lights are hanging overhead, look for a sign identifying Case Western Reserve University at the corner of Murray Hill Road (the first light at the bottom of the hill). Turn right onto Murray Hill, bear left at the traffic light, and turn left at the three-way stop on the other side of the bridge. You will be on Adelbert Road near the center of campus.

If you are coming from the south via Interstate 71 (or Interstate 77), proceed north until I-71 (or I-77) merges with Interstate 90, take I-90 east, then exit onto Chester eastbound as above.

Parking
See the campus map on the next page for designated visitor parking locations on campus.

By Air
Arrive at the Cleveland Hopkins International Airport. The fastest, most economical means of reaching the University from Hopkins is the RTA (Regional Transit Authority) Rapid Transit train eastbound to the University Circle station, which is just south of campus. A free University Circle shuttle bus connects the station with all areas of the campus.

By Bus
The city’s central bus depot is located downtown on Chester Avenue near East 14th Street. Taxis are available, or walk one block south on East 14th street to Euclid Avenue. There you can catch RTA Bus No. 6 eastbound to the Adelbert Road, Cornell Road, or East 115th Street stops.

By Train
Arrive at the AMTRAK station in downtown Cleveland. Take the RTA Waterfront rail line to Tower City and transfer to a train eastbound for University Circle. A free University Circle shuttle bus connects the station with all areas of the campus. Taxis are also available at the AMTRAK station.

Lodging
Overnight accommodations are available at the Glidden House (a bed-and-breakfast located on the north side of campus), at the Cleveland Inter-Continental Hotel (a few minutes from campus near the Cleveland Clinic), and at hotels in the downtown area, twenty minutes from campus by car.
University Circle Institutions
AFRICAN AMERICAN MUSEUM
1765 Crawford Road
Cleveland, OH 44106
Phone: 216-791-1700
Fax: 216-791-1774
www.aamcleveland.org

ALTA SOCIAL SETTLEMENT
12510 Mayfield Road
Cleveland, OH 44106
Phone: 216-421-1536
Fax: 216-795-4494

AMASA STONE HOUSE
975 East Boulevard
Cleveland, OH 44108
Phone: 216-451-1884
Fax: 216-451-7609

AMBLESIDE TOWERS
2190 Ambleside Road
Cleveland, OH 44106
Phone: 216-795-9005
Fax: 216-795-6820

AMERICAN CANCER SOCIETY
11432 Mayfield Road
Cleveland, OH 44106
Phone: 216-241-1177
Fax: 216-844-2959
www.cancer.org

AMERICAN HEART ASSOCIATION
Northeast Ohio Affiliate, Inc.
1689 East 115th St.
Cleveland, OH 44106
Phone: 216-791-7500
Fax: 216-791-5202
www.americanheart.org

AMERICAN SICKLE CELL ANEMIA ASSOCIATION
10300 Carnegie Avenue
Cleveland, OH 44106
Phone: 216-229-8600
Fax: 216-229-4500

ANTIOCH BAPTIST CHURCH
8869 Cedar Avenue
Cleveland, OH 44106
Phone: 216-421-1516
Fax: 216-229-0437

CALVARY PRESBYTERIAN CHURCH
2020 East 79th Street
Cleveland, OH 44103
Phone: 216-391-8448
Fax: 216-391-4899

CASE WESTERN RESERVE UNIVERSITY
10900 Euclid Avenue
Cleveland, OH 44106
Phone: 216-368-2000 (University operator)
Fax: See individual departments in this bulletin
www.cwru.edu

CATHERINE HORSTMANN HOME
2155 Overlook Road
Cleveland, OH 44106
Phone: 216-795-1638
Fax: 216-795-1638

CENTER FOR DIALYSIS CARE, INC.
P.O. Box 12220
Cleveland, OH 44112
Phone: 216-295-7014
Fax: 216-295-7014
Shaker Hts. Office: 216-295-7014

CHILDREN’S MUSEUM OF CLEVELAND
10730 Euclid Avenue
Cleveland, OH 44106
Phone: 216-791-KIDS (5437)
Fax: 216-791-8838
www.museum4kids.com

CHURCH OF THE COVENANT
11205 Euclid Avenue
Cleveland, OH 44106
Phone: 216-421-0482
Fax: 216-791-2228
www.covenantweb.org

CHURCH OF THE TRANSFIGURATION
(Formerly Emmanuel Episcopal Church)
8614 Euclid Avenue
Cleveland, OH 44106
Rev. Charles Beamer, Priest in Charge
Phone: 216-421-0524

CLEVELAND BOTANICAL GARDEN
11030 East Blvd.
Cleveland, OH 44106
Phone: 216-721-1600
Fax: 216-721-2056
www.cbgbgarden.org

CLEVELAND CENTER FOR CONTEMPORARY ART
8501 Euclid Avenue
Cleveland, OH 44106
Phone: 216-421-8671
Fax: 216-421-0737
www.contemporaryart.org

CLEVELAND CENTER FOR RESEARCH IN CHILD DEVELOPMENT
2084 Cornell Road
Cleveland, OH 44106
Phone: 216-421-7880
Fax: 216-421-8880
CLEVELAND CHAMBER MUSIC SOCIETY
1991 Lee Road #205
Cleveland, OH 44118
Phone: 216-531-7094
Fax: 216-571-5415

CLEVELAND CLINIC FOUNDATION
9500 Euclid Avenue
Cleveland, OH 44195
Phone: 216-444-2200
Fax: 216-444-0125
www.clevelandclinic.org

CLEVELAND CULTURAL GARDENS FEDERATION
3728 East 69th Street
Cleveland, OH 44105
Phone: 216-541-3553

CLEVELAND FRIENDS MEETING
10916 Magnolia Drive
Cleveland, OH 44106
Preferred Mailing Address:
2687 Landon Road Cleveland, OH 44122-2005
Phone: 216-791-2220

CLEVELAND HEARING & SPEECH CENTER
11206 Euclid Avenue
Cleveland, OH 44106
Phone: 216-231-8787
Fax: 216-231-7141
www.chsc.org

CLEVELAND HILLEL FOUNDATION, INC.
11291 Euclid Avenue
Cleveland, OH 44106
Phone: 216-231-0040
Fax: 216-231-0256
www.cwru.edu/affil/hillel

CLEVELAND INSTITUTE OF ART
11141 East Boulevard
Cleveland, OH 44106
Phone: 216-421-7000
Fax: 216-421-3224
www.cia.edu

CLEVELAND INSTITUTE OF MUSIC
11021 East Boulevard
Cleveland, OH 44106
Phone: 216-791-5000
Fax: 216-791-1530
www.cim.edu

CLEVELAND MUSEUM OF ART
11150 East Boulevard
Cleveland, OH 44106
Phone: 216-421-7340
Fax: 216-421-0411
www.clevelandart.org

CLEVELAND MUSEUM OF NATURAL HISTORY
1 Wade Oval, University Circle
Cleveland, OH 44106
Phone: 216-231-4600
Fax: 216-231-5919
www.cmnh.org

CLEVELAND MUSIC SCHOOL SETTLEMENT
11125 Magnolia Drive
Cleveland, OH 44106
Phone: 216-421-5806
Fax: 216-421-5813

CLEVELAND PLAY HOUSE
8500 Euclid Avenue
Cleveland, OH 44106
Phone: 216-795-7000
Fax: 216-795-7005
www.clevelandplayhouse.com

CLEVELAND PSYCHOANALYTIC INSTITUTE
11328 Euclid Avenue, Suite 209
Cleveland, OH 44106
Phone: 216-229-5959
Fax: 216-229-7321

CLEVELAND PUBLIC LIBRARY
Martin Luther King, Jr. Branch
1962 Stokes Boulevard
Cleveland, OH 44106
Phone: 216-623-7018
Fax: 216-623-7015
www.cpl.org

CLEVELAND SIGHT CENTER
1909 East 101st Street
Cleveland, OH 44106
Phone: 216-791-8118
Fax: 216-791-1101
www.clevelandsightcenter.org

CLEVELAND SIGNSTAGE THEATRE
8500 Euclid Avenue
Cleveland, OH 44106
Phone: 216-229-2838
Fax: 216-229-2769
TTY: 216-229-0431
www.signstage.org

CLEVELAND STUDENT HOUSING ASSOCIATION
11408 Bellflower Road
Cleveland, OH 44106
Phone: 216-231-9525
Fax: 216-231-9525
www.cwru.edu/affil/steiner

CUYAHOGA COUNTY CORONER’S OFFICE
11001 Cedar Road
Cleveland, OH 44106
Phone: 216-721-5610
Fax: 216-721-2559
www.cuyahoga.oh.us
DUNHAM TAVERN MUSEUM
6709 Euclid Avenue
Cleveland, OH 44103
Phone: 216-431-1060
Fax: 216-391-6285
www.logan.com/dunham

EARLY MUSIC AMERICA
11421-1/2 Bellflower Road
Cleveland, OH 44106
Phone: 216-229-1685
Fax: 216-229-1688

ELIZA BRYANT CENTER
7201 Wade Park Avenue
Cleveland, OH 44103
Phone: 216-361-6141
Fax: 216-361-2207

EPWORTH-EUCLID UNITED METHODIST CHURCH
1919 East 107th St.
Cleveland, OH 44106
Phone: 216-421-1200
Fax: 216-421-0327
www.epworth-euclid.org

ERNEST J. BOHN GOLDEN AGE CENTER OF CLEVELAND
1667 Ansel Road
Cleveland, OH 44106
Phone: 216-231-2793
Fax: 216-231-1429

EUCLID AVENUE CONGREGATIONAL CHURCH OF THE UNITED CHURCH OF CHRIST
9606 Euclid Avenue
Cleveland, OH 44106
Phone: 216-791-5200
Fax: 216-791-5205

FAIRHILL CENTER FOR AGING
12200 Fairhill Road
Cleveland, OH 44120
Phone: 216-421-1350
Fax: 216-421-8874
www.fairhillcenter.org

FINE ARTS GARDEN COMMISSION
c/o The Cleveland Museum of Art, 11150 East Boulevard
Cleveland, OH 44106
Phone: 216-421-7340

FIRST CHURCH OF CHRIST, SCIENTIST
2200 Overlook Road
Cleveland, OH 44106
Phone: 216-721-7766
www.forministry.com/44106fcocs

FIRST ENGLISH LUTHERAN CHURCH
2419 Euclid Heights Boulevard
Cleveland, OH 44106
Phone: 216-721-0476

GESTALT INSTITUTE OF CLEVELAND
1588 Hazel Road
Cleveland, OH 44106
Phone: 216-421-0468
Fax: 216-421-1729
www.gestaltcleveland.org

GRACE LUTHERAN CHURCH
13001 Cedar Road
Cleveland, OH 44118
Phone: 216-321-2790
Fax: 216-321-2865

HALLINAN CENTER
11303 Euclid Avenue
Cleveland, OH 44106
Phone: 216-421-1522
Fax: 216-421-2925

HANNA PERKINS SCHOOL
2084 Cornell Road
Cleveland, OH 44106
Phone: 216-421-7880
Fax: 216-421-8880

HEALTH MUSEUM OF CLEVELAND
8911 Euclid Avenue
Cleveland, OH 44106
Phone: 216-231-5010
Fax: 216-231-5129
www.healthmuseum.org

HITCHCOCK CENTER FOR WOMEN, INC.
1227 Ansel Road
Cleveland, OH 44108
Phone: 216-421-0662
Fax: 216-622-2428

HOLY ROSARY CHURCH
12021 Mayfield Road
Cleveland, OH 44106
Phone: 216-421-2995

INSTITUTE FOR CREATIVE LIVING
3630 Fairmount Boulevard
Cleveland, OH 44118
Phone: 216-932-3785
Fax: 216-932-4093

INTER-RELIGIOUS PARTNERS IN ACTION OF GREATER CLEVELAND
8514 Euclid Avenue
Cleveland, OH 44106-2069
Phone: 216-421-8560
Fax: 216-421-8719

JUDSON MANOR/JUDSON PARK
2181 Ambleside Road
Cleveland, OH 44106
Phone: 216-721-1234
Fax: 216-721-2607
www.judsonretirement.com
JUNIOR LEAGUE OF CLEVELAND, INC.
10819 Magnolia Drive
Cleveland, OH 44106
Phone: 216-231-6300
Fax: 216-231-5425
www.jlcleveland.org

KARAMU HOUSE
2355 East 89th Street
Cleveland, OH 44106
Phone: 216-795-7070
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Phone: 216-791-5760
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www.clevelandorchestra.com

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Fax: 216-231-0453
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SCULPTURE CENTER
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Fax: 216-621-9969
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