

DEPARTMENT OF MATHEMATICS

220 Yost Hall

www.case.edu/artsci/math

Phone: 216-368-2880; Fax: 216-368-5163

Daniela Calvetti, Chair

E-mail: daniela.calvetti@case.edu

UNDERGRADUATE PROGRAMS

Majors

A Bachelor of Arts in Mathematics, a Bachelor of Science in Mathematics, a Bachelor of Science in Mathematics and Physics, and a Bachelor of Science in Applied Mathematics 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.

Bachelor of Arts in Mathematics

(1) Mathematics Requirements

The B.A. degree 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) MATH 324 or 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 second major in Teacher 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

(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) MATH 324 or 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, or PHYS 203)

Bachelor of Science in Applied Mathematics

The B.S. degree in Applied Mathematics requires at least 50 hours of course work in mathematics and related subjects, in addition to a professional core that is specific to the area of application of interest to the student. A student in this degree program must design a program of study 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.

(1) Mathematics Requirements

- (a) MATH 121, 122, 223, and 224, or an equivalent sequence
- (b) Core Mathematics for Applied Mathematics
 - (i) MATH 304, 307, 321, 322, 330
 - (ii) MATH 324 or 425
- (c) Technical Electives: 18 credit hours (normally six courses) of technical electives as follows:
 - (i) Four approved courses, specific to the concentration area of interest to the student
 - (ii) Two other courses of MATH at the 300 level or higher

(2) Professional Core Requirement

The professional core requires 12 credit hours of course work specific to the area of application. This requirement is intended to promote scientific breadth and encourage application of mathematics to other fields.

(3) Non-Mathematics Requirements

The B.S. degree in applied 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 107-108, 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, or PHYS 203)

Areas of research in applied mathematics well represented in the department include:

- Applied Dynamical Systems
- Applied Probability and Stochastic Processes
- Imaging
- Life Science
- Scientific Computing

Study plans with emphasis on areas of application closely related to Mathematics but centered in other departments will be also considered. Such areas might include Engineering Applications, Biology, Cognitive Science, or Economics.

Bachelor of Science 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, fourth-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). There are 14 to 16 credits of open electives.

Year 1	PHYS 121 or 123 Mechanics	4	PHYS 122 or 124 Electricity & Magnetism	4	MATH 121 or 123 Calculus I	4
Year 1	MATH 122 or 124 Calculus II	4	MATH 223 or 227 Calculus III	3	ENGR 131 CompProg	3
Year 1	CHEM 105 or 111 Intro Chemistry	3/4	CHEM 106 or ENGR 145 Intro Chemistry	3/4	CHEM 113 Chem Lab	2
Year 2	PHYS 221 Intro to Modern Physics	3	PHYS 310 Classical Mechanics	3	MP group I***	3
Year 2	MATH 224 Diff Eqs	3	MATH 307 Linear Algebra	3	MATH 308 or 330 Algebra or Scient. Comput.	3
Year 3	PHYS 313 Thermodynamics & Stat Mechanics	3	PHYS 331 or 481 Quantum I	3	PHYS 332 or 482 Quantum II	3
Year 3	MATH 321 Analysis I	3	MATH 322 Analysis II	3	MATH 324 Complex Analysis	3
Year 3	PHYS 3XX**	3	MP group II***	3	MP group III***	3
Year 4	PHYS 423 Adv Elec & Mag	3	PHYS 472 Grad Lab	3	MP group IV***	3
Year 4	PHYS 351 or MATH 351 Sr Project	4				

SAGES	First and University Seminars	10
A&S SAGES	Breadth Requirements	12
Open Electives		14- 16

*Course usually taken in this year, offered only in F = fall, S = spring

**An advanced physics course to be selected from the following list: PHYS 315, 316, 326, 328, 336, 365.

***The "M&P 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, students may choose a course from outside the mathematics and physics departments as a substitute in the

M&P group.

****If approved by the M&P committee, other science sequence courses may be substituted.

*****The number of open electives will vary depending on whether students choose 3-credit or 4-credit courses to fulfill the chemistry/science requirement

Integrated B.S./M.S. Programs in Mathematics and/or Applied Mathematics

The integrated B.S./M.S. Program is intended for highly motivated candidates for the B.S. in Mathematics and Applied Mathematics who wish to pursue an advanced degree. 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 fewer than two semesters of remaining B.S. requirements to complete. Applicants 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 (400 level and above) that will count towards both B.S. and M.S. requirements. The courses to be double-counted must be specified at the time of application. Any undergraduate course work that is to be applied to the M.S. must be beyond that used to satisfy B.S. degree requirements and must conform to University, School, and Department rules. Students may petition to transfer graduate course work taken prior to application to the B.S./M.S. Program subject to the rules of the Graduate School.

Students for whom the master's project or thesis is a continuation and development of the senior project should register for MATH 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.

Integrated B.S./M.S. in Applied Mathematics and Another Discipline

There is the possibility of an integrated five-year study plan leading to a B.S. in Applied Mathematics and an M.S. in the area of application. In order to complete the requirements for the B.S./M.S. in five years, students must choose an area outside Mathematics that integrates well with Mathematics, such as Computing and Information Science, Operations Research, Systems Engineering, Control Theory, Biology, or Cognitive Science. 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 consult with this advisor concerning requirements for the M.S. degree.)

Minors

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, 307).