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INTRODUCTION

The Department of Chemical Engineering offers programs of study that lead to the Master of Science in Engineering (M.S.E.) and the Doctor of Philosophy (Ph.D.). The department also participates in the Master of Engineering (M. Eng.) Program and offers a technical concentration in Chemical Engineering. This booklet contains information about requirements for these various graduate degree programs. Graduate students must also comply with the regulations of the School of Graduate Studies given in the CWRU Bulletin.

Students pursuing advanced degrees are expected to distinguish themselves in knowledge of fundamentals through coursework. Students in the M.S. in Engineering (Plan A or Plan B) or Ph.D. programs must also demonstrate the ability to pursue independent research within the framework of a thesis or project. Additionally, students pursuing the Ph.D. degree must show the capability to synthesize their knowledge in the form of an independent research proposal.

GRADUATE DEGREE PROGRAMS

Master of Engineering Program

The Master of Engineering Program (M. Eng.) combines technical and business coursework into a single degree program. This program is aimed at the practicing engineer and does not include a research component. Six courses are common to all students in the M. Eng. Program (see below). In addition, students will select a four-course sequence as a specialization plus one additional technical course for breadth. The department offers the following concentration in Chemical Engineering:

Required M.Eng. Courses	Chemical Engineering Concentration
EPOM 405 Applied Eng'g Statistics (Sum.)	ECHE 460 Thermodynamics (Fall)
MGMT 421 Business for Engineers (Fall)	ECHE 461 Transport Phenomena (Spring)
EPOM 403 Product/Process Design Implementation (Spring)	ECHE 462 Chemical Reaction Eng'g (Spring)
EPOM 407 Engineering Economics/Financial Analysis (Fall, Sum.)	ECHE 475 Chemical Eng'g Analysis (Fall) or ECHE 480 Electrochemical Eng'g
EPOM 409 Master of Engineering Capstone Project (Spring)	Breadth Elective

Contact Suzette Williamson (216-368-0596) for more information about the M. Eng. degree and Professor Daniel Lacks for more information about the *Chemical Engineering Concentration*.

M.S.E. Program

There are two different degree plans for the M.S.E.: *Plan A* (research thesis) and *Plan B* (project). The *Plan A* degree is a research degree structured for in-residence students while the *Plan B* degree is most suited for part-time students.

Plan A – Students electing *Plan A* take 19 hours of graduate-level coursework (six courses and ECHE 401 *Chemical Engineering Communications*) plus ECHE 651 *Thesis MS* credits. As part of the degree requirements, students must also submit a written thesis, defend that thesis before a committee of the faculty (three ECHE), make an oral presentation at a departmental seminar, and serve as a teaching assistant. Serving as a TA is required even if the student is self-supported. The *Plan A* degree has two slightly different structures depending on whether the student is a regular master's candidate or a 5 year B.S./M.S. candidate. A comparison of the two degree paths appears below.

	Regular MS – Plan A (thesis)	BS/MS – Plan A (thesis)
BS Year		ECHE 462 – <i>Reaction Engineering</i> (3) or ECHE 461 – <i>Transport</i> (3)
		ECHE 651 – <i>MS Thesis</i> (3)
		ECHE 651 – <i>MS Thesis</i> (3)
MS Year 1 Fall	ECHE 401 – <i>ChE Communication</i> (1)	ECHE 401 – <i>ChE Communication</i> (1)
	ECHE 460 – <i>Thermodynamics</i> (3)	ECHE 460 – <i>Thermodynamics</i> (3)
	ECHE 475 – <i>ChE Analysis</i> (3) or equivalent graduate math course	ECHE 475 – <i>ChE Analysis</i> (3)
	Graduate elective (3)	Graduate elective (3)
	UNIV 400A,B – Professional Development for TA's (0)	UNIV 400A,B – Professional Development for TA's (0)
MS Year 1 Spring	ECHE 461 – <i>Transport</i> (3)	ECHE 461 – <i>Transport</i> (3) or ECHE 462 – <i>Reaction Eng'g</i> (3)
	ECHE 462 – <i>Reaction Engineering</i> (3)	Graduate elective (3)
	Graduate elective	ECHE 651 – <i>MS Thesis</i> (3)
MS Year 2	ECHE 651 – <i>MS Thesis</i> (9)	
	Total credits = 28	Total Credits = 28

Plan B – Part-time students and those students in the 5-1/2 year B.S./M.S. cooperative program follow the *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 the B.S./M.S. Cooperative Program, a student may be permitted to complete a 6 credit hour project and reduce the number of courses to seven. As part of the *Plan B* degree requirements, students must submit a written report and defend their work before a committee of the faculty (see *Definitions and Descriptions*); serving as a teaching assistant is not required. A comparison of the *Program of Study* for the regular and B.S./M.S. co-op degrees appears below.

MS – Plan B (3 credit project)		BS/MS Co-op – Plan B (6 credit project)	
ECHE 460 – <i>Thermodynamics</i>	3	ECHE 460 – <i>Thermodynamics</i>	3
ECHE 461 – <i>Transport</i>	3	ECHE 461 – <i>Transport</i>	3
ECHE 462 – <i>Reaction Engineering</i>	3	ECHE 462 – <i>Reaction Engineering</i>	3
ECHE 475 – <i>ChE Analysis</i> or equivalent graduate math course	3	ECHE 475 – <i>ChE Analysis</i> or equivalent graduate math course	3
4 Graduate elective courses	12	3 Graduate elective courses	9
ECHE 660 – <i>Special Problems</i>	3	ECHE 660 – <i>Special Problems</i>	6
Total Credits	27	Total Credits	27

Ph.D. 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.

In our Chemical Engineering department, entering Ph.D. students usually pursue a M.S.E. (Plan A) on their way to their Ph.D. degree. In special cases, however, the M.S.E. requirement can be waived. In any case, eighteen credit hours (minimum) of dissertation research are required for the Ph.D. degree. For students entering the Ph.D. program with only a B.S. degree, a total of twelve courses (36 credit hours) is also required. Course requirements for students entering with M.S. degrees are adjusted to account for work done at other universities, but a minimum of 6 courses (18 credits) must be taken at CWRU. In addition, the student must satisfy the *residency requirements* of the university (see *Definitions and Descriptions*).

Ph.D. students are required to serve as teaching assistants even if the student is self-supported.

Typical Program of Study for the Ph.D. Degree

Ph.D. (dissertation)	Credits	
ECHE 401 – <i>ChE Communication</i>	1	Required
ECHE 460 – <i>Thermodynamics</i>	3	Usually satisfied by pursuing the M.S. degree or by having a M.S. in Chemical Engineering from another institution.
ECHE 462 – <i>Reaction Engineering</i>	3	
ECHE 461 – <i>Transport</i>	3	
ECHE 475 – <i>ChE Analysis</i>	3	
+ minimum of 2 ECHE electives	6	
ECHE 469 – Departmental Seminar	0	
UNIV 400A,B – Professional Development for TA's	0	
6 breadth courses subject to the following constraints:	18	Transfer credit from another university is limited to 6 credits; a minimum of 6 courses is required
• Minimum of 1 additional graduate math or statistics course		
• Minimum of 4 courses outside ECHE		
• Breadth requirements may be adjusted for students entering with extensive MS course work.		
ECHE 701 – Ph.D. Dissertation (in addition to any ECHE 651 credits)	18	Required of all Ph.D. students
Total Credits	55	
Students must complete one year of residence in the Ph.D. program (must be able to TA courses).		
All Ph.D. students must fulfill a minimum of 3 teaching experiences as a requirement of the Case School of Engineering (ECHE 400T, 500T and 600T).		

SCHEDULES FOR DEGREE REQUIREMENTS

To ensure the orderly progression of graduate students toward completion of their degrees, the department has adopted due dates for degree requirements. These schedules apply to all full-time students. Part-time students (Plan B) and students in the Master of Engineering Program should consult with Professor Daniel Lacks to plan a schedule for completion of degree requirements.

Definitions of terms and descriptions of the various requirements are given on the pages following the schedules.

Knowledge of all degree requirements and compliance with all deadlines are the responsibility of the student.

M.S.E. DEGREE SCHEDULE, DUE DATES & DEADLINES

	Regular Student Entering in Fall Semester	Regular Student Entering in Spring Semester	Student Entering through B.S./M.S. Program
Assignments to Research Project:	Fall Semester First year	Spring Semester First year	Spring Semester Junior year
Program of Study:	End of First Fall Semester	End of First Spring Semester	Upon application to program
First Proposition: (ECHE 401 complete)	End of First Fall Semester	End of First Fall Semester	End of Fall Semester Graduate year
Thesis Seminar:	Spring Semester Second year	Spring Semester Second year	Spring Semester Graduate year
Thesis Defense:	Spring Semester Second year	Summer Second year	Summer Graduate year

**Ph.D. DEGREE
SCHEDULE*, DUE DATES & DEADLINES**

	Student Entering with B.S.	Student Entering with M.S.	Evaluation
Assignments to Research Advisor/Project	Fall semester First Year	First semester First year of Ph.D.	
Assemble Thesis Committee	Fall semester First Year	First semester First year of Ph.D.	
Program of Study	End of Fall Semester First Year	End of First Semester First Year of Ph.D.	
First (Independent) Proposition	<u>Assigned:</u> End of May, First Year <u>Exam:</u> Last Week of June, First Year	<u>Assigned:</u> End of May, First Year <u>Exam:</u> Last Week of June, First Year	Oral Exam by Candidacy Committee
Completion of 4 Required Courses; Minimum GPA=3.25 or equivalent	Fall & Spring Semesters First Year	Course Evaluations by Graduate Committee	
Decision on Admission to Ph.D. Candidacy	After successful defense of First Proposition and Completion of all Required Coursework		
Annual Reviews by Thesis Committee	May/June Each Year		
M.S.E. Complete (<i>If Applicable</i>)	No later than end of Second Year	N/A	Oral Defense to Thesis Committee
M.S.E. Seminar (<i>If Applicable</i>)	End of Second Year	N/A	
Second (Research) Proposition	End of Second Year	During Second Year	Oral Defense to Thesis Committee
Decision to Continue in Ph.D. program	End of August, Every Year, Based on Annual Reviews		
Dissertation Seminar	Last Semester Final year of Ph.D.		
Dissertation Defense	Last Semester Final year of Ph.D.		Oral Defense to Thesis Committee

* Schedule is based on the B.S. or M.S. student entering the department in the fall semester. This schedule and set of requirements applies to students entering the program Fall 2002 – present. For students entering the program Spring 2002 or earlier, please consult with Professor Heidi Martin to clarify your requirements.

GENERAL PROCEDURES

Procedures for Graduation:

Application for Graduation - The student should fill out an application for graduation, available at the Graduate Dean's Office, four months before the expected graduation date. An information sheet and calendar of deadlines are also available.

Thesis Preparation - Regulations for thesis and dissertation preparation can be obtained from the Graduate Dean's Office or through the Graduate Studies website. Read them carefully and adhere to them. The Dean's Office is strict on this point. They require two paper copies and an electronic copy of the completed thesis after the defense. All drafting, typing and reproduction costs incurred in the preparation of the thesis must be borne by the student.

Each student will be required to deposit one final copy of the thesis with the department for binding and permanent storage. Additional copies for the thesis advisor are also typically requested.

Scheduling of the Defense for the Ph.D. dissertation defense is done through the Graduate Dean's Office. The form for scheduling the defense must be submitted no later than three weeks before the defense. M.S. theses defenses are scheduled through the department. It is the responsibility of the student to inform and invite all Chemical engineering faculty and graduate students to his/her defense.

Other Forms - The graduating Ph.D. student should obtain a packet of dissertation material from the Dean's Office or through their website. The packet contains two white cards, one blue card, signature sheets to be returned with copies of the approved dissertation, a microfilm agreement, a copyright agreement and a survey form. These forms must be completed before the degree will be granted.

Changes in Research Topics or Advisors:

Assignments to research topics and advisors are made with the understanding that students will continue to work on their particular project until its completion. Because the faculty invests a great deal of time, energy, and financial resources on graduate students, all students are strongly encouraged to complete the projects upon which they initially embark. However, in those circumstances where a change of topic or advisor is deemed necessary by the advisor or the student, the following procedure will be followed.

- 1) The student shall continue work on the initial project until reaching a reasonable stopping point as determined by the advisor in consultation with the student. The Graduate Committee will also be advised of this stopping point.
- 2) At the stopping point, the student shall prepare a report on his or her research activities under this project. The report shall be submitted to both the advisor and the Graduate Committee.
- 3) After examination of this report, and after discussions between the Graduate Committee and the student, the Graduate Committee will make a recommendation to the department faculty concerning the change in topic and/or advisor. Several possible recommendations are listed below:
 - i) The student is encouraged to *continue without discrimination*. In this instance, the student will be allowed to seek out a new research advisor, and, if the new advisor has funding for the new project and is agreeable, funding for the student will continue without interruption.
 - ii) The student is allowed to continue *on probation*. In this instance, the student is allowed to seek out a new research advisor. However, the student will not be allowed to receive funding until completion of a probationary period (typically 2-3 months or one semester) as set by the faculty.
 - iii) The student *support is terminated* indefinitely. In cases where the student has shown little effort or commitment to the thesis topic, a recommendation that the student be *dismissed* from graduate study may be made.

Financial Support:

The Graduate Committee makes recommendations to the Chair for continuation of each student's support on the basis of information gathered from the performance evaluation.

The normal duration of financial support is:

- six terms (academic semesters and summers) for regular students pursuing a M.S. degree.
- four terms (academic semesters and summers) for B.S./M.S. students.
- twelve terms (academic semesters and summers) for Ph.D. students who enter the program holding an M.S. degree.
- fifteen terms (academic semesters and summers) for Ph.D. students who enter the graduate program holding a B.S. in Chemical engineering.

To secure support beyond the above periods, a student must submit a petition to the Graduate Committee providing a time table for completion of the research and all other degree requirements. This petition should be signed by the research advisor.

Monthly stipends for students who continue to receive support beyond the normal period will generally be reduced from the standard departmental stipend. During the year following the normal period of support, the maximum stipend will be \$250/month less than the standard rate. No support is permitted beyond the first year after the normal period. Exceptions to this stipend reduction require an appeal from the student and advisor detailing how the extension of time was caused by factors beyond the control of the student.

The Chemical Engineering Department can elect to terminate financial assistance in the event that a student fails to maintain at least a 3.0 grade point average or to maintain satisfactory progress on the thesis project (as determined by the thesis committee). Students will receive written notice of any impending changes in financial support at least one month in advance of that change.

Policy on Support of Students Admitted to the Graduate Program Without Financial Assistance

At no time during their programs should self-support and no-support students expect to receive financial assistance. However, in some circumstances the faculty research advisor may choose to provide some assistance to the student. In this case, this aid is considered to be gifted to the student and is separate from the usual financial awards made by the department.

With the consent of the Chair and faculty, research advisors may offer this extraordinary support at any level not to exceed the amount received by a fully supported student in the department. The duration these students can be supported must also not exceed department guidelines. Under no circumstances can departmental funds be used to support students in this category.

DEFINITIONS AND DESCRIPTIONS

Annual Reviews (May/June, each year)

The *thesis committee* will assess the student's research progress toward his/her Ph.D. through required annual review meetings between the committee and the student. Financial support of the student is contingent on completion of these reviews. In addition to presentation of the status of the research project, the timing of the following items coincide with the reviews:

First Review: The oral exam for the ***First Proposition*** conducted by the *candidacy committee*.

Second Review: ***Second Proposition Defense***; the *M.S. Thesis Defense*, if applicable (or preparation for it).

Candidacy

Ph.D. students are permitted to stay in the Ph.D. program (*i.e.*, granted permission to advance to candidacy) after passing the ***First (Independent) Proposition***, in addition to satisfying the GPA requirements for the core courses. Advancement to candidacy occurs only after the student completes all required coursework. For a student entering with a B.S. degree who is acquiring an M.S. en route to the Ph.D., advancement to candidacy occurs after completion of the First Proposition or completion of the *MS thesis*, whichever occurs later. With written approval (*Pre-candidacy form*) from the department, students may register for at most six credit hours per semester of research credits, ECHE 701, until they have been advanced to candidacy. The limited registration for ECHE 701 must be continuously maintained until advancement to candidacy occurs.

Candidacy Committee

A candidacy committee will be appointed annually to evaluate each of the first year student's ***First (Independent) Propositions*** through oral exams. For all students entering with a B.S. or M.S., the exams for the ***First Propositions*** will be during the last week of June of their first year.

The candidacy committee will consist of three faculty members appointed annually by the chairman. Members of the candidacy committee who are also serving as research advisors for any of the students being evaluated will be replaced by an alternate for that student's exam.

Coursework

The elective 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*.

Transfer of credit from another university is limited to 6 hours of graduate-level courses and must be approved by the student's research advisor, the department chairman, and the Dean of Graduate Studies. For students who complete a M.S. degree at another university, a minimum of six courses (eighteen credit hours) must be completed at CWRU.

Catalog descriptions of the graduate courses offered by the department are presented at the end of this booklet.

Defense

Students will be required to defend their thesis (Plan A) or project (Plan B) at its completion. Unanimous approval by the faculty committee is required. M.S. committees must consist of at least three ECHE faculty members. Ph.D. committees should consist of at least four faculty members (four is the minimum allowed by the Graduate School), and one must be from an outside department.

Departmental and University Requirements

Separate from the requirements for advancement to *candidacy*, Ph.D. students are also required to present a departmental seminar on their research prior to their defense. As a requirement of the Case School of Engineering, they must also fulfill 3 teaching experiences.

Entrance

To M.S. program - Enrollment as a graduate student holding a B.S. degree in Chemical Engineering, or, for B.S./ M.S. students, completion of the B.S. degree.

To Ph.D. program - Completion of the M.S. in Chemical Engineering at CWRU or enrollment as a graduate student holding a M.S. degree in Chemical Engineering.

Selected students may be invited to join the Ph.D. program directly without completing the M.S. degree.

First (Independent) Proposition

The First Proposition is the major criterion for admission into Ph.D. candidacy. It will test the student's ability in a short amount of time to grasp new research concepts sufficiently to be able to discuss them critically and comprehensively. It also tests the student's ability to go beyond course material and think creatively about a problem. The ability to discuss this material effectively through written and oral communication will be emphasized.

The First Proposition has two possible phases. All students pursuing a Ph.D. must complete the first phase. Depending on the results of the first examination, students may be required to complete the second phase. A student can be asked to terminate enrollment in the Ph.D. program after either phase. Details of the procedure are below.

1. First Phase:

The first phase involves both a written proposal and associated oral exam. The First Proposition topics are assigned, and each student will undergo the oral exam on the proposition 4 weeks later. For students entering the program in the fall semester, the assignments and exams will occur after the spring semester of the first year. For students entering the program in the spring semester, the timing of the exam is decided on an individual basis.

Each student will be assigned a unique research problem relating to some area of chemical engineering not directly related to the dissertation research. The student will then be expected to research the problem and synthesize a possible innovative method to solve this problem. The student should not just offer what other researchers have attempted, but instead review these approaches, and provide a new alternative. Innovation and sound application of chemical engineering fundamentals are emphasized.

The student will prepare a proposal that outlines this approach, assuming a two-year project scope. As a starting point, the student will be provided with a few references related to this topic; the proposition should contain a more detailed summary of pertinent literature, and demonstrate that the student is aware of the significance and possible applications of the research. The proposal should contain a research plan, a timetable, and a discussion of the experiment to be performed or the theory to be developed. Additional guidelines for the proposal will be provided by the graduate committee.

The proposal will be submitted to the *Candidacy Committee*, one week prior to the oral exam. The oral exam will consist of a presentation of the proposition, followed

by questions on the content of the proposition and the principles related to the research topic itself.

Following the evaluation of the written proposition and oral exam, the committee will recommend to the faculty one of several possible outcomes:

- Pass: The student performed adequately on both the written and oral components. This satisfies the Ph.D. *First Proposition* requirement.
- No-Pass: The student performed acceptably on some aspects, but did not perform well enough to earn a passing grade. Student must participate in the second phase.
- Fail: The student did poorly overall. Students receiving this grade **will not** be allowed a second attempt (the second phase). Students earning a failing grade must terminate their enrollment in the Ph.D. program.

2. Second Phase

The second phase is only for students who did not pass the first exam, but the department feels should be given a second attempt at passing, based on marginal performance on the first exam. The second exam will occur up to 6 months after the first exam. This phase includes both a written paper and oral exam. *Note: The candidacy committee may impose additional requirements on a case-by-case basis.* The paper (limit 20 pages) will consist of a summary of the student's dissertation research project – its scope and the student's progress. The student should present background on the nature of the research as well as the research approach and results.

The research summary will be given to the *Candidacy Committee*, who will convene an oral exam. The student will be questioned on both the research topic and fundamental chemical engineering principles. The student's research advisor may sit in on the oral examination as a non-participating member of the committee.

Following the evaluation of the research summary and oral exam, the committee will recommend to the faculty one of two possible outcomes:

- Pass: The student performed adequately on both the written and oral components. This satisfies the Ph.D. *First Proposition* requirement.
- Fail: The student did poorly. Students earning a failing grade must terminate their enrollment in the Ph.D. program.

Graduate Committee

A three-member faculty committee monitors the orderly progression of graduate students through degree requirements, conducts the annual performance evaluation,

and oversees the administration of the first and second propositions. At present, the graduate committee consists of Professors Daniel J. Lack, Heidi B. Martin, and Mohan Sankaran.

Graduate Student Association (G.S.A.)

The G.S.A. is the formal vehicle by which the graduate student body interfaces with the faculty and department. The G.S.A. performs many service functions for the department and its graduate students, including organization of social activities.

GPA Requirements

To remain in the Ph.D. program, a student must complete the four core courses, ECHE 460, ECHE 461, ECHE 462 and ECHE 475, with a minimum GPA of 3.25. Students entering the program with their M.S. degree are permitted to transfer credits for these courses, after the approval of the graduate committee and the chairman. At the discretion of the graduate committee or chairman, any student may be required to retake one or more of these courses.

A Ph.D. student must also maintain a cumulative GPA of 3.20.

Performance Evaluation

An assessment of the student's effectiveness in research and teaching duties is performed annually during the break between Fall and Spring semesters. Inputs from all the faculty are sought for this evaluation and the results are discussed with the student by the graduate committee.

Program of Study

The *Program of Study* is a compilation and schedule of the courses a student plans to take to complete degree requirements. The *Program of Study* must be approved by the student's research advisor, the department chairman, and the Dean of Engineering. Forms for the *Program of Study* are available in the department office or on the Graduate Studies website.

Residence

Graduate students working for the Ph.D. are required to satisfy the residency requirements of the university, which currently are consecutive registration in six academic semesters or six consecutive terms in a two calendar year period.

Graduate students are considered to be in residence when they are engaged in full time 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.

Second (Research) Proposition

The Second Proposition is written and orally defended before the student's *thesis committee*. Successful defense of this proposal is required for a student to remain in the Ph.D. program. The proposition provides a means for the student's thesis committee to evaluate the scope and approach of the work in an early stage of the research. For a student entering with a B.S., this defense should be at the end of his/her second year; for students with an M.S., it should be at the start of the second year. *Stipend support is contingent on timely completion of this requirement.*

This proposal (and the associated oral exam) will test the student's concept of the thesis problem and the proposed directions of approach. The proposition should demonstrate that the student is aware of the significance of the research. It should contain literature references to related work done by others, a research plan, a timetable, discussion of the experiment to be performed or the theory to be developed, as well as preliminary results already obtained.

Following the evaluation of the written proposition and oral exam, one of two possible outcomes is assigned:

- Pass: Requirements met. Student is advanced to candidacy.
- Fail: The proposal is returned to the student for further work. The student then resubmits the proposal and undergoes a second defense. Students earning a failing grade twice must terminate their enrollment in the Ph.D. program.

Seminar

All full-time M.S. students and all Ph.D. students are required to present a departmental seminar on their research before their defense.

Term

A term is either a regular academic semester or a summer session.

Thesis Committee

The thesis committee is responsible for continual evaluation of a student's progress toward his/her Ph.D. The committee will convene at least once a year, for a required annual review to provide feedback and direction. The committee will preside over the Ph.D. and M.S. (*if applicable*) defense(s), as well as the ***Second (Research) Proposition*** defense.

The role of the thesis committee in advancing a student to candidacy is as follows: After the *Candidacy Committee* grants the student permission to advance to candidacy (through passing the *First Proposition*), a student will later present a ***Second (Research) Proposition*** to the thesis committee. (Consult the student's Ph.D. degree schedule for expected timing of the proposition defense) The committee will examine the proposition through an oral defense; successful defense of this proposition is necessary for a student to remain in the Ph.D. program. A student failing the defense is asked to resubmit the proposal and defend again. If the student fails this defense on two attempts, the student is asked to terminate enrollment in the program.

The minimum thesis committee size is four faculty members. This includes the student's research advisor and at least one faculty member from an outside department. Additional members from within or outside the university are permitted beyond the minimum.