

DEGREE PROGRAM REQUIREMENTS*
DOCTOR OF PHILOSOPHY DEGREE
Mechanical Engineering and Mechanics

I. ABBREVIATED OVERVIEW OF REQUIREMENTS FOR THE PhD DEGREE AND CRITICAL TIMELINES FOR FULL-TIME STUDENTS

1. Select a PhD adviser, then complete and submit the Adviser Selection Form.

2. Complete five core courses with a minimum gpa of 3.35/4.0 within the first three semesters of graduate study. The student must use the first five core courses taken for the gpa calculation. Core courses may not be retaken. (If ME 453 is not taken as part of the core course sequence, it must be taken at a later point.)

This requirement represents the first stage of candidacy at the Department level

3. Form the PhD Committee (required for administration of General Examination).

4. Complete the General Examination. Students who started their PhD prior to the Fall 2018 semester can take either the existing form of the General Examination, or, if the PhD advisor, the student and the PhD committee are all in agreement, the student can take the new form of the General Examination. Students who start their PhD program as of the Fall 2018 semester must take the new form of the General Examination. The existing form of the General Examination must be completed no later than the end of the second semester after the minimum core course gpa is attained. The new form of the General Examination is taken during the fourth semester when the core course requirements will have been completed. Note: The University requirement is that the General Examination must be completed no later than seven months prior to the time when the candidate plans to receive the degree.

This requirement represents the second stage of candidacy at the Department level.

5. Write the proposal for the PhD program. The proposal includes the proposed research and the course plan. For students starting their PhD program as of the Spring 2019 semester or thereafter, the course plan must include three additional depth and breadth courses beyond the five core courses.

6. Present the PhD proposal to the PhD Committee no later than the end of the semester following the semester in which the General Exam was passed.

7. File for PhD candidacy at the College level. After the proposal is approved by the PhD Committee, submit the original General Exam Signature page, the original Proposal signature page, a copy of the proposal, and a completed Application to Candidacy form to Ms. Brie Lisk, 314A Packard Lab. Approval of the proposal by the Associate Dean admits the student to candidacy for the PhD in the P. C. Rossin College of Engineering and Applied Science.

8. Present the dissertation research. A dissertation defense announcement is sent to all faculty and graduate students at least one week prior to the defense presentation.

*Each degree candidate is responsible for ensuring that his/her program is compatible with the degree requirements given in the most recent version of the Lehigh University Catalog and the Graduate Student Handbook of the P. C. Rossin College of Engineering and Applied Science: (<http://go.lehigh.edu/enggradhandbook>)

II. COURSE REQUIREMENTS

Students pursuing the PhD must complete a total of eight courses. Five of these courses are the required core courses and three are depth and breadth courses

Required Core Courses

Group I: Required Core Courses in Engineering Mathematics (two courses):	
<u>ME 452</u>	Mathematical Methods In Engineering I (plus one of the following courses)
<u>ME 453</u>	Mathematical Methods In Engineering II
or <u>ME 413</u>	Numerical Methods in Mechanical Engineering
Group II: Required Core Courses in Mechanical Engineering (minimum of 2 courses, up to three courses):	
<u>ME 423</u>	Heat and Mass Transfer
<u>ME 430</u>	Advanced Fluid Mechanics
<u>ME 433</u>	Linear Systems and Control
<u>MECH 406</u>	Fundamentals of Solid Mechanics
<u>MECH 425</u>	Analytical Methods in Dynamics and Vibrations
Group III: Optional Core Course (only one course):	
<u>ME 401</u>	Integrated Product Development
or <u>ME 402</u>	Advanced Manufacturing Science

These five courses may be taken as part of a student's study for a Lehigh Master of Science degree or upon entry directly into the PhD program.

All courses to be included in the GPA calculation must be taken during the first three semesters of graduate study if the student is a full-time student; the first five core courses taken by the student are used for the GPA calculation. Core courses may not be retaken.

All PhD students must take **ME 453** Mathematical Methods in Engineering II, prior to graduation.

The PhD degree requires a minimum of 72 credit hours if taken at Lehigh, or 48 credit hours if a Master of Science degree was awarded from another accredited institution. Fifteen of these credit hours correspond to the required core courses.

Required Depth and Breadth Courses

In addition to the required core courses, it is necessary to complete:

- Two (2) graduate courses in the student's (MEM) emphasis area (depth requirement); and
- One (1) graduate course outside the (MEM) emphasis area but related to the student's research (breadth requirement).

A Group I math core course cannot be used to satisfy the breadth requirement. For students working in an interdisciplinary area, the advisor in coordination with the PhD committee possess the freedom to choose the most appropriate courses for the depth and breadth requirements.

PhD students must also take ME 453, which can either be taken as part of the five core course requirement or as an additional course.

III. GENERAL EXAMINATION

Only after attainment of a minimum GPA of 3.35/4.0 in the five core courses is a student allowed to proceed with the General Examination.

Immediately following successful completion of the core courses, the student forms the Doctoral Committee, which includes the dissertation advisor as the Committee Chair. The minimum number of committee members is four. Of these, three, including the Committee Chair, are to be voting Lehigh faculty members. With the written approval of the Dean of the College, one of the three aforementioned faculty members, each of whom must have a doctoral degree, may be drawn from categories that include departmentally approved adjunct, professors of practice, university lecturers, and courtesy faculty appointees. This latter member may not serve as the Committee Chair. The fourth required member must be from outside the student's Department (or outside the student's program if there is only one Department in the college). Committees may include additional members who possess the requisite expertise and experience. The Doctoral Committee is responsible for both administration of the General Exam and oversight of the student's program of study.

Committee members must be approved by the University's Graduate and Research Committee; such approval may be delegated to the department or program sponsoring the degree.

The Doctoral Committee is responsible for both administration of the General Exam and oversight of the student's program of study.

The General Examination is completed during the fourth semester of graduate study.

Students taking the General Examination should register for three credits of the independent study course ME 450. The advisor of the PhD student should request, through the Associate Chair of the Department, her/his own section of ME 450 for this purpose prior to the start of the semester of the General Examination.

During the first half of the fourth semester, the advisor assigns a topic to the student after discussion with the student and approval of the Doctoral Committee. The student then does a literature search and defines several major unresolved issues in a report that should not exceed seven (7) pages of text. During the second half of the semester, the student formulates a research proposal that aims to clarify the underlying principles of the originally defined topic, while

addressing the major unresolved issues. The format will conform to the guidelines for a proposal of a major funding agency (NSF, NIH, DOE, DOD) and will not exceed ten (10) pages of text.

The student submits the proposal to the Doctoral Committee and schedules the oral exam by the last day of class. The Committee decides on a grade to be assigned upon completion of the three credit independent study course (ME 450). The General Examination must be passed at least seven months before the degree is to be conferred.

IV. RESEARCH PROPOSAL AND FILING FOR CANDIDACY AT THE COLLEGE LEVEL.

During the semester following completion of the General Examination (e.g., the Fall semester following completion of the General Examination during the Spring semester), the student completes a research proposal and applies for formal PhD candidacy at the College level. Formulation of the research proposal for the doctoral program includes not only the research plan, but also an outline of all coursework. The student presents the proposal in both written and oral form to his/her Doctoral Committee for approval.

Upon Committee approval, the proposal is submitted to the Associate Dean of Graduate Studies of the P. C. Rossin College of Engineering and Applied Science. In addition to the approved proposal, the student submits the original General Exam Signature page, the original Proposal Signature page, a copy of the proposal, and a completed Application to Candidacy form. These documents are given to Ms. Brie Lisk, 314A Packard Lab. Approval of the proposal by the Associate Dean admits the student to candidacy for the PhD in the P. C. Rossin College of Engineering and Applied Science.

V. DISSERTATION PREPARATION AND DEFENSE

Upon completion of coursework and research, the candidate prepares a dissertation describing the results and conclusions of his/her research. A written dissertation draft is submitted to the Doctoral Committee, and the candidate presents a public defense of the dissertation. A dissertation defense announcement must be sent to all faculty and graduate students in the department and posted within the department at least one week before the defense is given. A satisfactory defense of the dissertation and acceptance of the written draft by the Doctoral Committee completes the Departmental requirements for the doctoral degree. To complete the degree requirements, especially in this final phase, the dissertation must also conform to the timing and guidelines of the P. C. Rossin College of Engineering and Applied Science, as described in the College Graduate Student Handbook. Candidates should be especially aware of strict timelines for submitting drafts of the dissertation; these timelines are indicated in the academic calendar and are available from the Registrar's Office.

VI. ADDITIONAL REQUIREMENTS

- Two or more manuscripts must be submitted for (peer-reviewed) journal publication prior to the dissertation defense. At least one of these manuscripts must have gone through a first (external) review process. A student may petition, with detailed justification, to account for unusual preparation efforts, for example: submittal of a single manuscript to an extraordinarily competitive journal; an unreasonably long review time for a submitted manuscript; and alternate products consistent with the indicators of scholarship in the student's area of research.

- The minimum number of department seminars must be attended by the student during the course of the PhD program.

VII. REPLACEMENT CORE COURSE

A minimum GPA of 3.35/4.0 (based on the first five graduate core courses taken) must be attained. This minimum GPA requirement represents the first stage of candidacy for the PhD degree at the Department level. If the minimum requirement is not met, the student may petition to: (a) take one replacement course from the same Group I, II or III of core courses; or (b) take one replacement course in the form of a (non-core) advanced course, but only after the petition is approved and the course instructor is made aware of the student's petition for grade replacement. All petitions require approval of the PhD advisor, then approval of the Graduate Committee.

VIII. TRANSFER OF COURSES TAKEN AT ANOTHER UNIVERSITY

A student pursuing the PhD after completion of an MS/MSc degree from another institution may petition to have two courses taken at that institution be approved as equivalent to MEM core courses, with no more than one course equivalent to a Lehigh Group I core course (math course) and one course equivalent to a Group II core course (course in a fundamental subject area). In addition, the student may petition to substitute courses taken elsewhere for the two (2) non-core advanced courses in their subject area (depth requirement) and the one (1) non-core course outside their emphasis area (breadth requirement). All of the foregoing replacement courses must be approved by the instructor of the corresponding Lehigh course. The student must submit a petition with the following: (a) a syllabus in English or a sufficiently detailed print-out of the course catalog from the MS institution; (b) a letter of support or a signed petition from the PhD advisor; and (c) any additional documentation beyond the syllabus as requested by the instructor. If permission is granted for the foregoing replacement courses, three (3) core courses will remain for completion at Lehigh.

IX. UNIVERSITY AND DISTANCE EDUCATION RESIDENCY REQUIREMENTS

University Residency Requirement for Distance Education PhD Students

Concentrated Learning Requirement: To fulfill the concentrated learning requirement for the doctoral degree, a candidate must complete two semesters as a full-time graduate student or at least 18 credit hours of Lehigh graduate study within a fifteen-month period either on or off campus. The concentrated learning requirement is intended to ensure that doctoral students spend a period of concentrated study and intellectual association with other scholars. Individual departments may impose additional stipulations. Candidates should check with their advisors to be certain that they have satisfied their concentrated learning requirements.

Department Residency Requirement for Distance Education PhD Students

After a PhD student has passed the General Examination, PhD students who perform their research at a remote location are required to spend two days of intellectual association at Lehigh during each semester of the academic year. Each visit is to include:

- (i) A 20 minute presentation given to a defined group of graduate students and a limited number of faculty on a recent research article of direct relevance to the research of the PhD student. This presentation will be followed by extensive discussion and interaction.
- (ii) Discussion of issues of mutual research interest with a minimum of three other graduate students engaged in related research at the University. These students may be within the research group of the dissertation adviser or another adviser(s).

The PhD student will submit documentation each semester to the Secretarial Coordinator of the Graduate Program, indicating satisfaction of requirements (i) and (ii). Documentation of requirement (i) will include the complete citation of the journal article that served as the basis for the 20 minute presentation and names of graduate students and faculty present. For requirement (ii), a one page summary of the interactions with other students is required, including their names and highlights as to how the student's own research has been influenced by these discussions.