

## PH.D. in MECHANICAL ENGINEERING

The Ph.D. program in Mechanical Engineering consists of 33 credits of graduate level course work plus 9 credits of Doctoral Dissertation. The Ph.D. program is designed to allow for considerable flexibility in course selection and specialization of study. Course work must be completed with a cumulative grade point average of 3.0 or higher (see [Graduate Catalog](#) for relevant details). In addition, the student must pass the Qualifying Examination, Candidacy Examination and fulfill the teaching requirement prior to completing the dissertation requirements. The Ph.D. should be obtainable in four years of full-time study after entering the program. There is no foreign language requirement for the Ph.D.

### I. Course Requirements

- A. At least five courses (15 credits) at the 600 or higher level in Mechanical Engineering (MEEG). At least three of these courses shall be selected from the following list:
  - MEEG 690 Intermediate Engineering Mathematics
  - MEEG 610 Intermediate Solid Mechanics
  - MEEG 620 Intermediate Dynamics
  - MEEG 630 Intermediate Fluid Mechanics
  - MEEG 640 Intermediate Heat Transfer
  - MEEG 683 Orthopedic Biomechanics
  - MEEG 624 Control of Dynamical Systems
- B. Five additional graduate-level courses in Engineering, Science or Mathematics (15 credits) of which at least three courses (9 credits) must be at the 800 level.
- C. At least one course (3 credits) in mathematics other than MEEG690.
- D. At least three semesters of MEEG 600 Seminar (0 credits). Special arrangements can be made for part-time students to fulfill this requirement.
- E. 9 credits of MEEG 969 Doctoral Dissertation.

An individual course can be used to meet more than one of the requirements provided the total number of credits is at least 33. MEEG 868 cannot be used toward these requirements.

With the written approval of the thesis advisor and of the Graduate Committee, requirements A and C may be fully or partially waived for a student who has been awarded a Master's degree in Mechanical Engineering (up to a maximum of 12 credits). With similar approval, to the extent that courses at the 800 level (other than MEEG 868 or MEEG 869) were used to satisfy the Master's degree requirements, requirement B may be fully or partially waived. Evidence must be given to show that courses taken for the Master's degree are equivalent to those being waived. If any course waivers are granted, the total number of course credits required for the PhD will be reduced by the number of credits equivalent to those being waived. Under no circumstances will requirements equivalent to more than 12 credits be waived.

Students will submit a proposed course plan (including any requests for course waivers as described above) to the Dissertation Committee at the time of their candidacy exam. Upon approval, it will enter into the candidate's file. Deviations from the proposed plan must be approved by the Dissertation Committee. A copy of the course plan must be sent to the University Office of Graduate Studies.

### II. Dissertation Requirements

A dissertation is required which demonstrates the student's ability to conduct independent research. A Dissertation Committee is selected by the advisor and approved by the Department Chairperson. This committee will also serve as the student's Candidacy Examination Committee. At least three Mechanical Engineering Department faculty members and at least one faculty member from another department

will serve on the Dissertation Committee. The Committee will be chaired by the research advisor, who must be a regular full-time member of the Department of Mechanical Engineering Faculty. During the course of the research, the student will periodically review progress with the Committee.

The student must orally present the dissertation before the Dissertation Committee at an open defense. The student shall supply final draft copies of the dissertation to members of the Committee at least two weeks before the oral defense. The dissertation must meet the academic and professional standards set forth by the University.

### **III. Qualifying Examination**

The purpose of the qualifying examination is to assess the aptitude of a doctoral student in the early stages of the program. A student must be enrolled in the Ph.D. program, have a minimum GPA of 3.2 and a minimum of 12 graduate coursework credits to complete the qualifying exam.

The qualifying exam will consist of three parts

- a) a research aptitude exam based on the student's research interest area
- b) one math exam (based on the content in MEEG 690)
- c) one mechanical engineering topic exam (based on undergraduate-level mechanical engineering and the content in one of the core courses, MEEG 610, MEEG 620, MEEG 630, MEEG 640)

Part a) will be offered between the end of the first semester and the end of the second semester of study and will:

- i) Include a 2-3 page report reviewing and summarizing typically 3 or 4 published peer reviewed journal articles from the literature, in the student's research interest area. The journal articles will be selected by the student's advisor and no more than one of them shall have been authored by the advisor.
- ii) Include a 20 minute oral presentation of the above described report, followed by a period of questioning related to the selected papers.
- iii) Be graded by a committee of at least three faculty members, including the student's research advisor and two other faculty members, not advising the student, appointed by the department chair. The criteria for grading will be established by the faculty and provided to the student ahead of the exam.

Parts b) and c) will be written exams, offered in early June and must be taken at the first opportunity after the completion of 12 graduate coursework credits toward the Ph.D.

In judging student performance on this examination, the faculty has three options: (i) outright passing, (ii) giving a second chance, and (iii) outright failing. If the student is given a second chance, the faculty will specify the parameters for taking and passing the second chance exam. These decisions will be made in a faculty meeting held as soon as possible following the grading of the exams. There will be no third chance given. A student who ultimately fails the Qualifying Examination is not eligible to continue in the Ph.D. program, but may apply to change his/her matriculation to the MSME program.

### **IV. Candidacy Examination**

The Ph.D. Candidacy Examination must be taken within one and a half years of successful completion of the Qualifying Examination and at least one year prior to the dissertation defense. The student will prepare a comprehensive, written research proposal and defend it orally before the Candidacy Examination Committee (the composition of which is specified in II). The Candidacy Examination is intended to test the student's ability to synthesize knowledge in the formulation of an independent research proposal. Performance is judged by the Candidacy Examination Committee, and any additional requirements they wish to impose must be satisfied before the student is admitted to candidacy. Additional requirements could include, but are not limited to: taking additional course work, modifying the written research proposal, and defending the revised proposal before the Candidacy Examination

Committee. Satisfactory completion of any additional requirements must be approved by the student's Candidacy Examination Committee.

#### **V. Teaching Requirement**

The ability to communicate effectively is an essential skill for all PhD graduates. Therefore, all PhD students are required to fulfill a teaching requirement, which consists of serving as a Teaching Assistant (TA) for one or two semesters, depending on the assignment. Students are expected to continue to be actively involved in their research while serving as a TA.

International graduate students are required to take International Teaching Assistant (ITA) training through the University's English Language Institute (ELI) prior to their first semester as a graduate student. Training and assessment are part of the University's requirements for the proficiency of international TA's. A final decision on how to resolve any deficiency is made by the Graduate Program Coordinator in consultation with the student's thesis advisor and the Department Chair.

Teaching Assistant positions are assigned by the Graduate Curriculum Chair in advance for the upcoming semester. Students are encouraged to submit their preferences for specific TA positions early to facilitate the process. Although every effort is made to satisfy these requests, students should recognize that this might not be possible in all cases. In addition, the educational needs of the Department may require the Graduate Curriculum Chair to ask students to fill specific TA positions.

NOTE: Students already enrolled in the Ph.D. program can choose to switch to the new guidelines, or continue under the current guidelines.

#### **VI. Learning Outcomes and Assessment**

A. The student will demonstrate the ability to apply graduate-level mathematics to the solution of engineering problems in at least two of the general areas of solid mechanics, fluid mechanics, dynamics and heat transfer.

Direct assessment: Student learning relative to this outcome is assessed by the student's performance on the written Ph.D. Qualifying exam.

Indirect assessment: A current and updated employment listing will serve as indirect evidence of student attainment of the learning goal.

B. The student will demonstrate the ability to conduct, present and defend graduate-level research including literature review, motivation, methodology utilized, results, unique contributions, and conclusions generated.

Direct assessment: Student learning relative to this outcome is assessed by the quality of the written dissertation and performance in the dissertation defense.

Indirect assessment: A current and updated employment listing will serve as indirect evidence of student attainment of the learning goal.

C. The student will demonstrate the ability to propose and present relevant graduate-level research including the description of importance of a problem, a literature review of potential topics where unique contributions can be made and anticipated methodology.

Direct assessment: Student learning related to this outcome is assessed by performance on the Candidacy Examination.

Indirect assessment: A current and updated employment listing will serve as indirect evidence of student attainment of the learning goal.