Requirements
The PhD is awarded to students who demonstrate high academic achievement and research competence in the fields of mechanical engineering. To earn a PhD, a student must complete an approved, rigorous program of advanced course work and submit and defend an original dissertation of independent research. The Department of Mechanical and Industrial Engineering (MIE) expects all successful doctoral candidates to show depth of knowledge and research innovation in their chosen field of specialization.

The MIE department admits applicants to the PhD program either directly after earning a suitable bachelor's degree (i.e., direct entry) or after earning a suitable master's degree (i.e., advanced entry). Upon acceptance into the program, an applicant is designated as a doctoral student. This designation is changed to doctoral candidate upon successful completion of the doctoral qualifying examinations (both written and oral exams) as well as all the required course work.

Academic and Research Advisors
PhD students must find a research advisor within their first year of study. The research advisor must be a full-time or jointly appointed faculty or affiliated member of the MIE department; otherwise, a petition must be filed and approved by the MIE Graduate Affairs Committee. If the research advisor is outside the MIE department, a faculty member with 50 percent or more appointments in the MIE department must be chosen as the co-advisor. Students are advised by the academic advisor of their discipline before they select their research advisor(s).

Change of Research Advisor
Students who wish to change their research advisor need to use the MIE petition form to make that request. The petition form must be signed by the student and by the student's current and future research advisor. The signed petition form should then be submitted to the MIE department for further processing.

Course Requirements and Plan of Study
A typical program of study includes at least 40 semester hours of course work beyond a bachelor’s degree. Students who choose to get a master’s degree along the way to a PhD must complete a total of 52 semester hours (32 semester hours to earn a master’s degree and an additional 20 semester hours in order to earn a PhD). The 32 semester hours of course work that apply toward the master’s degree may include up to 8 semester hours of thesis or 4 semester hours of project or approved independent study course work. Students may petition the MIE Graduate Affairs Committee to substitute up to 4 semester hours of Independent Study (ME 7978) as part of their required course work. An independent study must be approved by the research advisor. When thesis or project is selected, an independent study course cannot be taken.

Each doctoral student, together with his or her research advisor, should develop an initial program during the first semester of study. The final program is also subject to the approval of the dissertation committee, who will add the program of study to the student’s record upon admission to doctoral candidacy.

PhD Students Annual Review
All PhD students in the MIE department must complete the PhD Students Annual Review form and submit the required documents by no later than January 31st of their third year of study (second year for PhD advanced entry) and all subsequent years thereafter.

PhD Candidacy
To qualify as a doctoral candidate, a doctoral student must successfully complete the doctoral qualifying examinations (both a written comprehensive exam and an oral exam—see below) as well as all the required course work.

Doctoral Qualifying Examinations
Background and motivation: To demonstrate breadth and depth in each of the subject exams, crossover and merging exams are necessary in an effort to provide students with an opportunity to master the core disciplines in mechanical or industrial engineering (at both undergraduate and graduate levels) along with a focus area of importance to their specialization. These exams also provide an assessment as to whether students have adequate knowledge to pursue advanced study and possess attributes of a doctoral candidate by demonstrating understanding of and the ability to apply fundamental principles. Also, an oral exam tied to the written exams is necessary in an effort to evaluate a student’s potential to perform independent research in the chosen field of specialization for the doctoral program.

Doctoral qualifying examinations framework: The doctoral qualifying examinations consist of the following two parts:

1. Two written comprehensive exams, which are respectively referred to as exam A and exam B
2. An oral exam to be administered no later than the end of the semester in which the written exams are taken and passed

WRITTEN COMPREHENSIVE EXAMINATIONS
All doctoral students admitted directly with a bachelor’s degree must take the written comprehensive exams no later than the first time that it is offered after their first two years of study. The written comprehensive exams include two exams, exam A and exam B, which are given on the Thursday and/or Friday of the first week of classes during regular semesters. A complete list of these exams along with topical coverage and details are provided in the PhD Qualifying Examinations Guidelines on the MIE department graduate website (http://www.mie.neu.edu/mie_degrees-programs/graduate-studies/). Students should also consult extensively with their research advisor regarding all aspects of the qualifying exams.

Written Comprehensive Exams Rules
Exam A, about four to six hours in length, should be selected from the list of major exams based on the student’s concentration (i.e., materials, mechanics, mechatronics, or thermofluids, sample list provided). No deviation from this rule will be permitted. Exam B, about two to three hours in length, should be selected from the list of B exams for PhD degree program in mechanical engineering (a sample list is provided below), and only one exam from this list should be selected. All students are required to have their research advisor’s approval for their selection of exams A and B prior to registering to take the written comprehensive exams. Note that exam B cannot be similar or close to one of the topics covered in exam A.

List of exams A and B are based on student’s research concentration:

Samples of exam A for mechanical engineering PhD students:
• Materials Science Engineering (MSE): Kinetics of Materials (MSE1), and Thermodynamics of Materials (MSE2)
• Mechanics (MEC): Mechanics of Deformable Media (MEC1), Dynamics and Vibration (MEC2), and Finite Element Method (MEC3)
• Dynamic Systems and Control (DSC): Dynamic Systems (DSC1); Mechanical Vibrations (DSC2); and Control Systems (DSC3)
• Thermofluids Science (TFS): Thermodynamics (TFS1); Fluid Mechanics (TFS2); and Heat Transfer (TFS3)

Samples of exam B for mechanical engineering PhD students:
• Control Systems (DSC3)
• Dynamic Systems (DSC1)
• Dynamics and Vibration (MEC2)
• Engineering Mathematics (MTH)
• Finite Element Method (MEC3)
• Fluid Mechanics (TFS2)
• Heat Transfer (TFS3)
• Kinetics of Materials (MSE1)
• Mechanics of Deformable Media (MEC1)
• Thermodynamics (TFS1)
• Thermodynamics of Materials (MSE2)

ORAL EXAMINATION
The objective of the oral exam is to assess a student's potential to perform independent research in the chosen field of specialization. This exam shall be administered no later than the end of the semester in which the written exams are taken and passed. The exam shall be publicly advertised at least one week in advance, and all faculty members and students may attend and participate.

Oral examination procedure: The student’s research advisor convenes and chairs an oral examination committee comprised of a minimum of three faculty members deemed appropriate by the research advisor. This committee provides a set of technical papers pertinent to the student’s research area at least one month before the examination. The oral examination committee will then conduct the exam that comprises the following two parts (both completed in a one-hour session):

1. A 30-minute oral presentation on a selected number of papers out of the assigned technical papers
2. A 30-minute oral exam by committee members’ questions and evaluation of the student covering topics specifically related to the student’s research area

GRADING PROCEDURE
Grading procedure and results of the written comprehensive examination: The MIE Graduate Affairs Committee will review all students’ performance in the written comprehensive exams. Depending on the results of both major and minor exams and in consultation with the student’s research advisor, the Graduate Affairs Committee will recommend one of the following three possible options:

1. No invitation to oral exam: The student will be dismissed from the program. He or she may be granted a master’s degree if the requirements are already met; otherwise, the student may continue to fulfill the requirements for a master’s degree in industrial engineering (IE), mechanical engineering (ME), or other MIE departmental MS degree (e.g., operations research (OR)).
2. No invitation to oral exam yet: The student will be asked to retake the written exam(s) again in the next offering and/or take additional courses.
3. Student is invited to oral exam.

The Graduate Affairs Committee makes its final recommendation considering all aspects of the exam including, but not limited to, examiners’ reports and results, student’s research performance, and course work. The Graduate Affairs Committee reserves the right to recommend option 1 above for students who register for the exams but do not show up.

Grading procedure and results of the oral examination: If the student’s performance in the oral exam is not satisfactory, the student will be dismissed from the program. He or she may be granted a master’s degree if the requirements are met; otherwise, the student may continue to fulfill the requirements for a master’s degree in industrial engineering (IE), mechanical engineering (ME), or other MIE departmental MS degree (e.g., operations research (OR)).

Upon successfully passing the oral exam, the student continues in the PhD program. Upon passing all the required course work, he or she will become a PhD candidate. The results of written and oral exams and any recommended course work will become part of the student’s record.

APPEAL PROCEDURE
The preliminary qualifying examination process provides means for reevaluation for students who fail one or more exams to appeal the Graduate Affairs Committee decision. All communications related to these examinations should be coordinated through the student’s research advisor. Only the student’s research advisor may request the MIE Graduate Affairs Committee to reevaluate the student’s failed exams using the appeal form found at the link (http://www.coe.neu.edu/sites/default/files/pdfs/coe/gse/miepetitionform.pdf).

PhD Students Changing Their Program
PhD students who, for any reason, decide to change their degree program (i.e., from PhD in ME to PhD in IE or vice versa) must take (or retake) the doctoral qualifying examinations (both written comprehensive exams and oral exam) based on the student’s new major research area (i.e., industrial engineering, materials, mechanics, mechatronics, or thermofluids).

Interdisciplinary PhD Students with MIE as the Home Department
Students pursuing the College of Engineering (COE) interdisciplinary PhD program with the MIE department as their home department must take one of the major written comprehensive exams (exam A) of the MIE doctoral qualifying examinations. The minor exam (exam B) can be substituted with appropriate exam(s) from other department(s) involved with the student’s interdisciplinary PhD program. Students dismissed from the ME or IE PhD programs in the MIE department cannot enroll in the PhD Interdisciplinary Engineering program with MIE as the primary affiliation.

Dissertation Proposal Preparation and Presentation Timing
Students must present their dissertation proposal no more than 12 months after successfully completing the oral exam. In addition, the presentation of the dissertation proposal and the actual dissertation defense (see below) shall be no less than 6 months apart. The student’s dissertation committee will invite any additional faculty deemed appropriate to that field; this dissertation committee will then conduct the dissertation proposal session. Each student’s dissertation committee must be comprised of at least three members, including the research
advisor. At least two of those three members must be full-time MIE faculty members.

Dissertation Course Requirements
Upon successful completion of the doctoral qualifying examinations (both written preliminary and oral exams) as well as all the required course work, the doctoral candidate, in consultation with his or her research advisor, must register in two consecutive semesters (may include full summer term) for Dissertation (ME 9990). Upon completion of this sequence, the student must then register for Dissertation Continuation (ME 9996) in every semester (in each fall and spring term and also in the summer term if summer is the student’s last semester) until the dissertation is completed. Students may not register for Dissertation Continuation (ME 9996) until they fulfill the two-semester sequence of Dissertation (ME 9990).

To meet the full-time registration requirement for PhD students who have completed the majority of their course work and not yet reached PhD candidacy, a zero-credit course, Candidacy Preparation—Doctoral (ME 8960), can be taken if needed to fulfill the full-time course registration requirement. Candidacy Preparation—Doctoral (ME 8960) is an individual instruction course, billed as one semester hour, and graded S or U. Candidacy Preparation—Doctoral (ME 8960) does not have any course content, and students must register in a section for which their research or academic advisor is listed as the “instructor.”

Final Oral (Dissertation Defense) Examination
All doctoral candidates must pass a final oral exam. This exam will be scheduled once the dissertation committee agrees that the candidate’s research is at a stage where it is appropriate for formal presentation and after completion of all other PhD requirements, including all the course work approved in the final program of study. The objective of the exam is for the candidate to present and defend the results of the dissertation research and to demonstrate depth of knowledge and significant expertise in the area of that research under questioning from the dissertation committee and other attendees.

The exam shall be publicly advertised at least one week in advance and all faculty members may attend and participate. At the conclusion of the presentation and subsequent questions period, the dissertation committee will convene to determine the outcome. The committee may recommend that the candidate be awarded the PhD or may require additional research and/or modifications of the dissertation. In some cases, candidates may be asked to present an additional final oral dissertation defense.

Residency Requirement
After achieving PhD candidacy, the university residency requirement is satisfied by two semesters of full-time graduate registration or four semesters of part-time graduate registration. Students must be continually enrolled during the pursuit of dissertation.

Program Requirements
Complete all courses and requirements listed below unless otherwise indicated.

Milestones
Doctoral qualifying exams (both written comprehensive and oral area exams)
Annual review
Dissertation committee formation
Dissertation proposal
Dissertation defense

Core Requirements

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<tr>
<td>MEIE 6830</td>
<td>Graduate Traineeship I (Technical Writing and Communications) (2 SHs)</td>
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</tr>
<tr>
<td>MEIE 6860</td>
<td>Graduate Traineeship II (Research Ethics and Professional Development) (2 SHs)</td>
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Approved Course Work
Requires 40 semester hours of course work, including up to 4 semester hours of Independent Study (ME 7978). Students who choose to get an MS degree along the way to a PhD must complete a total of 52 semester hours (32 semester hours toward the sought MS degree and 20 semester hours beyond the earned MS degree). The 32 semester hours applied toward the master’s degree may include up to 8 semester hours of MS Thesis or 4 semester hours of MS Project or approved independent study course work. Please consult your faculty advisor for acceptable courses.

Dissertation

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<th>Code</th>
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<tbody>
<tr>
<td>ME 9990</td>
<td>Dissertation</td>
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Program Credit/GPA Requirements
40 total semester hours required
Minimum 3.000 GPA required