ENGINEERING MECHANICS, PH.D.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

<table>
<thead>
<tr>
<th>Mode of Instruction Definitions</th>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students are able to complete a program with minimal disruptions to careers and other commitments.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Evening/Weekend: Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Face-to-Face: Courses typically meet during weekdays on the UW-Madison Campus.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Online: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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</table>

CURRICULAR REQUIREMENTS

Requirements | Detail
--- | ---
Minimum Credit Requirement | 60 credits
Minimum Residence Credit Requirement | 32 credits
Minimum Graduate Coursework Requirement | 30 credits must be graduate-level coursework. Details can be found in the Graduate School's Minimum Graduate Coursework (50%) policy (https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/)). In addition, at least 18 of the non-research credits must be in classes having the graduate-level designation.

REQUIREDS COURSES

At least 36 of the required 60 credits must be in classes satisfying the following general requirements and mathematics, breadth and depth requirements.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E M A /CIV ENGR/ M E 508</td>
<td>Composite Materials</td>
<td>21</td>
</tr>
<tr>
<td>E M A 519</td>
<td>Fracture Mechanics</td>
<td></td>
</tr>
<tr>
<td>E M A 522</td>
<td>Aerodynamics Lab</td>
<td></td>
</tr>
<tr>
<td>E M A 523</td>
<td>Flight Dynamics and Control</td>
<td></td>
</tr>
<tr>
<td>E M A /M E 540</td>
<td>Experimental Vibration and Dynamic System Analysis</td>
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</tr>
</tbody>
</table>

Overall GPA 3.00 GPA required.
Graduate GPA Requirement This program follows the Graduate School's policy: https://policy.wisc.edu/library/UW-1203 (https://policy.wisc.edu/library/UW-1203/).
Other Grade Requirements Courses in which grades of BC, C, or below are received cannot be counted toward the degree except as follows:
1) Credits of C will be allowed provided they are balanced by twice as many credits of A or by four times as many credits of AB,
2) Credits of BC will be allowed provided they are balanced by twice as many credits of AB or by an equal number of credits of A.

Assessments and Examinations
Ph.D. qualifying examination is required of all students. After acceptance of the student’s doctoral plan of study, the student must take an oral preliminary examination. Final oral examination is required at the end of the thesis work.

Language Requirements
No language requirements.

Breadth Requirement
All doctoral students are required to complete a doctoral minor or Graduate/Professional certificate. In consultation with, and approval by, the graduate faculty advisor/department, students should select one of the following options:

- Graduate/Professional certificate
- Option A (External Minor): Fulfillment of this minor requires approval of the doctoral minor program. This minor must be outside of the student's doctoral major program.
- Option B (Distributed Minor): Fulfillment of this minor requires 9 course credits from two or more departments outside the major, in related courses selected for their relevance to a particular area of concentration. The following rules apply:
  1. Courses typically included on or within the scope of the E M A Qualifying Exam shall not be considered for the Ph.D. Minor Option B.
  2. At least 6 credits must be taken in courses listed in the UW-Madison Guide as "Grad 50% "courses.
Mathematics Requirements

At least 6 credits (2 courses) must be in applied mathematics from the following list:

- MATH 519: Ordinary Differential Equations
- MATH 521: Analysis I
- MATH 522: Analysis II
- MATH 540: Linear Algebra II
- MATH 619: Analysis of Partial Differential Equations
- MATH 623: Complex Analysis
- MATH 703: Methods of Applied Mathematics 1
- MATH 704: Methods of Applied Mathematics 2
- MATH/COMP SCI 714: Mathematics I
- MATH/COMP SCI 715: Mathematics II

Breadth Requirement

As part of their M.S. or Ph.D., students must have taken courses from at least 2 of the 3 areas defined below. For each of the 2 areas, the student must have taken at least 2 courses. The courses must be at a similar level to those listed below.

Solid Mechanics

- E M A 506: Advanced Mechanics of Materials I
- E M A/CIV ENGR/ME 508: Composite Materials
- E M A 519: Fracture Mechanics
- E M A/M S & E 541: Heterogeneous and Multiphase Materials
- E M A/M E 570: Experimental Mechanics
- E M A 605: Introduction to Finite Elements
- E M A 611: Advanced Mechanical Testing of Materials
- E M A/E P 615: Micro- and Nanoscale Mechanics
- E M A 622: Mechanics of Continua
- E M A 630: Viscoelastic Solids
- E M A 700: Theory of Elasticity
- E M A/M E 703: Plasticity Theory and Physics
- E M A 705: Advanced Topics in Finite Elements
- E M A/M E 706: Plates, Shells and Pressure Vessels
- E M A/M E 708: Advanced Composite Materials
- E M A/M E 722: Introduction to Polymer Rheology
- M E/B M E 603: Topics in Bio-Medical Engineering (Topic: FE for Biomechanics)
- M E 753: Friction, Lubrication and Wear

Fluid Mechanics

- E M A 521: Aerodynamics

E M A 622: Mechanics of Continua
- M E 563: Intermediate Fluid Dynamics
- M E 572: Intermediate Gas Dynamics
- M E 573: Computational Fluid Dynamics
- M E 769: Combustion Processes
- M E 770: Advanced Experimental Instrumentation
- M E 774: Chem Kinetics of Combust Systems
- E M A/CIV ENGR/ME 775: Turbulent Heat and Momentum
- MATH 705: Mathematical Fluid Dynamics

Dynamics

- E M A 523: Flight Dynamics and Control
- E M A/M E 540: Experimental Vibration and Dynamic System Analysis
- E M A 542: Advanced Dynamics
- E M A 545: Mechanical Vibrations
- E M A/ASTRON 550: Astrodynamics
- E M A 610: Structural Finite Element Model Validation
- E M A 642: Satellite Dynamics
- E M A 742: Theory and Applications in Advanced Dynamics
- E M A 745: Advanced Methods in Structural Dynamics
- E M A 747: Nonlinear and Random Mechanical Vibrations
- M E/E C E 577: Automatic Controls Laboratory
- M E 740: Advanced Vibrations
- M E 747: Advanced Computer Control of Machines and Processes
- M E 748: Optimum Design of Mechanical Elements and Systems

Depth Requirement

At least 4 courses (12 credits) must be 700-level or above in mechanics, applied mathematics, or computer science. At least 2 of the courses (6 credits) must be from List 1 (below), and the remaining 2 courses (6 credits) may be from List 1 or List 2.

List 1

- Any E M A course except E M A 790, E M A 890, or E M A 990.
- E M A 601: Special Topics courses may only be counted as 700-level if designated as such by the instructor.
- CBE 720: Microhydrodynamics, Brownian Motion, and Complex Fluids
- CIV ENGR/G L E 730: Engineering Properties of Soils
- CIV ENGR/G L E 735: Soil Dynamics
- MATH 705: Mathematical Fluid Dynamics
- M E 740: Advanced Vibrations
- M E 746: Dynamics of Controlled Systems
- M E 747: Advanced Computer Control of Machines and Processes
It is acceptable for students who earned an M.S. degree in Engineering Mechanics at UW-Madison to use coursework completed while in the M.S. degree program to meet the requirements above.