ENGINEERING MECHANICS: RESEARCH, MS

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

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

NAMED OPTION 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 typically take enough credits aimed at completing the program in a year or two.</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>
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<tr>
<td>Face-to-Face: Courses typically meet during weekdays on the UW-Madison Campus.</td>
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<td>Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.</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>
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CURRICULAR REQUIREMENTS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Detail</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Credit</td>
<td>30 credits</td>
<td></td>
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<tr>
<td>Minimum Residence Credit</td>
<td>16 credits</td>
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<tr>
<td>Minimum Graduate Coursework Requirement</td>
<td>15 credits must be graduate-level coursework. Refer to the Graduate School: Minimum Graduate Coursework (50%) Requirement policy: <a href="https://policy.wisc.edu/library/UW-1244">https://policy.wisc.edu/library/UW-1244</a></td>
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Overall GPA requirement: 3.00 GPA required.

Graduate GPA Requirement: Refer to the Graduate School: Grade Point Average (GPA) Requirement policy: https://policy.wisc.edu/library/UW-1203.

Other Grade Requirements: Students must earn a C or above in all formal coursework. Students may not have more than two incompletes on their record at any one time.

Assessments and Examinations: A thesis is not required for a master’s degree in Engineering Mechanics. Credit for master’s research (E M A 790) will be granted toward meeting the MS requirements only when a formal MS thesis is submitted and approved by the thesis committee. If submitting a MS thesis, a thesis Oral Defense is required. Candidates must pass an oral exam administered by a three-member committee, selected by the student’s advisor. At least two of the committee members must be members of the UW-Madison Graduate Faculty. (For more information, see https://grad.wisc.edu/documents/committees/.) Typically, the student presents an overview of their thesis/research, and then the examiners ask questions in closed session. See the Graduate School’s information https://grad.wisc.edu/current-students/masters-guide/ and note the requirement for an advisor approval page.

REQUIRED COURSES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM A/CIV ENGR/</td>
<td>Composite Materials</td>
<td></td>
</tr>
<tr>
<td>M E 508</td>
<td></td>
<td></td>
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<tr>
<td>EM A 519</td>
<td>Fracture Mechanics</td>
<td></td>
</tr>
<tr>
<td>EM A 522</td>
<td>Aerodynamics Lab</td>
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<tr>
<td>EM A 523</td>
<td>Flight Dynamics and Control</td>
<td></td>
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<tr>
<td>EM A/M E 540</td>
<td>Experimental Vibration and Dynamic System Analysis</td>
<td></td>
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<tr>
<td>EM A/</td>
<td>Heterogeneous and Multiphase Materials</td>
<td></td>
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<tr>
<td>M S &amp; E 541</td>
<td></td>
<td></td>
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<tr>
<td>EM A/E P 547</td>
<td>Engineering Analysis I</td>
<td></td>
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<tr>
<td>EM A/E P 548</td>
<td>Engineering Analysis II</td>
<td></td>
</tr>
<tr>
<td>EM A/M E 570</td>
<td>Experimental Mechanics</td>
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</tr>
</tbody>
</table>

Mathematics Requirements: 3

Students must take at least 3 credits (1 course) from the following list:

<table>
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<th>Title</th>
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<tbody>
<tr>
<td>EM A/E P 547</td>
<td>Engineering Analysis I</td>
</tr>
<tr>
<td>EM A/E P 548</td>
<td>Engineering Analysis II</td>
</tr>
<tr>
<td>MATH 519</td>
<td>Ordinary Differential Equations</td>
</tr>
<tr>
<td>MATH 521</td>
<td>Analysis I</td>
</tr>
<tr>
<td>MATH 522</td>
<td>Analysis II</td>
</tr>
</tbody>
</table>
Breadth Requirement

Students must take at least 5 courses from the list below. At least 3 must be identified by a *. The courses must span at least 2 of the 3 areas defined below. For each of the 2 areas, the student must take at least 2 courses.

Solid Mechanics

- E M A 506 Advanced Mechanics of Materials I  
- E M A/CIV ENGR/M E 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 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 710 Mechanics of Continua  
- E M A/M E 722 Introduction to Polymer Rheology  
- M E/B M E 516 Finite Elements for Biological and Other Soft Materials  
- M E 753 Friction, Lubrication and Wear  

Fluid Mechanics

- E M A 521 Aerodynamics  
- E M A 524 Rocket Propulsion  
- E M A 710 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  
- M E/CIV ENGR/E M A 775 Turbulent Heat and Momentum Transfer  
- 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  
- or M E/E C E 733 Advanced Computer Control of Machines and Processes  

- M E 748 Optimum Design of Mechanical Elements and Systems  

Depth Requirement

At least 2 courses (6 credits) must be numbered 700 or above in mechanics, from the following list:

- 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 course numbered 700 or above 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 or M E/E C E 732 Dynamics of Controlled Systems  
- M E 747 Advanced Computer Control of Machines and Processes  
- M E 748 Optimum Design of Mechanical Elements and Systems  
- M E 751 Advanced Computational Dynamics  
- M E 753 Friction, Lubrication and Wear  
- M E 769 Combustion Processes  
- M E 770 Advanced Experimental Instrumentation  
- M E 774 Chem Kinetics of Combust Systems  
- M E/CIV ENGR/E M A 775 Turbulent Heat and Momentum Transfer  

Independent Study/Research Credits

Thesis Pathway
Independent Study Pathway

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMA 599</td>
<td>Independent Study</td>
<td>minimum of 3 credits</td>
</tr>
<tr>
<td>EMA 790</td>
<td>Master’s Research and Thesis</td>
<td>minimum of 6 credits</td>
</tr>
</tbody>
</table>

1 These pathways are internal to the program and represent different curricular paths a student can follow to earn this degree. Pathway names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

Independent Study / Research

All students must take a minimum of 3 credits of EMA 599. A maximum of 6 credits of EMA 599 may be applied to the minimum credit requirement. Students in the thesis pathway may use a maximum of 12 credits of EMA 599 and EMA 790, combined, toward the minimum credit requirement. Credit for EMA 790 will be granted toward satisfying the MS requirements only when a formal MS thesis is submitted and approved by the thesis committee.

Seminars

Up to 3 credits of Mechanics Seminar may be applied to the credit minimum requirement.