

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>), in addition to the program requirements listed below.

NAMED OPTION REQUIREMENTS MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
Yes	No	No	No	No

Mode of Instruction Definitions

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.

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.

Face-to-Face: Courses typically meet during weekdays on the UW–Madison Campus.

Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.

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.

CURRICULAR REQUIREMENTS

Requirement Detail

Minimum Credit Requirement	30 credits
Minimum Residence Credit Requirement	16 credits
Minimum Graduate Coursework Requirement	15 credits must be graduate-level coursework. Refer to the Graduate School: Minimum Graduate Coursework (50%) Requirement policy: https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/).

Overall Graduate GPA Requirement	3.00 GPA required. Refer to the Graduate School: Grade Point Average (GPA) Requirement policy: https://policy.wisc.edu/library/UW-1203 (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 (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 (https://grad.wisc.edu/current-students/masters-guide/) and note the requirement for an advisor approval page.
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Language Requirements	No language requirements.
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REQUIRED COURSES

Code	Title	Credits
General		
The program requires 30 credits of technical coursework approved by the student's advisor.		
All courses must be numbered 500 or above. At least 15 credits must be taken in courses numbered 600 and above OR from the following list:		15
E M A/CIV ENGR/ M E 508	Composite Materials	
E M A 519	Fracture Mechanics	
E M A 522	Aerodynamics Lab	
E M A 523	Flight Dynamics and Control	
E M A/M E 540	Experimental Vibration and Dynamic System Analysis	
E M A/ M S & E 541	Heterogeneous and Multiphase Materials	
E M A/E P 547	Engineering Analysis I	
E M A/E P 548	Engineering Analysis II	
E M A/M E 570	Experimental Mechanics	
Mathematics Requirements		3
Students must take at least 3 credits (1 course) from the following list:		
E M A/E P 547	Engineering Analysis I	
E M A/E P 548	Engineering Analysis II	
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 I	
MATH 704	Methods of Applied Mathematics-2	
MATH/ COMP SCI 714	Methods of Computational Mathematics I	
MATH/ COMP SCI 715	Methods of Computational Mathematics II	

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 *	3
E M A/CIV ENGR/ M E 508	Composite Materials	3
E M A 519	Fracture Mechanics *	3
E M A/M S & E 541	Heterogeneous and Multiphase Materials *	3
E M A/M E 570	Experimental Mechanics	3
E M A 605	Introduction to Finite Elements *	3
E M A 611	Advanced Mechanical Testing of Materials *	3
E M A/E P 615	Micro- and Nanoscale Mechanics *	3
E M A 630	Viscoelastic Solids *	3
E M A 700	Theory of Elasticity *	3
E M A/M E 703	Plasticity Theory and Physics	3
E M A 705	Advanced Topics in Finite Elements *	3
E M A/M E 706	Plates, Shells and Pressure Vessels	3
E M A/M E 708	Advanced Composite Materials	3
E M A 710	Mechanics of Continua	3
E M A/M E 722	Introduction to Polymer Rheology	3
M E/B M E 516	Finite Elements for Biological and Other Soft Materials	3
M E 753	Friction, Lubrication and Wear	3

Fluid Mechanics

E M A 521	Aerodynamics *	3
E M A 524	Rocket Propulsion *	3
E M A 710	Mechanics of Continua	3
M E 563	Intermediate Fluid Dynamics *	3
M E 572	Intermediate Gas Dynamics *	3
M E 573	Computational Fluid Dynamics *	3
M E 769	Combustion Processes	3
M E 770	Advanced Experimental Instrumentation	3
M E 774	Chem Kinetics of Combust Systems	3
M E/CIV ENGR/ E M A 775	Turbulent Heat and Momentum Transfer	3
MATH 705	Mathematical Fluid Dynamics	3

Dynamics

E M A 523	Flight Dynamics and Control *	3
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E M A/M E 540	Experimental Vibration and Dynamic System Analysis *	3
E M A 542	Advanced Dynamics *	3
E M A 545	Mechanical Vibrations *	3
E M A/ASTRON 550	Astrodynamic	3
E M A 610	Structural Finite Element Model Validation *	3
E M A 642	Satellite Dynamics *	3
E M A 742	Theory and Applications in Advanced Dynamics *	3
E M A 745	Advanced Methods in Structural Dynamics *	3
E M A 747	Nonlinear and Random Mechanical Vibrations *	3
M E/E C E 577	Automatic Controls Laboratory	4
M E 740	Advanced Vibrations	3
M E 747	Advanced Computer Control of Machines and Processes	3
or M E/E C E 733	Advanced Computer Control of Machines and Processes	
M E 748	Optimum Design of Mechanical Elements and Systems	3

Depth Requirement**6**

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 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*¹

E M A 599	Independent Study (minimum of 3 credits)
E M A 790	Master's Research and Thesis (minimum of 6 credits)
<i>Independent Study Pathway</i> ¹	
E M A 599	Independent Study (minimum of 3 credits)

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 E M A 599. A maximum of 6 credits of E M A 599 may be applied to the minimum credit requirement. Students in the thesis pathway may use a maximum of 12 credits of E M A 599 and E M A 790, combined, toward the minimum credit requirement. Credit for E M A 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.