

ENGINEERING MECHANICS, PHD

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum degree requirements (<https://guide.wisc.edu/graduate/#requirements>) and policies (<https://guide.wisc.edu/graduate/#policies>), in addition to the program requirements listed below.

MAJOR 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	60 credits
Minimum Residence Credit Requirement	32 credits
Minimum Graduate Coursework Requirement	30 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/). In addition, at least 18 of the non-research credits must be in classes having the graduate-level designation.

Overall	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 (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	PhD 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.
Graduate School Breadth Requirement	All doctoral students are required to complete a doctoral minor or graduate/professional certificate. Refer to the Graduate School: Breadth Requirement in Doctoral Training policy: https://policy.wisc.edu/library/UW-1200 (https://policy.wisc.edu/library/UW-1200/).
	Students should consult with advisor.

REQUIRED COURSES

At least 36 of the required 60 credits must be in classes satisfying the following: general requirements, mathematics requirements, breadth and depth requirements. All courses must be numbered 500 and above. It is acceptable for students who earned an MS degree in Engineering Mechanics at UW–Madison to use coursework completed while in the MS degree program to meet the requirements below.

Code	Title	Credits
General Requirements		
At least 21 credits must be in coursework numbered 600 and above OR from the following list:		21
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		
At least 6 credits (2 courses) must be in applied mathematics from the following list:		6
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 1
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

As part of their MS or PhD, students must complete courses from at least 2 of the 3 areas defined below (Solid Mechanics, Fluid Mechanics, Dynamics). For each of the 2 areas, the student must complete 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/ M E 508	Composite Materials
M E/B M E 516	Finite Elements for Biological and Other Soft 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 708	Advanced Composite Materials
E M A/M E 722	Introduction to Polymer Rheology
E M A 710	Mechanics of Continua
M E 753	Friction, Lubrication and Wear

Fluid Mechanics

E M A 521	Aerodynamics
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	Astroynamics
E M A 610	Structural Finite Element Model Validation
E M A 642	Satellite Dynamics
E M A 742	
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 4 courses (12 credits) must be numbered 700 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 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
MATH 705	Mathematical Fluid Dynamics
M E 740	Advanced Vibrations
M E 746	Dynamics of Controlled Systems
or M E/ E C E 732	Dynamics of Controlled Systems
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
M E 751	Advanced Computational Dynamics
M E 753	Friction, Lubrication and Wear
M E 768	Precision Measurements
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

List 2

COMP SCI/ MATH 714	Methods of Computational Mathematics I
COMP SCI/ MATH 715	Methods of Computational Mathematics II
COMP SCI/ E C E 760	Machine Learning
E C E 717	Linear Systems
E C E/ COMP SCI 761	Mathematical Foundations of Machine Learning
E C E/COMP SCI/ STAT 861	Theoretical Foundations of Machine Learning
MATH 703	Methods of Applied Mathematics 1
MATH 704	Methods of Applied Mathematics-2
M E 718	Modeling and Simulation in Polymer Processing
M E 758	Solid Modeling
M E 761	Topics in Thermodynamics
M E 764	Advanced Heat Transfer I- Conduction
M S & E 748	Structural Analysis of Materials
M S & E 750	Imperfections and Mechanical Properties
M S & E 760	Molecular Modeling of Materials
PHYSICS 711	Theoretical Physics-Dynamics
PHYSICS 715	Statistical Mechanics
PHYSICS 721	Theoretical Physics- Electrodynamics
PHYSICS 731	Quantum Mechanics
PHYSICS 732	Quantum Mechanics
PHYSICS 751	Advanced Solid State Physics
PHYSICS 801	Special Topics in Theoretical Physics (when taught as Nanostructures in Science and Technology)