

ENGINEERING MECHANICS: AEROSPACE ENGINEERING, MS

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.

NAMED OPTION REQUIREMENTS

MODE OF INSTRUCTION

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

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	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	No formal examination required.
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Language Requirements	No language requirements.
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REQUIRED COURSES

This program requires a minimum of 30 credits, inclusive of the requirements in the course list below. Within the 30 credits, at least 27 credits must be formal credits. The remaining 3 credits may be formal credits or may be earned through co-op or independent study credits. (Formal credits are course offerings that are not seminar courses, thesis research courses, co-op/internship, or independent study courses.)

Code	Title	Credits
Graduate Seminar		
Two semesters of M E 903, successfully completed, are required. These should be taken during the first two semesters (Fall and Spring).		0
M E 903	Graduate Seminar	
M E 903	Graduate Seminar	
Engineering Analysis Course		
Select one:		3
E M A/E P 547	Engineering Analysis I	
or E M A/E P 548	Engineering Analysis II	
Formal course numbered 700 and above		
Students must take at least one formal course (3 credits) in any Engineering Mechanics and Aerospace Engineering (E M A) course numbered 700 or greater. ^{1,2}		3
Depth Requirement (Topical Areas)		
Students must complete at least two of the five topical areas below. To establish sufficient depth in aerospace sciences, the courses selected must involve completion of at least two of the five topical areas. Students should check the future course offerings plans when choosing, since not all courses are offered every year (and hence not all topical areas can be completed every year).		12
Additional Courses		
The additional courses required to meet the 30-credits minimum for completion of the degree must be selected from among the courses listed in the topical areas or elective course lists below. ³		12
Total Credits		30

¹ Formal courses/credits are course offerings that are not seminar courses, thesis research courses, co-op/internship, or independent study courses.

² Seminar, research, and co-op/independent courses (such as E M A 790 (<https://guide.wisc.edu/search/?P=E%20M%20A%20790>) Master's Research and Thesis, E M A 890 (<https://guide.wisc.edu/search/?P=E%20M%20A%20890>) Pre-Dissertator Research, E M A 990 (<https://guide.wisc.edu/search/?P=E%20M%20A%20990>) Research and Thesis, E M A 599 Independent Study and E M A 702 (<https://guide.wisc.edu/search/?P=E%20M%20A%20702>) Graduate Cooperative Education Program) are not eligible to satisfy this requirement.

³ With faculty advisor approval, a combined maximum of 3 credits may be satisfied through co-op/internship or independent study credits.

TOPICAL AREAS

Fluid and Thermal Sciences ¹

Code	Title	Credits
E M A 521	Aerodynamics ²	3
Select one:		3
E M A 524	Rocket Propulsion	
M E 471	Gas Turbine and Jet Propulsion	
M E 561	Intermediate Thermodynamics	
M E 563	Intermediate Fluid Dynamics	
M E 564	Heat Transfer	
M E 572	Intermediate Gas Dynamics	
M E 761	Topics in Thermodynamics	
M E 764	Advanced Heat Transfer I- Conduction	
M E 768	Precision Measurements	
M E 769	Combustion Processes	
M E/CIV ENGR/ E M A 775	Turbulent Heat and Momentum Transfer	

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.

² If you have already completed an equivalent course as an undergrad then you may take two courses total from the second list and meet this requirement.

Rigid Body Dynamics ¹

Code	Title	Credits
E M A 542	Advanced Dynamics ²	3
Select one:		3
E M A 523	Flight Dynamics and Control	
E M A/ ASTRON 550	Astrodynamic	
E M A 642	Satellite Dynamics	
M E 451	Kinematics and Dynamics of Machine Systems	
M E 746	Dynamics of Controlled Systems	
or M E/ E C E 732	Dynamics of Controlled Systems	
M E 751	Advanced Computational Dynamics	

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do not appear in the Graduate School admissions application, and they will not appear on the transcript.

² If you have already completed an equivalent course as an undergrad then you may take two courses total from the second list and meet this requirement.

Structural Dynamics ¹

Code	Title	Credits
Select one: ²		3
M E 440	Intermediate Vibrations	
E M A 545	Mechanical Vibrations	
E C E 717	Linear Systems	
Select one:		3
M E/E M A 540	Experimental Vibration and Dynamic System Analysis	
E M A 610	Structural Finite Element Model Validation	
E M A 747	Nonlinear and Random Mechanical Vibrations	
M E 740	Advanced Vibrations	

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² If you have already completed an equivalent course as an undergrad then you may take two courses total from the second list and meet this requirement.

Aerospace Mechanics and Materials ¹

Code	Title	Credits
Select two courses:		6
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 630	Viscoelastic Solids	
E M A 700	Theory of Elasticity	
E M A/M E 703	Plasticity Theory and Physics	
E M A 710	Mechanics of Continua	

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Computation ¹

Code	Title	Credits
Select one: ²		3
E M A 605	Introduction to Finite Elements	
M E 573	Computational Fluid Dynamics	
Select one:		3
E M A/E P 548	Engineering Analysis II	
E M A 605	Introduction to Finite Elements	

E M A 705	Advanced Topics in Finite Elements
M E/COMP SCI/ E C E 532	Matrix Methods in Machine Learning
M E/COMP SCI/ E C E 539	Introduction to Artificial Neural Networks
M E 548	Introduction to Design Optimization
M E 748	Optimum Design of Mechanical Elements and Systems
M E 573	Computational Fluid Dynamics
M E/COMP SCI/ E C E/E M A/ E P 759	High Performance Computing for Applications in Engineering
MATH/ COMP SCI 513	Numerical Linear Algebra
MATH/ COMP SCI 514	Numerical Analysis
MATH/ COMP SCI 714	Methods of Computational Mathematics I

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² If you have already completed an equivalent course as an undergrad then you may take two courses total from the second list and meet this requirement.

ELECTIVE COURSE OFFERINGS

Fall Elective Course Offerings

Code	Title	Credits
E C E 717	Linear Systems	3
E M A 506	Advanced Mechanics of Materials I	3
E M A 521	Aerodynamics	3
E M A 524	Rocket Propulsion	3
E M A/MS & E 541	Heterogeneous and Multiphase Materials	3
E M A 605	Introduction to Finite Elements	3
E M A/M E 703	Plasticity Theory and Physics	3
E P/E M A 547	Engineering Analysis I	3
M E 440	Intermediate Vibrations	3
M E/E M A 540	Experimental Vibration and Dynamic System Analysis	3
M E/E M A 570	Experimental Mechanics	3
M E 573	Computational Fluid Dynamics	3
E M A 599	Independent Study	1-3
E M A 702	Graduate Cooperative Education Program	1-2

Spring Elective Course Offerings

Code	Title	Credits
E M A 522	Aerodynamics Lab	3
E M A 523	Flight Dynamics and Control	3
E M A/ASTRON 550	Astro dynamics	3
E M A/M E 570	Experimental Mechanics	3
E M A 610	Structural Finite Element Model Validation	3

E M A 611	Advanced Mechanical Testing of Materials	3
E M A 630	Viscoelastic Solids	3
E M A 642	Satellite Dynamics	3
E M A 705	Advanced Topics in Finite Elements	3
E M A 710	Mechanics of Continua	3
E M A 747	Nonlinear and Random Mechanical Vibrations	3
M E 563	Intermediate Fluid Dynamics	3
M E 569	Applied Combustion	3
M E 572	Intermediate Gas Dynamics	3
M E 769	Combustion Processes	3
M E/CIV ENGR/ E M A 775	Turbulent Heat and Momentum Transfer	3
E M A 599	Independent Study	1-3
E M A 702	Graduate Cooperative Education Program	1-2

Fall/Spring Elective Course Offerings (offering varies)

Code	Title	Credits
E M A 700	Theory of Elasticity	3
MATH 705	Mathematical Fluid Dynamics	3
M E/N E 520	Two-Phase Flow and Heat Transfer	3
M E 561	Intermediate Thermodynamics	3
M E 564	Heat Transfer	3
M E 761	Topics in Thermodynamics	3
M E 764	Advanced Heat Transfer I- Conduction	3
M E 770	Advanced Experimental Instrumentation	3
M E 774	Chem Kinetics of Combust Systems	3

Other Policy

Students in this program may not take courses outside the prescribed curriculum without faculty advisor and program director approval. Students in this program cannot enroll concurrently in other undergraduate or graduate degree programs.