

# ENGINEERING MECHANICS: AEROSPACE ENGINEERING, 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	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

Minimum Credit Requirement

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.

Language Requirements No language requirements.

### REQUIRED COURSES

Code	Title	Credits
<b>Engineering Analysis Course</b>		<b>3</b>
E M A/E P 547 or E M A/ E P 548	Engineering Analysis I Engineering Analysis II	
<b>Technical Elective: may be fulfilled through any of the following options</b>		<b>3</b>
E M A 601	Special Topics in Engineering Mechanics (Topic: Mechanics Seminar) <sup>1</sup>	
E P 468	Introduction to Engineering Research (Graduate Student Section ONLY)	
E M A 599	Independent Study	
M E 699	Advanced Independent Study	
<b>Courses numbered 700 and above</b>		<b>3</b>
Students must take at least one course (3 credits) in E M A in any course numbered 700 or greater. <sup>2</sup>		
<b>Depth Requirement (Topical Areas)</b>		<b>12</b>
Students must complete at least two of the five topical areas below. <sup>3</sup>		
<b>Remaining Courses</b>		<b>9</b>
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.		
<b>Total Credits</b>		<b>30</b>

<sup>1</sup> E M A 601 Special Topics in Engineering Mechanics: Mechanics Seminar may be taken twice (total of 2 credits) for this degree. It is offered in the Fall and Spring terms only.

<sup>2</sup> Seminar, research, and co-op 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, 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.

<sup>3</sup> To establish sufficient depth in aerospace sciences, the courses selected must involve completion of at least two of the following five topical areas. You 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).

## TOPICAL AREAS

### Fluid and Thermal Sciences<sup>1</sup>

Code	Title	Credits
E M A 521	Aerodynamics <sup>2</sup>	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 769	Combustion Processes	
M E/CIV ENGR/ E M A 775	Turbulent Heat and Momentum Transfer	

<sup>1</sup> 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.

<sup>2</sup> 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<sup>1</sup>

Code	Title	Credits
E M A 542	Advanced Dynamics <sup>2</sup>	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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<sup>2</sup> 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<sup>1</sup>

Code	Title	Credits
Select one: <sup>2</sup>		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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<sup>2</sup> 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<sup>1</sup>

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/M E 706	Plates, Shells and Pressure Vessels	
E M A 710	Mechanics of Continua	

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### Computation<sup>1</sup>

Code	Title	Credits
Select one: <sup>2</sup>		3
E M A 605	Introduction to Finite Elements	
M E 573	Computational Fluid Dynamics	
Select one:		3
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/COMP SCI/ I SY E 558	Introduction to Computational Geometry	
M E 748	Optimum Design of Mechanical Elements and Systems	

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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<sup>2</sup> 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.

### 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/M S & 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

### 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	Astrodynamics	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
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### 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.