

# ENGINEERING MECHANICS, BS

for the degree of Bachelor of Science in Engineering Mechanics

**department website:** <http://mechse.illinois.edu/>  
**department faculty:** Mechanical Science & Engineering Faculty  
 (<https://mechse.illinois.edu/people>)  
**overview of college admissions & requirements:** The Grainger  
 College of Engineering (<https://grainger.illinois.edu/admissions>)  
**college website:** <https://grainger.illinois.edu/>

Engineering mechanics is a discipline devoted to the solution of engineering and mechanics problems through integrated application of mathematical, scientific, and engineering principles. Special emphasis is placed on the physical principles underlying modern engineering design.

In this program (accredited by the Engineering Accreditation Commission of ABET, [www.abet.org](http://www.abet.org)), students in engineering mechanics develop a strong foundation in mathematics, physics, and chemistry. The program derives its strength from a rigorous curriculum composed of statics, dynamics, solid mechanics, fluid mechanics, and mechanics of materials courses. These topics form the basis of all engineering disciplines and have wide applicability in modern engineering. Special emphasis is placed on advanced dynamics, continuum mechanics, and the rapidly emerging field of computational mechanics. Laboratory experiments in fluid mechanics and mechanics of materials complement an integrated design sequence, which starts freshman year. Engineering design, communication, teamwork, and laboratory experiences are integrated throughout the entire curriculum. Students also have the opportunity for independent, creative work in a one-on-one or small group environment under the supervision of a faculty member.

Students in engineering mechanics also benefit from a built-in area of specialization in one of seven secondary fields within mechanics, such as biomechanics, experimental mechanics, mechanics of materials and more. Alternatively, students may fashion their own area of specialization with departmental approval. At the end of the curriculum, students take the capstone senior design course where the knowledge and skills they have learned are applied to projects submitted to the department by corporate or faculty sponsors, preparing Engineering Mechanics students for their next leap into industry or graduate school.

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## Overview of Curricular Requirements

The curriculum requires 128 hours for graduation and is organized as shown below.

Technical grade point average requirements for graduation and advanced-level course registration apply to students in this curriculum. These rules are summarized at the College of Engineering's (<https://wiki.illinois.edu/wiki/display/ugadvise/Degree+Requirements/#DegreeRequirements-TechnicalGPARequirement>) Undergraduate Advising Website (<https://wiki.cites.illinois.edu/wiki/display/ugadvise/Technical+GPA+Requirements?src=search>).

## Orientation and Professional Development

These courses introduce the opportunities and resources your college, department, and curriculum can offer you as you work to achieve your career goals. They also provide the skills to work effectively and successfully in the engineering profession.

Code	Title	Hours
ENG 100	Engineering Orientation <sup>1</sup>	0
TAM 195	Mechanics in the Modern World	1
ME 290	Seminar	0
Total Hours		1

<sup>1</sup> External transfer students take ENG 300 instead.

## Foundational Mathematics and Science

These courses stress the basic mathematical and scientific principles upon which the engineering discipline is based.

Code	Title	Hours
CHEM 102	General Chemistry I	3
CHEM 103	General Chemistry Lab I	1
CHEM 104	General Chemistry II	3
CHEM 105	General Chemistry Lab II	1
MATH 221	Calculus I <sup>1</sup>	4
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 415	Applied Linear Algebra	3
MATH 441	Differential Equations	3
MATH 442	Intro Partial Diff Equations	3
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
PHYS 213	Univ Physics: Thermal Physics	2
PHYS 214	Univ Physics: Quantum Physics	2
Total Hours		40

<sup>1</sup> MATH 220 may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.

## Engineering Mechanics Technical Core

These courses stress fundamental concepts and basic laboratory techniques that comprise the common intellectual understanding of engineering mechanics.

Code	Title	Hours
CS 101	Intro Computing: Engrg & Sci	3
ECE 205	Electrical and Electronic Circuits	3
ME 170	Computer-Aided Design	3
ME 200	Thermodynamics	3
ME 470	Senior Design Project	3
TAM 211	Statics	3
TAM 212	Introductory Dynamics	3
TAM 251	Introductory Solid Mechanics	3
TAM 252	Solid Mechanics Design	1
TAM 270	Design for Manufacturability	3
TAM 324	Behavior of Materials	4

TAM 335	Introductory Fluid Mechanics	4
TAM 412	Intermediate Dynamics	4
TAM 445	Continuum Mechanics	4
TAM 470	Computational Mechanics	3
Total Hours		47

## Secondary Field Option Electives

This component of the curriculum enables the student to specialize further by electing a secondary field, a coherent group of technical courses in mechanics and closely related subjects. The current secondary fields are:

- Biomechanics
- Computational Mechanics
- Engineering Science and Applied Mathematics
- Experimental Mechanics
- Fluid Mechanics
- Mechanics of Materials
- Solid Mechanics

Each secondary field generally specifies two required courses and two additional courses from a list of approved elective courses. For each of the secondary fields, the required and approved elective courses specified for each are listed below. To add flexibility to the program and to accommodate particular interests, the student may petition to substitute appropriate courses, including 500-level courses if the student has the adequate preparation, for any of the secondary field elective courses. Without petition, a student may select any one course listed as required in one of the secondary field options to satisfy elective course credits in a chosen secondary field.

Code	Title	Hours
<b>Secondary field electives selected from departmentally approved courses for Secondary Field Options.</b>		12
<b>Biomechanics</b>		
Required Courses		
MCB 150	Molec & Cellular Basis of Life	4
MCB 151	Molec & Cellular Laboratory	1
TAM 461	Cellular Biomechanics	4
Approved Courses		
ECE 473	Fund of Engrg Acoustics	3 or 4
ECE 380	Biomedical Imaging	3
ME 481	Whole-Body Musculoskel Biomech	3 or 4
ME 482	Musculoskel Tissue Mechanics	3 or 4
ME 483	Mechanobiology	4
BIOP 401	Introduction to Biophysics	3
TAM 499	Senior Thesis	3
<b>Computational Mechanics</b>		
Required Courses		
CS 357	Numerical Methods I	3
ME 471	Finite Element Analysis	3 or 4
Approved Courses		
CS 450	Numerical Analysis	3 or 4
CS 457	Numerical Methods II	3
ME 412	Numerical Thermo-Fluid Mechs	2 to 4
TAM 499	Senior Thesis	3

<b>Engineering Science and Applied Mathematics</b>		
Required Courses		
MATH 446	Applied Complex Variables	3 or 4
MATH 448	Complex Variables (Or Any 400 level MATH course, excluding MATH 415, MATH 441, and MATH 442)	3 or 4
Approved Courses		
AE 353	Aerospace Control Systems	3
AE 402	Orbital Mechanics	3 or 4
CEE 491	Decision and Risk Analysis	3 or 4
ECE 329	Fields and Waves I	3
ECE 330	Power Ckts & Electromechanics	3
ECE 473	Fund of Engrg Acoustics	3 or 4
MATH 423	Differential Geometry	3 or 4
MATH 447	Real Variables	3 or 4
MATH 482	Linear Programming	3 or 4
MATH 484	Nonlinear Programming	3 or 4
MATH 489	Dynamics & Differential Eqns	3 or 4
MATH 490	Advanced Topics in Mathematics	1 to 4
PHYS 402	Light	3 or 4
STAT 400	Statistics and Probability I	4
STAT 410	Statistics and Probability II	3 or 4
TAM 499	Senior Thesis	3

## Experimental Mechanics

Required Courses		
TAM 456	Experimental Stress Analysis	3
ECE 206	Electrical and Electronic Circuits Lab	1
Approved Courses		
CS 357	Numerical Methods I	3
ECE 473	Fund of Engrg Acoustics	3 or 4
ME 360	Signal Processing	3.5
PHYS 402	Light	3 or 4
TAM 499	Senior Thesis	3

## Fluid Mechanics

Required Courses		
TAM 435	Intermediate Fluid Mechanics	4
ME 410	Intermediate Gas Dynamics	3 or 4
Approved Courses		
AE 412	Viscous Flow & Heat Transfer	4
CEE 445	Air Quality Modeling	4
CEE 451	Environmental Fluid Mechanics	3
CEE 453	Urban Hydrology and Hydraulics	4
ECE 473	Fund of Engrg Acoustics	3 or 4
ME 412	Numerical Thermo-Fluid Mechs	2 to 4
TAM 499	Senior Thesis	3

## Mechanics of Materials

Required Courses		
TAM 424	Mechanics of Structural Metals	3 or 4
TAM 427	Mechanics of Polymers	3
TAM 428	Mechanics of Composites	3
Approved Courses		
CEE 310	Transportation Engineering	3

MSE 401	Thermodynamics of Materials	3
MSE 489	Matl Select for Sustainability	3 or 4
NPRE 431	Materials in Nuclear Engrg	3
TAM 499	Senior Thesis	3

### Solid Mechanics

#### Required Courses

TAM 424	Mechanics of Structural Metals	3 or 4
TAM 451	Intermediate Solid Mechanics	4

#### Approved Courses

CEE 360	Structural Engineering	3
CEE 460	Steel Structures I	3
CEE 461	Reinforced Concrete I	3
CS 357	Numerical Methods I	3
ECE 473	Fund of Engrg Acoustics	3 or 4
TAM 499	Senior Thesis	3

## Liberal Education

The liberal education courses (<https://wiki.cites.illinois.edu/wiki/display/ugadvice/Liberal+Education+Electives?src=search>) develop students' understanding of human culture and society, build skills of inquiry and critical thinking, and lay a foundation for civic engagement and lifelong learning.

Code	Title	Hours
	Electives from the campus General Education Social and Behavioral Sciences list.	6
	Electives from the campus General Education Humanities and the Arts list.	6
	Electives either from a list approved by the college, or from the campus General Education lists for Social and Behavioral Sciences or Humanities and the Arts.	6
Total Hours		18

Students entering after the Spring 2018 semester must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course, (ii) one non-western course and (iii) one U.S. minority culture(s) course from the General Education cultural studies lists. Students entering prior to the Spring 2018 semester will need to complete requirements (i) and either (ii) or (iii). Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western, non-western and U.S. minority culture(s) lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.

## Composition

These courses teach fundamentals of expository writing.

Code	Title	Hours
RHET 105	Writing and Research	4
Advanced Composition (satisfied by completing TAM 324 and ME 470 in the Engineering Mechanics Technical Core)		
Total Hours		4

## Free Electives

These unrestricted electives, subject to certain exceptions as noted at the College of Engineering Advising Website (<https://wiki.illinois.edu/wiki/display/ugadvice/Degree+Requirements/#DegreeRequirements-FreeElectives>), give the student the opportunity to explore any intellectual

area of unique interest. This freedom plays a critical role in helping students to define research specialties or to complete minors.

Code	Title	Hours
	Free electives. Additional unrestricted course work, subject to certain exceptions as noted at the College of Engineering Advising Website, so that there are at least 128 credit hours earned toward the degree.	6

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## Suggested Sequence

The schedule that follows is illustrative, showing the typical sequence in which courses would be taken by a student with no college course credit already earned and who intends to graduate in four years. Each individual's case may vary, but the position of required named courses is generally indicative of the order in which they should be taken.

### First Year

First Semester	Hours
TAM 195 Mechanics in the Modern World	1
MATH 221 Calculus I	4
CHEM 102 General Chemistry I	3
CHEM 103 General Chemistry Lab I	1
ENG 100 Engineering Orientation	0
RHET 105 Writing and Research or ME 170 <sup>2</sup>	4-3
Liberal education elective <sup>3</sup>	3
Semester Hours	
	16-15

### Second Semester

PHYS 211 University Physics: Mechanics	4
MATH 231 Calculus II	3
CHEM 104 General Chemistry II	3
CHEM 105 General Chemistry Lab II	1
ME 170 Computer-Aided Design or RHET 105 <sup>2</sup>	3-4
Liberal education elective <sup>3</sup>	3
Semester Hours	
	17-18

### Second Year

#### First Semester

PHYS 212 University Physics: Elec Mag	4
MATH 241 Calculus III	4
CS 101 Intro Computing: Engrg Sci	3
TAM 211 Statics	3
ME 290 Seminar	0
Liberal education elective <sup>3</sup>	3
Semester Hours	
	17

#### Second Semester

PHYS 213 Univ Physics: Thermal Physics	2
PHYS 214 Univ Physics: Quantum Physics	2
TAM 212 Introductory Dynamics	3
TAM 251 Introductory Solid Mechanics	3
TAM 252 Solid Mechanics Design	1

ECE 205 Electrical and Electronic Circuits	3
Liberal education elective <sup>3</sup>	3
<b>Semester Hours</b>	<b>17</b>

<sup>4</sup> Selected from departmentally approved lists of Secondary Field Electives (<http://mechanical.illinois.edu/undergraduate/bs-engineering-mechanics/#EMSecondaryFields>).

**Third Year****First Semester**

ME 200 Thermodynamics	3
MATH 415 Applied Linear Algebra	3
ME 270 Design for Manufacturability	3
TAM 335 Introductory Fluid Mechanics	3
Free Elective	3
<b>Semester Hours</b>	<b>15</b>

**Second Semester**

TAM 324 Behavior of Materials	4
MATH 441 Differential Equations	3 or 4
TAM 412 Intermediate Dynamics	4
TAM 445 Continuum Mechanics	4
<b>Semester Hours</b>	<b>15-16</b>

**Fourth Year****First Semester**

ME 470 or Senior Design Project Secondary field elective <sup>4</sup>	3
MATH 442 Intro Partial Diff Equations	3 or 4
TAM 470 Computational Mechanics	3
Secondary field elective <sup>4</sup>	3
Liberal education elective <sup>3</sup>	3
<b>Semester Hours</b>	<b>15-16</b>

**Second Semester**

ME 470 or Senior Design Project Secondary field elective <sup>4</sup>	3
Secondary field elective <sup>4</sup>	6
Liberal education elective <sup>3</sup>	3
Free elective	3
<b>Semester Hours</b>	<b>15</b>

**Total Hours:** 127-129

<sup>1</sup> MATH 220 may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.

<sup>2</sup> RHET 105 may be taken in the first or second semester of the first year as authorized. The alternative is ME 170.

<sup>3</sup> Liberal education electives (<https://wiki.illinois.edu/wiki/display/ugadvise/Degree+Requirements/#DegreeRequirements-LiberalEducationElectives>) must include 6 hours of social & behavioral sciences and 6 hours of humanities & the arts course work from the campus General Education lists. The remaining 6 hours may be selected from a list maintained by the college, or additional course work from the campus General Education lists for social & behavioral sciences or humanities & the arts. Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course, (ii) one non-western culture(s) course, and (iii) one U.S. Minority Culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western, non-western, and U.S. Minority lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.