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/faculty/)
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), 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. The seven pre-approved secondary fields are:

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

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.

For the degree of Bachelor of Science in Engineering Mechanics

Graduation Requirements
Minimum Technical GPA (https://wiki.illinois.edu/wiki/display/ugadvise/Degree+Requirements/#DegreeRequirements-TechnicalGPARequirement): 2.0
T GPA is required for required Engineering courses and any technical elective courses. See Technical GPA (https://wiki.illinois.edu/wiki/display/ugadvise/Degree+Requirements/#DegreeRequirements-TechnicalGPARequirement) to clarify requirements.

Minimum Overall GPA: 2.0
Minimum hours required for graduation: 128 hours

General education: Students must complete the Campus General Education (https://courses.illinois.edu/gened/DEFAULT/DEFAULT/) requirements including the campus general education language requirement. Specific Advanced Composition courses required for this degree are listed below.

Orientation and Professional Development

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ENG 100</td>
<td>Engineering Orientation</td>
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<tr>
<td>TAM 195</td>
<td>Mechanics in the Modern World</td>
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<tr>
<td>ME 290</td>
<td>Seminar</td>
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Foundational Mathematics and Science

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

<table>
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<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>CS 101</td>
<td>Intro Computing: Engrg &amp; Sci</td>
<td>3</td>
</tr>
<tr>
<td>ECE 205</td>
<td>Electrical and Electronic Circuits</td>
<td>3</td>
</tr>
<tr>
<td>ME 170</td>
<td>Computer-Aided Design</td>
<td>3</td>
</tr>
<tr>
<td>ME 200</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 470</td>
<td>Senior Design Project</td>
<td>3</td>
</tr>
<tr>
<td>TAM 211</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>TAM 212</td>
<td>Introductory Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>TAM 251</td>
<td>Introductory Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>TAM 252</td>
<td>Solid Mechanics Design</td>
<td>1</td>
</tr>
<tr>
<td>TAM 270</td>
<td>Design for Manufacturability</td>
<td>3</td>
</tr>
<tr>
<td>TAM 324</td>
<td>Behavior of Materials</td>
<td>4</td>
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Information listed in this catalog is current as of 02/2021
Secondary Field Option Electives

<table>
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<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>TAM 335</td>
<td>Introductory Fluid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>TAM 412</td>
<td>Intermediate Dynamics</td>
<td>4</td>
</tr>
<tr>
<td>TAM 445</td>
<td>Continuum Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>TAM 470</td>
<td>Computational Mechanics</td>
<td>3</td>
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<tr>
<td>Total Hours</td>
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<td>47</td>
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</table>

Secondary field electives selected from departmentally approved courses for Secondary Field Options. 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 fashion an individualized secondary field option. The only requirements are that the courses be related to mechanics, form a coherent and cohesive group, include at least two engineering courses, and total at least 12 hours of advanced-level coursework that are distinct from required courses in the Engineering Mechanics curriculum. This can include 500-level courses, if the student has the adequate preparation, for any of the secondary field elective courses. Each student must formally declare their choice of secondary field with a Mechanical Science and Engineering Undergraduate Programs Office advisor using a Secondary Field Options form.

Biomechanics

- **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

Computational Mechanics

- **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

Engineering Science and Applied Mathematics

- **Required Courses**
  - MATH 446 Applied Complex Variables 3-4
  - or MATH 442 Complex Variables

  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 Cchts & 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
- or 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
- NP RE 431 Materials in Nuclear Engrg 3
- TAM 499 Senior Thesis 3

Solid Mechanics

**Required Courses**

Information listed in this catalog is current as of 02/2021
Electives

Total Hours of Curriculum to Graduate

128 credit hours earned toward the degree.
certain exceptions as noted by the College, so that there are
Free electives. Additional unrestricted course work, subject to
Arts lists for Social and Behavioral Sciences or Humanities and the
list, or additional courses from the campus General Education
The Grainger College of Engineering Liberal Education course
Code
TAM 499  Senior Thesis

Approved Courses
CEE 360  Structural Engineering
CEE 460  Steel Structures I
CEE 461  Reinforced Concrete I
CS 357  Numerical Methods I
ECE 473  Fund of Engrg Acoustics

Electives
Code
TAM 424  Mechanics of Structural Metals
TAM 451  Intermediate Solid Mechanics
CEE 360  Structural Engineering
CEE 460  Steel Structures I
CEE 461  Reinforced Concrete I
CS 357  Numerical Methods I
ECE 473  Fund of Engrg Acoustics
TAM 499  Senior Thesis

Suggested Sequence

The curriculum sequence below is a suggested sequence, as all Grainger Engineering students work with a department academic advisor to achieve their educational goals, specific to their needs and preparation. Dynamic and Static curricular maps, which include prerequisite sequencing, can be found here (https://grainger.illinois.edu/academics/undergraduate/majors-and-minors/engineering-mechanics-map/).

First Year

First Semester
TAM 195  Mechanics in the Modern World
ENG 100  Engineering Orientation
MATH 221  Calculus I
CHEM 102  General Chemistry I
CHEM 103  General Chemistry Lab I
RHET 105  Writing and Research
or ME 170
General education elective
Semester Hours 16

Second Semester
MATH 231  Calculus II
CHEM 104  General Chemistry II
CHEM 105  General Chemistry Lab II
PHYS 211  University Physics: Mechanics
ME 170  Computer-Aided Design
or RHET 105
General education elective
Semester Hours 17

Second Year

First Semester
PHYS 212  University Physics: Elec Mag
MATH 241  Calculus III
CS 101  Intro Computing: Engrg Sci
TAM 211  Statics
ME 290  Seminar
General education elective
Semester Hours 17

Second Semester
PHYS 213  Univ Physics: Thermal Physics
PHYS 214  Univ Physics: Quantum Physics
TAM 212  Introductory Dynamics
TAM 251  Introductory Solid Mechanics
TAM 252  Solid Mechanics Design
ECE 205  Electrical and Electronic Circuits
General education elective
Semester Hours 17

Third Year

First Semester

Information listed in this catalog is current as of 02/2021
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ME 200</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 415</td>
<td>Applied Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>TAM 335</td>
<td>Introductory Fluid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>TAM 270</td>
<td>Design for Manufacturability</td>
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**Second Semester**

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<tr>
<td>TAM 324</td>
<td>Behavior of Materials</td>
<td>4</td>
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<tr>
<td>MATH 441</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>TAM 412</td>
<td>Intermediate Dynamics</td>
<td>4</td>
</tr>
<tr>
<td>TAM 445</td>
<td>Continuum Mechanics</td>
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**Fourth Year**

**First Semester**

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<tbody>
<tr>
<td>ME 470</td>
<td>Senior Design Project (or Secondary field elective)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 442</td>
<td>Intro Partial Diff Equations</td>
<td>3</td>
</tr>
<tr>
<td>TAM 470</td>
<td>Computational Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Secondary field elective</td>
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<tr>
<td>General education elective</td>
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**Second Semester**

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<th>Course Code</th>
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<td>Secondary Field Elective (or ME 470)</td>
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<td>General education elective</td>
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<td>Total Hours:</td>
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1. 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.

2. RHET 105 (or an alternative Composition I sequence) is taken either in the first or second semester of the first year, according to the student’s UIN (Spring if your UIN is Odd). ME 170 is taken the other semester. Composition I guidelines can be found at http://catalog.illinois.edu/general-information/degree-general-education-requirements/under Written Communication Requirement.

3. Students must take 6 hours from the campus General Education Social and Behavioral Sciences list, 6 hours from campus General Education Humanities and the Arts list, and 6 hours from a liberal education list approved by the college or from the campus General Education lists for Social and Behavioral Sciences or Humanities and 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 general education courses that simultaneously satisfy these cultural studies requirements.

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