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), 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

TTPA 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

<table>
<thead>
<tr>
<th>Code</th>
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<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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<td>ME 290</td>
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Foundational Mathematics and Science

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<tr>
<td>CHEM 102</td>
<td>General Chemistry I</td>
<td>3</td>
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<tr>
<td>CHEM 103</td>
<td>General Chemistry Lab I</td>
<td>1</td>
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<tr>
<td>CHEM 104</td>
<td>General Chemistry II</td>
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<tr>
<td>CHEM 105</td>
<td>General Chemistry Lab II</td>
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<tr>
<td>MATH 221</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
<td>MATH 231</td>
<td>Calculus II</td>
<td>3</td>
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<tr>
<td>MATH 241</td>
<td>Calculus III</td>
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<tr>
<td>MATH 415</td>
<td>Applied Linear Algebra</td>
<td>3</td>
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<tr>
<td>MATH 441</td>
<td>Differential Equations</td>
<td>3</td>
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<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>
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<tr>
<td>PHYS 213</td>
<td>Univ Physics: Thermal Physics</td>
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<tr>
<td>PHYS 214</td>
<td>Univ Physics: Quantum Physics</td>
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Engineering Mechanics Technical Core

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<tbody>
<tr>
<td>CS 101</td>
<td>Intro Computing: Engrg &amp; Sci</td>
<td>3</td>
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<td>ECE 205</td>
<td>Electrical and Electronic Circuits</td>
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<td>ME 170</td>
<td>Computer-Aided Design</td>
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<td>ME 200</td>
<td>Thermodynamics</td>
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<td>ME 470</td>
<td>Senior Design Project</td>
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<td>TAM 211</td>
<td>Statics</td>
<td>3</td>
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<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>
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<td>TAM 252</td>
<td>Solid Mechanics Design</td>
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<tr>
<td>TAM 270</td>
<td>Design for Manufacturability</td>
<td>3</td>
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<tr>
<td>TAM 324</td>
<td>Behavior of Materials</td>
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Information listed in this catalog is current as of 08/2020
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<thead>
<tr>
<th>Code</th>
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<th>Hours</th>
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<tr>
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<td>Introductory Fluid Mechanics</td>
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<td>TAM 412</td>
<td>Intermediate Dynamics</td>
<td>4</td>
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<td>TAM 445</td>
<td>Continuum Mechanics</td>
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<td>TAM 470</td>
<td>Computational Mechanics</td>
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### Secondary Field Option Electives

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<tr>
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<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td></td>
<td><strong>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.</strong></td>
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#### Biomechanics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>MCB 150</td>
<td>Molec &amp; Cellular Basis of Life</td>
<td>4</td>
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<tr>
<td>MCB 151</td>
<td>Molec &amp; Cellular Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>TAM 461</td>
<td>Cellular Biomechanics</td>
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#### Computational Mechanics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CS 357</td>
<td>Numerical Methods I</td>
<td>3</td>
</tr>
<tr>
<td>ME 471</td>
<td>Finite Element Analysis</td>
<td>3 or 4</td>
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#### Engineering Science and Applied Mathematics

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>MATH 446</td>
<td>Applied Complex Variables</td>
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Any 400 level MATH course, excluding MATH 415, MATH 441, and MATH 442.

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tr>
<td></td>
<td><strong>Approved Courses</strong></td>
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<tr>
<td>AE 353</td>
<td>Aerospace Control Systems</td>
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<td>AE 402</td>
<td>Orbital Mechanics</td>
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<tr>
<td>CEE 491</td>
<td>Decision and Risk Analysis</td>
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<tr>
<td>ECE 329</td>
<td>Fields and Waves I</td>
<td>3</td>
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<tr>
<td>ECE 330</td>
<td>Power Ckts &amp; Electromechanics</td>
<td>3</td>
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<tr>
<td>ECE 473</td>
<td>Fund of Engrg Acoustics</td>
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<tr>
<td>MATH 423</td>
<td>Differential Geometry</td>
<td>3 or 4</td>
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<tr>
<td>MATH 447</td>
<td>Real Variables</td>
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<tr>
<td>MATH 482</td>
<td>Linear Programming</td>
<td>3 or 4</td>
</tr>
<tr>
<td>MATH 484</td>
<td>Nonlinear Programming</td>
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<tr>
<td>MATH 489</td>
<td>Dynamics &amp; Differential Eqs</td>
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<tr>
<td>MATH 490</td>
<td>Advanced Topics in Mathematics</td>
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<tr>
<td>PHYS 402</td>
<td>Light</td>
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<tr>
<td>STAT 400</td>
<td>Statistics and Probability I</td>
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<tr>
<td>STAT 410</td>
<td>Statistics and Probability II</td>
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<td>TAM 499</td>
<td>Senior Thesis</td>
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#### Experimental Mechanics

<table>
<thead>
<tr>
<th>Code</th>
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<tr>
<td>TAM 456</td>
<td>Experimental Stress Analysis</td>
<td>3</td>
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<tr>
<td>ECE 206</td>
<td>Electrical and Electronic Circuits Lab</td>
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#### Fluid Mechanics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>AE 412</td>
<td>Viscous Flow &amp; Heat Transfer</td>
<td>4</td>
</tr>
<tr>
<td>CEE 445</td>
<td>Air Quality Modeling</td>
<td>4</td>
</tr>
<tr>
<td>CEE 451</td>
<td>Environmental Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>CEE 453</td>
<td>Urban Hydrology and Hydraulics</td>
<td>4</td>
</tr>
<tr>
<td>ECE 473</td>
<td>Fund of Engrg Acoustics</td>
<td>3 or 4</td>
</tr>
<tr>
<td>ME 412</td>
<td>Numerical Thermo-Fluid Mechs</td>
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#### Mechanics of Materials

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>TAM 424</td>
<td>Mechanics of Structural Metals</td>
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<tr>
<td>TAM 427</td>
<td>Mechanics of Polymers</td>
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<tr>
<td>or TAM 428 Mechanics of Composites</td>
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### Information listed in this catalog is current as of 08/2020
### Electives

<table>
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<tr>
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<th>Hours</th>
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<tr>
<td>TAM 424</td>
<td>Mechanics of Structural Metals</td>
<td>3 or 4</td>
</tr>
<tr>
<td>TAM 451</td>
<td>Intermediate Solid Mechanics</td>
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#### Approved Courses

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<tr>
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<th>Hours</th>
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<tbody>
<tr>
<td>CEE 360</td>
<td>Structural Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEE 460</td>
<td>Steel Structures I</td>
<td>3</td>
</tr>
<tr>
<td>CEE 461</td>
<td>Reinforced Concrete I</td>
<td>3</td>
</tr>
<tr>
<td>CS 357</td>
<td>Numerical Methods I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 473</td>
<td>Fund of Engr Acoustics</td>
<td>3 or 4</td>
</tr>
<tr>
<td>TAM 499</td>
<td>Senior Thesis</td>
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</table>

For the degree of Bachelor of Science in Engineering Mechanics

#### 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**

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>TAM 195</td>
<td>Mechanics in the Modern World</td>
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<tr>
<td>ENG 100</td>
<td>Engineering Orientation</td>
<td>0</td>
</tr>
<tr>
<td>MATH 221</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<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>
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<tr>
<td>RHET 105</td>
<td>Writing and Research</td>
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General education elective\(^3\)

**Semester Hours**

16-15

**Second Semester**

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<tbody>
<tr>
<td>MATH 231</td>
<td>Calculus II</td>
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<td>CHEM 104</td>
<td>General Chemistry II</td>
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<tr>
<td>CHEM 105</td>
<td>General Chemistry Lab II</td>
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<tr>
<td>PHYS 211</td>
<td>University Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>ME 170</td>
<td>Computer-Aided Design</td>
<td>3-4</td>
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<tr>
<td>RHET 105</td>
<td>or RHET</td>
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General education elective\(^3\)

**Semester Hours**

17-18

**Second Year**

**First Semester**

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<tbody>
<tr>
<td>PHYS 212</td>
<td>University Physics: Elec Mag</td>
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<tr>
<td>MATH 241</td>
<td>Calculus III</td>
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<tr>
<td>CS 101</td>
<td>Intro Computing: Engr Sci</td>
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<td>TAM 211</td>
<td>Statics</td>
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<tr>
<td>ME 290</td>
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General education elective\(^3\)

**Semester Hours**

17

**Second Semester**

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<tr>
<td>PHYS 213</td>
<td>Univ Physics: Thermal Physics</td>
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<td>PHYS 214</td>
<td>Univ Physics: Quantum Physics</td>
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<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>
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<td>TAM 252</td>
<td>Solid Mechanics Design</td>
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<td>ECE 205</td>
<td>Electrical and Electronic Circuits</td>
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General education elective\(^3\)

**Semester Hours**

17

**Third Year**

**First Semester**
<table>
<thead>
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<th>Course Title</th>
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<tbody>
<tr>
<td>ME 200</td>
<td>Thermodynamics</td>
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<td>MATH 415</td>
<td>Applied Linear Algebra</td>
<td>3</td>
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<td>TAM 335</td>
<td>Introductory Fluid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>TAM 270</td>
<td>Design for Manufacturability</td>
<td>3</td>
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**Second Semester**

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<tr>
<td>TAM 324</td>
<td>Behavior of Materials</td>
<td>4</td>
</tr>
<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>
<td>4</td>
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<td><strong>Semester Hours</strong></td>
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**Fourth Year**

**First Semester**

<table>
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<th>Course Code</th>
<th>Course Title</th>
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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>
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<tr>
<td></td>
<td>Secondary field elective</td>
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<tr>
<td></td>
<td>General education elective</td>
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<tr>
<td></td>
<td><strong>Semester Hours</strong></td>
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**Second Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Secondary Field Elective (or ME 470)</td>
<td>3</td>
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<tr>
<td></td>
<td>Secondary field elective</td>
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<td></td>
<td>General education elective</td>
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<td></td>
<td>Free elective</td>
<td>3</td>
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<tr>
<td></td>
<td><strong>Semester Hours</strong></td>
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</table>

**Total Hours:** 128

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).