ENGINEERING MECHANICS, BS

for the degree of Bachelor of Science in Engineering Mechanics

The Engineering Mechanics program at Illinois (accredited by the Engineering Accreditation Commission of ABET, www.abet.org) is a major that focuses on the principles of mechanics that underpin design and engineering in diverse industries including materials, energy, biotechnology, civil, and aerospace to name a few. Students learn rigorous mathematical, scientific, and engineering principles in subject areas such as statics, dynamics, strength of materials, and fluid dynamics. Further, Engineering Mechanics students learn how to apply these basic principles in modern engineering design through laboratory and project work. The program also benefits from a cohesive secondary field which students can tailor to fit their academic and career objectives. Engineering Mechanics is well suited for students with an interest in analysis and design, and physical principles.

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Graduation Requirements

Minimum Technical GPA (https://go.grainger.illinois.edu/TechnicalGPA/): 2.0
TGPA is required for required Engineering courses and any technical elective courses. See Technical GPA (https://go.grainger.illinois.edu/TechnicalGPA/) 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>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ENG 100</td>
<td>Engineering Orientation ¹</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>
<td>Seminar</td>
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Foundational Mathematics and Science

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<tr>
<th>Code</th>
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<tbody>
<tr>
<td>CHEM 102</td>
<td>General Chemistry I</td>
<td>3</td>
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<td>CHEM 103</td>
<td>General Chemistry Lab I ²</td>
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<tr>
<td>MATH 221</td>
<td>Calculus I ³</td>
<td>4</td>
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<td>MATH 231</td>
<td>Calculus II</td>
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<tr>
<td>MATH 241</td>
<td>Calculus III</td>
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<tr>
<td>MATH 257</td>
<td>Linear Algebra with Computational Applications ⁴</td>
<td>3</td>
</tr>
<tr>
<td>MATH 441</td>
<td>Differential Equations ⁵</td>
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<tr>
<td>MATH 442</td>
<td>Intro Partial Diff Equations</td>
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<td>PHYS 211</td>
<td>University Physics: Mechanics</td>
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<tr>
<td>PHYS 212</td>
<td>University Physics: Elec &amp; Mag</td>
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<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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Engineering Mechanics Technical Core

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<th>Code</th>
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<tbody>
<tr>
<td>CS 101</td>
<td>Intro Computing: Engrg &amp; Sci ⁶</td>
<td>3</td>
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<tr>
<td>ECE 205</td>
<td>Electrical and Electronic Circuits ⁷</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 ⁸</td>
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<tr>
<td>TAM 211</td>
<td>Statics</td>
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<td>TAM 212</td>
<td>Introductory Dynamics ⁹</td>
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<td>TAM 251</td>
<td>Introductory Solid Mechanics</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>
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<tr>
<td>TAM 324</td>
<td>Behavior of Materials ⁶</td>
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<td>TAM 335</td>
<td>Introductory Fluid Mechanics</td>
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<tr>
<td>TAM 412</td>
<td>Intermediate Dynamics</td>
<td>4</td>
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<tr>
<td>TAM 445</td>
<td>Continuum Mechanics</td>
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<tr>
<td>TAM 470</td>
<td>Computational Mechanics</td>
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<td>Total Hours</td>
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Secondary Field Option Electives

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.

Information listed in this catalog is current as of 10/2021
## 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 497 Independent Study 1 to 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 497 Independent Study 1 to 3

## Engineering Science and Applied Mathematics

**Required Courses**
- MATH 446 Applied Complex Variables 3-4
- or MATH 448 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 Ckts & Electromechanics 3
- ECE 473 Fund of Engrg Acoustics 3 or 4
- PHYS 402 Light 3 or 4
- TAM 497 Independent Study 1 to 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 497 Independent Study 1 to 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
- 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 497 Independent Study 1 to 3

## Mechanics of Materials

**Required Courses**
- TAM 424 Mechanics of Structural Metals 3 or 4
- TAM 428 Mechanics of Composites 3

**Approved Courses**
- CEE 310 Transportation Engineering 3
- MSE 401 Thermodynamics of Materials 3
- MSE 455 Macromolecular Solids 3
- MSE 489 Matl Select for Sustainability 3 or 4
- NPRE 431 Materials in Nuclear Engrg 3
- TAM 497 Independent Study 1 to 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 497 Independent Study 1 to 3

## Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>MATH 220</td>
<td>Aerospace Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>AE 402</td>
<td>Orbital Mechanics</td>
<td>3 or 4</td>
</tr>
<tr>
<td>CEE 491</td>
<td>Decision and Risk Analysis</td>
<td>3 or 4</td>
</tr>
<tr>
<td>ECE 329</td>
<td>Fields and Waves I</td>
<td>3</td>
</tr>
<tr>
<td>ECE 330</td>
<td>Power Ckts &amp; Electromechanics</td>
<td>3</td>
</tr>
<tr>
<td>ECE 473</td>
<td>Fund of Engrg Acoustics</td>
<td>3 or 4</td>
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<tr>
<td>PHYS 402</td>
<td>Light</td>
<td>3 or 4</td>
</tr>
<tr>
<td>TAM 497</td>
<td>Independent Study</td>
<td>1 to 3</td>
</tr>
</tbody>
</table>

## Total Hours of Curriculum to Graduate

128

1. *External transfer students take ENG 300 instead.*
2. CHEM 103 ([http://catalog.illinois.edu/search/?P=CHEM%20103](http://catalog.illinois.edu/search/?P=CHEM%20103)) requirement waived for students who received test-based credit (AP, IB, or proficiency) for CHEM 102 ([http://catalog.illinois.edu/search/?P=CHEM%20102](http://catalog.illinois.edu/search/?P=CHEM%20102)), similarly CHEM 105 ([http://catalog.illinois.edu/search/?P=CHEM%20105](http://catalog.illinois.edu/search/?P=CHEM%20105)) requirement waived for students who received test-based credit for CHEM 104 ([http://catalog.illinois.edu/search/?P=CHEM%20104](http://catalog.illinois.edu/search/?P=CHEM%20104)). Students are still required to have 128 hours minimum to graduate.
3. 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.
4. MATH 415 ([http://catalog.illinois.edu/search/?P=MATH%20415](http://catalog.illinois.edu/search/?P=MATH%20415)) may be substituted for students entering prior to Fall 2021.
Transfer or incoming students with credit upon admission to the Engineering Mechanics program may substitute MATH 284 (http://catalog.illinois.edu/search/?P=MATH%20284) or MATH 285 (http://catalog.illinois.edu/search/?P=MATH%20285) with a grade of B+ or higher.

CS 124 or CS 125 (http://catalog.illinois.edu/search/?P=CS%20125) or ECE 220 (http://catalog.illinois.edu/search/?P=ECE%20220) may be substituted.

ECE 110 (http://catalog.illinois.edu/search/?P=ECE%20110) and ECE 210 (http://catalog.illinois.edu/search/?P=ECE%20210) (or ECE 211 (http://catalog.illinois.edu/search/?P=ECE%20211)) combined may be substituted.

Advanced Composition satisfied by completing TAM 324 and ME 470.

The Grainger College of Engineering approved liberal education course list can be found here (https://go.grainger.illinois.edu/LiberalEducation/). Note that these credit hours could carry the required cultural studies designation required for campus general education requirements.

The Grainger College of Engineering restrictions to free electives can be found here (https://go.grainger.illinois.edu/FreeElectives/).

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 and corequisite 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 elective³

Semester Hours 16-15

Second Semester

MATH 231 Calculus II

CS 101 Intro Computing: Engrg Sci

PHYS 211 University Physics: Mechanics

ME 170 Computer-Aided Design or RHET 105²

General education elective³

Semester Hours 16-17

Second Year

First Semester

MATH 257 Linear Algebra with Computational Applications

CHEM 104 General Chemistry II

CHEM 105 General Chemistry Lab II

TAM 211 Statics

TAM 270 Design for Manufacturability

ME 290 Seminar

General education elective³

Semester Hours 16

Second Semester

MATH 241 Calculus III

PHYS 212 University Physics: Elec Mag

TAM 212 Introductory Dynamics

TAM 251 Introductory Solid Mechanics

TAM 252 Solid Mechanics Design

General education elective³

Semester Hours 18

Third Year

First Semester

MATH 441 Differential Equations

ECE 205 Electrical and Electronic Circuits

ME 200 Thermodynamics

TAM 335 Introductory Fluid Mechanics

Free Elective

Semester Hours 16

Second Semester

PHYS 213 Univ Physics: Thermal Physics

PHYS 214 Univ Physics: Quantum Physics

TAM 324 Behavior of Materials

TAM 412 Intermediate Dynamics

TAM 445 Continuum Mechanics

Semester Hours 16

Fourth Year

First Semester

ME 470 Senior Design Project (or Secondary field elective)³

MATH 442 Intro Partial Diff Equations

TAM 470 Computational Mechanics

Secondary field elective³

General education elective³

Semester Hours 15

Second Semester

Secondary Field Elective (or ME 470)³

Secondary field elective³

General education elective³

Free elective

Semester Hours 15

Total Hours: 128

Information listed in this catalog is current as of 10/2021
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. Select with departmental approval or choose from departmentally pre-approved list of Secondary Field Electives (http://mechanical.illinois.edu/undergraduate/bs-engineering-mechanics/#EMSecondaryFields).

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