# Mechanical Engineering, BSE

## Requirements

The Bachelor of Science in Engineering (BSE) with a major in mechanical engineering requires a minimum of 129 s.h. of credit, including two 0 s.h. department seminars. At the time of graduation, students must have a cumulative grade-point average of at least 2.00 in all college work used to complete degree requirements and in all UI coursework in order to be awarded the BSE.

All BSE students are required to take the same collegiate curriculum. For information about these collegiate requirements, see the Bachelor of Science in Engineering, BSE in the catalog. 6 s.h. of a student's major courses fulfill the basic science or college-level math collegiate requirement. Students completing the major in mechanical engineering also fulfill the collegiate statistics requirement by completing STAT:2020 Probability and Statistics for the Engineering and Physical Sciences.

The BSE with a major in mechanical engineering requires the following coursework.

| Requirements | Hours |
|---|---|
| Collegiate Curriculum | 49 |
| Basic Science and College-Level Math, from Major Requirements or Focus Area | 6 |
| Major Requirements (includes two 0 s.h. seminars) | 53 |
| Focus Area | 21 |

## Major Requirements

Major requirements include a set of common courses (56 s.h.), two departmental seminars (0 s.h.), and one capstone design course (3 s.h.).

| Course # | Title | Hours |
|---|---|---|
| All of these: | | |
| ME:2200 | Introduction to Mechanical Engineering Design | 2 |
| ME:2300 | Manufacturing Processes | 3 |
| ME:3045 | Heat Transfer | 3 |
| ME:3052 | Mechanical Systems | 4 |
| ME:3351 | Engineering Instrumentation | 2 |
| ME:3600 | Control of Mechanical Engineering Systems | 3 |
| ME:4048 | Energy Systems Design | 4 |
| ME:4055 | Mechanical Systems Design | 3 |
| ME:4080 | Experimental Engineering | 4 |
| ENGR:2110 | Statics | 2 |
| ENGR:2120 | Electrical Circuits | 3 |
| ENGR:2130 | Thermodynamics | 3 |
| ENGR:2510 | Fluid Mechanics | 4 |
| ENGR:2710 | Dynamics | 3 |
| ENGR:2720 | Materials Science | 3 |
| ENGR:2750 | Mechanics of Deformable Bodies | 3 |
| MATH:3550 | Engineering Vector Calculus | 3 |
| PHYS:1612 | Introductory Physics II (with lab) | 4 |

### Departmental Seminars

| Course # | Title | Hours |
|---|---|---|
| Both of these: | | |
| ME:2020 | Mechanical Engineering Program Seminar | 0 |
| ME:3091 | Professional Seminar: Mechanical Engineering | 0 |

### Capstone Design Course

| Course # | Title | Hours |
|---|---|---|
| This course: | | |
| ME:4086 | Mechanical Engineering Design Project | 3 |

## Focus Area

Students must select focus area courses according to guidelines established by the Department of Mechanical Engineering. The mechanical engineering program offers a variety of focus area options, including standard focus areas developed and maintained by the program and flexible focus areas tailored to individual student interests. The focus area is a set of 21 s.h. of elective courses taken during the second through fourth years that provide mechanical engineering undergraduate students with a unique opportunity to acquire advanced education in an area of their choice.

Standard focus areas are offered in energy and environment [p. 1], manufacturing [p. 2], mechanical engineering design [p. 3], and robotics and autonomous systems [p. 3]. For guidelines regarding tailored focus areas, see ME Focus Areas on the Department of Mechanical Engineering website.

Focus areas in mechanical engineering consist of required courses, focus area electives, and additional electives; carefully selected elective courses may contribute to earning a minor and/or certificate.

### Energy and Environment

Students in the energy and environment focus area complete one required course (3 s.h.), at least two focus area electives (6 s.h.), and up to four additional electives to total 21 s.h.

### Required Energy and Environment Course

| Course # | Title | Hours |
|---|---|---|
| At least one of these: | | |
| ME:5145 | Intermediate Heat Transfer | 3 |
| ME:5160/CEE:5369 | Intermediate Mechanics of Fluids | 3 |

### Energy and Environment Electives

| Course # | Title | Hours |
|---|---|---|
| At least two of these: | | |
| ME:4111/CEE:4511 | Scientific Computing and Machine Learning | 3 |
| ME:4160 | Engines and Power Plants | 3 |
| ME:5145 | Intermediate Heat Transfer (if not taken as a required course) | 3 |
| ME:5149 | Propulsion Engineering | 3 |

| | | |
|---|---|---|
| ME:5160/CEE:5369 | Intermediate Mechanics of Fluids (if not taken as a required course) | 3 |
| CEE:4107/CBE:4410 | Sustainable Systems | 3 |

## Additional Electives, Energy and Environment

The remainder of the 21 s.h. must be fulfilled by electives. In addition to the following courses, students may also select courses not already taken from the lists of required energy and environment courses and approved energy and environment electives. See "Flexible Electives" in this section of the catalog for more information.

| Course # | Title | Hours |
|---|---|---|
| ME:4024 | Product Design and Realization | 3 |
| ME:4125 | Biomimetic Fluid Dynamics | 3 |
| ME:4175 | Computational Naval Hydrodynamics | 3 |
| ME:4186 | Enhanced Design Experience | 3 |
| ME:5143 | Computational Fluid and Thermal Engineering | 3 |
| ME:5210/CBE:5110 | Intermediate Thermodynamics | 3 |
| CBE:3405 | Green Chemical and Energy Technologies | 3 |
| CBE:5415/IGPI:5415 | Satellite Image Processing and Remote Sensing of Atmosphere | 3 |
| CBE:5417/ CEE:5417/IGPI:5417 | Physical Meteorology and Atmospheric Radiative Transfer | 3 |
| CEE:3371 | Principles of Hydraulics and Hydrology | 3 |
| CEE:4102 | Groundwater | 3 |
| CEE:4159/ CBE:4459/IGPI:4159 | Air Pollution Control Technology | 3 |
| CEE:5380 | Fluid Flows in Environmental Systems | 3 |
| ECE:5620 | Electric Power Systems and Renewable Energy | 3 |
| ISE:2500 | Engineering Economy | 3 |
| May include one of these: | | |
| SEES:1080 | Introduction to Environmental Science | 3-4 |
| SEES:1290 | Energy and the Environment | 3 |

# Manufacturing

Students in the manufacturing focus area complete two required courses (6 s.h.), at least two focus area electives (6 s.h.), and up to three additional electives (9 s.h.) to total 21 s.h.

## Required Manufacturing Courses

| Course # | Title | Hours |
|---|---|---|
| This course: | | |
| ME:4111/CEE:4511 | Scientific Computing and Machine Learning | 3 |
| And at least one of these: | | |
| ME:4116/ISE:4116 | Manufacturing Processes Simulations and Automation | 3 |
| ME:4140 | Modern Robotics and Automation | 3 |
| ME:5146 | Modeling of Materials Processing | 3 |

## Manufacturing Electives

| Course # | Title | Hours |
|---|---|---|
| At least two of these: | | |
| ME:4024 | Product Design and Realization | 3 |
| ME:4116/ISE:4116 | Manufacturing Processes Simulations and Automation (if not taken as a required course) | 3 |
| ME:4140 | Modern Robotics and Automation (if not taken as a required course) | 3 |
| ME:4145 | Industrial Internet of Things (IIoT) | 3 |
| ME:4200 | Modern Engineering Materials for Mechanical Design | 3 |
| ME:5146 | Modeling of Materials Processing (if not taken as a required course) | 3 |
| ME:5167/CEE:5137 | Composite Materials | 3 |
| ME:5170 | Data-Driven Analysis in Engineering Mechanics | 3 |

## Additional Electives, Manufacturing

The remainder of the 21 s.h. must be fulfilled by electives. In addition to the following courses, students may also select courses not already taken from the lists of required manufacturing courses and approved manufacturing electives. See "Flexible Electives" in this section of the catalog for more information.

| Course # | Title | Hours |
|---|---|---|
| ME:4110/CEE:4515 | Computer-Aided Engineering | 3 |
| ME:4112/CEE:4512 | Engineering Design Optimization | 3 |
| ME:4117 | Finite Element Analysis | 3 |
| ME:4150 | Artificial Intelligence in Engineering | 3 |
| ME:4153/CEE:4532 | Fundamentals of Vibrations | 3 |
| ME:4186 | Enhanced Design Experience | 3 |
| ME:5114 | Nonlinear Control in Robotic Systems | 3 |
| ME:5143 | Computational Fluid and Thermal Engineering | 3 |
| ME:5145 | Intermediate Heat Transfer | 3 |
| ME:5159/CEE:5549 | Fracture Mechanics | 3 |
| ME:5300 | Uncertainty Quantification and Design Optimization | 3 |
| BME:5620 | Introduction to Applied Biomedical Finite Element Modeling | 3 |
| ECE:5550 | Internet of Things | 3 |
| ISE:3300 | Manufacturing Systems | 3 |
| ISE:3600/CEE:3142/ STAT:3620 | Quality Control | 3 |
| ISE:3700 | Operations Research | 3 |

| | | |
|---|---|---|
| ISE:4620 | Design of Experiments for Quality Improvement | 3 |
| ISE:4900 | Introduction to Six Sigma | 3 |

## Mechanical Engineering Design

Students in the mechanical engineering design focus area complete two required courses (6 s.h.), at least two focus area electives (6 s.h.), and up to three additional electives (9 s.h.) to total 21 s.h.

### Required Design Courses

| Course # | Title | Hours |
|---|---|---|
| Both of these: | | |
| ME:4111/CEE:4511 | Scientific Computing and Machine Learning | 3 |
| ME:4186 | Enhanced Design Experience | 3 |

Students in the mechanical engineering design focus area are required to apply for a yearlong design experience comprised of ME:4086 Mechanical Engineering Design Project (see "Capstone Design Course") in the fall and ME:4186 Enhanced Design Experience in the spring (see Policy on Participation in PEDE or VIPT Programs). Students who are not accepted or who are unable to take the yearlong set of courses are required to replace ME:4186 with a course from the section titled "Design Electives" or " Additional Electives–Mechanical Engineering Design."

### Design Electives

| Course # | Title | Hours |
|---|---|---|
| At least two of these: | | |
| ME:4024 | Product Design and Realization | 3 |
| ME:4110/CEE:4515 | Computer-Aided Engineering | 3 |
| ME:4112/CEE:4512 | Engineering Design Optimization | 3 |
| ME:4117 | Finite Element Analysis | 3 |
| ME:5143 | Computational Fluid and Thermal Engineering | 3 |
| ME:5170 | Data-Driven Analysis in Engineering Mechanics | 3 |
| ME:5300 | Uncertainty Quantification and Design Optimization | 3 |

### Additional Electives, Mechanical Engineering Design

The remainder of the 21 s.h. must be fulfilled by electives. In addition to the following courses, students may also select courses not already taken from the list of approved design electives. See "Flexible Electives" in this section of the catalog for more information.

| Course # | Title | Hours |
|---|---|---|
| ME:4116/ISE:4116 | Manufacturing Processes Simulations and Automation | 3 |
| ME:4120 | Advanced Linear Control Systems | 3 |
| ME:4125 | Biomimetic Fluid Dynamics | 3 |
| ME:4140 | Modern Robotics and Automation | 3 |
| ME:4145 | Industrial Internet of Things (IIoT) | 3 |
| ME:4150 | Artificial Intelligence in Engineering | 3 |
| ME:4153/CEE:4532 | Fundamentals of Vibrations | 3 |
| ME:4175 | Computational Naval Hydrodynamics | 3 |
| ME:4200 | Modern Engineering Materials for Mechanical Design | 3 |
| ME:5114 | Nonlinear Control in Robotic Systems | 3 |
| ME:5120 | Vehicle System Dynamics | 3 |
| ME:5145 | Intermediate Heat Transfer | 3 |
| ME:5149 | Propulsion Engineering | 3 |
| ME:5150/CEE:5540 | Intermediate Mechanics of Deformable Bodies | 3 |
| ME:5154 | Intermediate Kinematics and Dynamics | 3 |
| ME:5159/CEE:5549 | Fracture Mechanics | 3 |
| ME:5160/CEE:5369 | Intermediate Mechanics of Fluids | 3 |
| ME:5167/CEE:5137 | Composite Materials | 3 |
| ME:5179/CEE:5179 | Continuum Mechanics | 3 |

## Robotics and Autonomous Systems

Students in the robotics and autonomous systems focus area complete two required courses (6 s.h.), at least two focus area electives (6 s.h.), and up to three additional electives (9 s.h.) to total 21 s.h.

### Required Robotics and Autonomous Systems Courses

| Course # | Title | Hours |
|---|---|---|
| Both of these: | | |
| ME:4111/CEE:4511 | Scientific Computing and Machine Learning | 3 |
| ME:4120 | Advanced Linear Control Systems | 3 |

### Robotics and Autonomous Systems Electives

| Course # | Title | Hours |
|---|---|---|
| At least two of these: | | |
| ME:4116/ISE:4116 | Manufacturing Processes Simulations and Automation | 3 |
| ME:4140 | Modern Robotics and Automation | 3 |
| ME:4145 | Industrial Internet of Things (IIoT) | 3 |
| ME:4150 | Artificial Intelligence in Engineering | 3 |
| ME:4175 | Computational Naval Hydrodynamics | 3 |
| ME:4176 | Experimental Naval Hydrodynamics | 3 |
| ME:5114 | Nonlinear Control in Robotic Systems | 3 |
| ME:5120 | Vehicle System Dynamics | 3 |
| ME:5170 | Data-Driven Analysis in Engineering Mechanics | 3 |
| ME:6115 | Cooperative Autonomous Systems | 3 |

## Additional Electives, Robotics and Autonomous Systems

The remainder of the 21 s.h. must be fulfilled by electives. In addition to the following courses, students may also select courses not already taken from the list of approved robotics and autonomous systems electives. See "Flexible Electives" in this section of the catalog for more information.

| Course # | Title | Hours |
|---|---|---|
| ME:4024 | Product Design and Realization | 3 |
| ME:4110/CEE:4515 | Computer-Aided Engineering | 3 |
| ME:4125 | Biomimetic Fluid Dynamics | 3 |
| ME:4153/CEE:4532 | Fundamentals of Vibrations | 3 |
| ME:4186 | Enhanced Design Experience | 3 |
| ME:5150/CEE:5540 | Intermediate Mechanics of Deformable Bodies | 3 |
| ME:5154 | Intermediate Kinematics and Dynamics | 3 |
| ME:5300 | Uncertainty Quantification and Design Optimization | 3 |
| ECE:5550 | Internet of Things | 3 |
| ENGR:2730 | Computers in Engineering | 3 |

## Flexible Electives

Students in all mechanical engineering focus areas may apply up to 3 s.h. of flexible elective courses to the additional elective requirement. Flexible elective courses include the following.

- A College of Engineering course that is required for another BSE major, excluding department seminars.
- A mechanical engineering course (prefix ME) numbered 4100 or above.
- A chemistry course (prefix CHEM) numbered above 1110, a mathematics course (prefix MATH) numbered above 3350, or a physics course (prefix PHYS) numbered above 1612. Students who have completed ME:4111 Scientific Computing and Machine Learning cannot use MATH:3800 Introduction to Numerical Methods as a flexible elective.
- An independent study (ME:4098) in a mechanical engineering subject area.