

# MECHANICAL ENGINEERING, BSE

**Degree:** Bachelor of Science in Engineering (BSE)

**Major:** Mechanical Engineering

## Program Overview

The Bachelor of Science in Engineering degree program with a major in Mechanical Engineering is accredited by the Engineering Accreditation Commission of ABET.

The Department of Mechanical and Aerospace Engineering also offers a double major in Mechanical and Aerospace Engineering. Students completing this plan of study meet the requirements for both the Aerospace Engineering program and the Mechanical Engineering program.

## Program Educational Objectives

- Graduates will enter and successfully engage in careers in Mechanical Engineering and other professions appropriate to their background, interests, and skills.
- Graduates will engage in continued learning through post-baccalaureate education and/or professional development in engineering or other professional fields.
- Graduates will develop as leaders in their chosen professions.

## Learning Outcomes

As preparation for achieving the above educational objectives, the Bachelor of Science in Engineering degree program with a major in Mechanical Engineering is designed so that students attain:

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## Co-op and Internship Programs

Opportunities are available for students to alternate studies with work in industry or government as a co-op student, which involves paid full-

time employment over seven months (one semester and one summer). Students may work in one or two co-ops, beginning in the third year of study. Co-ops provide students the opportunity to gain valuable hands-on experience in their field by completing a significant engineering project while receiving professional mentoring. During a co-op placement, students do not pay tuition but maintain their full-time student status while earning a salary. Alternatively or additionally, students may obtain employment as summer interns.

## Undergraduate Policies

For undergraduate policies and procedures, please review the Undergraduate Academics section of the General Bulletin.

## Accelerated Master's Programs

Undergraduate students may participate in accelerated programs toward graduate or professional degrees. For more information and details of the policies and procedures related to accelerated studies, please visit the Undergraduate Academics section of the General Bulletin.

## BS/MS Program

The combined bachelors/masters program allows a student to double count 9 credit hours of graduate course work towards the Bachelor of Science in Engineering degree in any one of the department's two degree programs. By completing the remaining graduate credit hours and a thesis, a student may earn a Master of Science degree in mechanical or aerospace engineering. This typically takes 5 years or slightly longer. Application to this program is initiated in the spring of the junior year with the department's graduate student programs office. A minimum grade point of 3.2 is required for consideration for this accelerated program.

## BS/MS Academic Program Details

The current regulations for the MS degree by the School of Graduate Studies require a minimum of 18 credit hours of coursework at the 400-level (or higher). Please note that any 400-level course taken prior to admission to the BS/MS Program cannot typically be counted as part of the MS degree. However, EMAE 398 may be included in the double counted credit hours toward the MS Thesis, if appropriate.

Follow the link below to learn more about the components of the BS/MS Program.

- BS/MS Application Process

If you have additional questions, please contact either:

- Professor Chirag Kharangate crk91@case.edu
- Student Affairs Specialist Nathaniel Vishner nnv@case.edu

## Program Requirements

Students seeking to complete this major and degree program must meet the general requirements for bachelor's degrees and the Unified General Education Requirements. Students completing this program as a secondary major while completing another undergraduate degree program do not need to satisfy the school-specific requirements associated with this major.

Code	Title	Hours
<b>Required Mathematics, Science and Engineering Courses</b>		
MATH 121	Calculus for Science and Engineering I	4
MATH 122	Calculus for Science and Engineering II	4

or MATH 124	Calculus II	
MATH 223	Calculus for Science and Engineering III	3
or MATH 227	Calculus III	
MATH 224	Elementary Differential Equations	3
or MATH 228	Differential Equations	
PHYS 121	General Physics I - Mechanics	4
or PHYS 123	Physics and Frontiers I - Mechanics	
PHYS 122	General Physics II - Electricity and Magnetism	4
or PHYS 124	Physics and Frontiers II - Electricity and Magnetism	
CHEM 111	Principles of Chemistry for Engineers	4
ENGR 130	Foundations of Engineering and Programming	3
ENGR 145	Chemistry of Materials	4
ENGR 200	Statics and Strength of Materials	3
ENGR 210	Introduction to Circuits and Instrumentation	4
ENGR 399	Impact of Engineering on Society	3

Code	Title	Hours
<b>Major Courses</b>		
ECIV 310	Strength of Materials	3
EMAE 160	Mechanical Manufacturing	3
EMAE 181	Dynamics	3
EMAE 250	Computers in Mechanical Engineering	3
EMAE 251	Thermodynamics	3
EMAE 252	Fluid Mechanics	3
EMAE 260	Design and Manufacturing I	3
EMAE 285	Mechanical Engineering Measurements Laboratory	4
EMAE 350	Mechanical Engineering Analysis	3
EMAE 351	Control of Mechanical Systems	3
EMAE 353	Heat Transfer	3
EMAE 355	Design of Fluid and Thermal Elements	3
EMAE 360	Design and Manufacturing II	3
EMAE 370	Design of Mechanical Elements	3
EMAE 398	Senior Project	3
PHYS 221	Introduction to Modern Physics <sup>a</sup>	3
or STAT 312	Basic Statistics for Engineering and Science	
Technical Electives <sup>b</sup>		12
<b>Total Hours</b>		<b>61</b>

a Other science electives for Mechanical Engineering students can be selected with the approval of the student's advisor and the chair using an Academic Advisement Requirement Form.

b Can be chosen from all 200-, 300-, and 400-level CSDS, EBME, ECIV, ECSE, EMAC, EMAE, and EMSE courses. All 300- and 400-level ECHE courses. All 300-level MATH and STAT courses with advisor approval.

## Sample Plan of Study

The following is a suggested program of study. Current students should always consult their advisers and their individual graduation requirement plans as tracked in SIS.

<b>First Year</b>		
<b>Fall</b>		<b>Hours</b>
CHEM 111	Principles of Chemistry for Engineers	4
MATH 121	Calculus for Science and Engineering I	4
PHYS 121	General Physics I - Mechanics	4
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>15</b>

<b>Spring</b>		
MATH 122	Calculus for Science and Engineering II	4
PHYS 122	General Physics II - Electricity and Magnetism	4
ENGR 130	Foundations of Engineering and Programming	3
ENGR 145	Chemistry of Materials	4
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>18</b>

<b>Second Year</b>		
<b>Fall</b>		
MATH 223	Calculus for Science and Engineering III	3
ENGR 200	Statics and Strength of Materials	3
EMAE 160	Mechanical Manufacturing	3
EMAE 250	Computers in Mechanical Engineering	3
Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>15</b>

<b>Spring</b>		
MATH 224	Elementary Differential Equations	3
ENGR 210	Introduction to Circuits and Instrumentation	4
EMAE 181	Dynamics	3
EMAE 251	Thermodynamics	3
Science Elective		3
<b>Hours</b>		<b>16</b>

<b>Third Year</b>		
<b>Fall</b>		
EMAE 252	Fluid Mechanics	3
EMAE 285	Mechanical Engineering Measurements Laboratory	4
EMAE 350	Mechanical Engineering Analysis	3
ECIV 310	Strength of Materials	3
Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>16</b>

<b>Spring</b>		
EMAE 260	Design and Manufacturing I	3
EMAE 353	Heat Transfer	3
EMAE 370	Design of Mechanical Elements	3
EMAE 351	Control of Mechanical Systems	3
Breadth, or Elective course <sup>a</sup>		3
Technical Elective		3
<b>Hours</b>		<b>18</b>

<b>Fourth Year</b>		
<b>Fall</b>		
EMAE 355	Design of Fluid and Thermal Elements	3
EMAE 360	Design and Manufacturing II	3

Breadth, or Elective course <sup>a</sup>	3
Technical Elective	3
Open Elective	3
<b>Hours</b>	<b>15</b>
<b>Spring</b>	
EMAE 398 Senior Project	3
ENGR 399 Impact of Engineering on Society	3
Breadth, or Elective course <sup>a</sup>	3
Technical Elective	3
Technical Elective	3
<b>Hours</b>	<b>15</b>
<b>Total Hours</b>	<b>128</b>

<sup>a</sup> Unified General Education Requirement.

## Sample Plan of Study: Double Major in Mechanical and Aerospace Engineering

### First Year

<b>Fall</b>		<b>Hours</b>
CHEM 111	Principles of Chemistry for Engineers	4
MATH 121	Calculus for Science and Engineering I	4
PHYS 121	General Physics I - Mechanics	4
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>15</b>
<b>Spring</b>		
MATH 122	Calculus for Science and Engineering II	4
PHYS 122	General Physics II - Electricity and Magnetism	4
ENGR 130	Foundations of Engineering and Programming	3
ENGR 145	Chemistry of Materials	4
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>18</b>

### Second Year

<b>Fall</b>		
MATH 223	Calculus for Science and Engineering III	3
ENGR 200	Statics and Strength of Materials	3
EMAE 160	Mechanical Manufacturing	3
EMAE 250	Computers in Mechanical Engineering	3
Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>15</b>
<b>Spring</b>		
MATH 224	Elementary Differential Equations	3
PHYS 221	Introduction to Modern Physics	3
ENGR 210	Introduction to Circuits and Instrumentation	4
EMAE 181	Dynamics	3
EMAE 251	Thermodynamics	3
<b>Hours</b>		<b>16</b>

### Third Year

<b>Fall</b>		
EMAE 252	Fluid Mechanics	3

EMAE 285	Mechanical Engineering Measurements Laboratory	4
EMAE 350	Mechanical Engineering Analysis	3
ECIV 310	Strength of Materials	3
Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>16</b>
<b>Spring</b>		
EMAE 260	Design and Manufacturing I	3
EMAE 353	Heat Transfer	3
EMAE 359	Aero/Gas Dynamics	3
EMAE 370	Design of Mechanical Elements	3
EMAE 376	Aerostructures	3
EMAE 351	Control of Mechanical Systems	3
<b>Hours</b>		<b>18</b>

### Fourth Year

<b>Fall</b>		
EMAE 383	Flight Mechanics	3
EMAE 384	Orbital Dynamics	3
EMAE 355	Design of Fluid and Thermal Elements	3
EMAE 360	Design and Manufacturing II	3
Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>15</b>
<b>Spring</b>		
EMAE 356	Aerospace Design	3
EMAE 382	Propulsion	3
EMAE 398	Senior Project	3
ENGR 399	Impact of Engineering on Society	3
Breadth, or Elective course <sup>a</sup>		3
Breadth, or Elective course <sup>a</sup>		3
<b>Hours</b>		<b>18</b>
<b>Total Hours</b>		<b>131</b>

<sup>a</sup> Unified General Education Requirement.