

MECHANICAL ENGINEERING

Home Department: Mechanical Engineering

Department Head:

Bassem Ramadan, Ph.D
Room 2-103 MC, 810-762-7992
me@kettering.edu (tbrown@kettering.edu)

Program Overview

The Bachelor of Science in Mechanical Engineering (ME) prepares students for a broad range of careers associated with the design and implementation of mechanical systems involving the conversion, transmission, and utilization of energy. Mechanical engineering courses that provide breadth in the discipline include design, dynamics, engineering materials, thermodynamics, fluid mechanics, heat transfer, vibrations, systems analysis, and associated laboratories. Large and well-equipped laboratories in experimental mechanics, heat transfer, fluid mechanics, engines, vibrations, hydraulics, instrumentation, and automotive emissions support the mechanical engineering program.

Mechanical Engineering students may elect to customize their degree by taking a set of elective courses in a specific area; either by pursuing a concentration within the Mechanical Engineering program or by pursuing a Minor with non-Mechanical Engineering programs. For more details see Mechanical Engineering Program Concentrations (p. 3) or Minors.

The Mechanical Engineering program is accredited by the Engineering Accreditation Commission (EAC) of ABET.

Program Educational Objectives

With their Kettering education as a foundation, within a few years of graduation, graduates will attain:

- A reputation for working effectively and ethically in diverse professional environments.
- Leadership in their profession while actively pursuing lifelong learning and contributing to progress within their field.
- The ability to practice responsible decision making and apply best practices to their professional endeavors.

BS/MASTERS PATHWAY

Undergraduate students also have an opportunity to get their bachelor's and master's degrees in five years with the BS/MASTERS Pathway.

Program Curriculum Requirements

Code	Title	Credit Hours
First Year Experience		
CILE-101	First Year Foundations	1
General Education		
COMM-101	Rhetoric & Writing	4
ECON-201	Economic Principles	4
LA-201	Sophomore Seminar: Exploring the Human Condition	4
LA-489	Sr. Seminar: Leadership, Ethics	4
Advanced Humanities Electives ¹		8

Advanced Social Science Electives ¹	8
Total Credit Hours	33

¹ Humanities and Social Science advanced electives must be selected from approved 300 and 400 level courses.

Code	Title	Credit Hours
Mathematics and Basic Science		
CHEM-135 & CHEM-136	Principles of Chemistry and Principles of Chemistry Lab	4
MATH-101 or MATH-101X	Calculus I	4
MATH-102 or MATH-102H or MATH-102X	Calculus II	4
MATH-203 or MATH-203H or MATH-203X	Multivariate Calculus	4
MATH-204 or MATH-204H	Differential Equations & Laplace Transforms	4
MATH-258	Probability and Statistics	4
MATH-305	Numerical Methods and Matrices	4
PHYS-114 & PHYS-115	Newtonian Mechanics and Newtonian Mechanics Laboratory	4
PHYS-224 & PHYS-225	Electricity and Magnetism and Electricity and Magnetism Laboratory	4
Math/Science Elective ¹		4
<i>Credit Hours Subtotal:</i>		<i>40</i>
Engineering Topics		
EE-212 & MECH-231L	Applied Electrical Circuits and Signals for Mechanical Systems Lab ²	4
IME-100	Interdisciplinary Design and Manufacturing	4
MECH-100	Engineering Graphical Communication	4
MECH-210	Statics	4
MECH-212	Mechanics of Materials	4
MECH-300	Computer Aided Engineering	4
MECH-307	Materials Engineering	4
MECH-310	Dynamics	4
MECH-311	Introduction to Mechanical System Design	4
MECH-312	Mechanical Component Design I	4
MECH-320	Thermodynamics	4
MECH-322	Fluid Mechanics	4
MECH-330 & MECH-331	Dynamic Systems with Vibrations and Dynamic Sys w Vibrations Lab	4
MECH-420	Heat Transfer	4
MECH-422	Energy Systems Laboratory	4

MECH-430 & MECH-431	Dynamic Systems with Controls and Dynamic Systems with Controls Lab	4
<i>Credit Hours Subtotal:</i>		64
Electives		
Two Free Electives ³		8
Two Mechanical Engineering Electives ⁴		8
Mechanical Engineering Senior Design Project		4
<i>Credit Hours Subtotal:</i>		20
Culminating Undergraduate Experience		
CILE-400	Culminating Undergraduate Experience: Thesis ⁵	4
Total Credit Hours		128

(Minimum) Total Credits Required for the Program: 161

¹ Math/Science elective is described as: Any level BIOL, CHEM, MATH or PHYS that is not used to complete core degree requirements.

² Students pursuing an Electrical Engineering minor take EE-210/EE-211 in lieu of MECH-231L/EE-212.

³ Free electives are described as: Any Kettering University course except any course that consists of an elementary nature when advanced topics have been mastered, and any course that consists of topics, which are very similar to topics which have been mastered.

⁴ ME electives are described as: Any 300-599 level BIOL, CE, CHEM, CHME, CS, ECE, EE, EP, IME, ISYS, MATH (except pre-calc and college math), MECH, or PHYS that is not used to complete core degree requirements. In addition, BUSN-303, BUSN-304 and MGMT-419 also qualify as M.E. Electives.

⁵ Students are automatically registered for CILE-400 in a co-op term when they reach Junior II status.

Mechanical Engineering Concentrations

Students majoring in Mechanical Engineering may select a concentration consisting of 20 credit hours of courses focused in a particular area. Concentrations may include both required and elective courses. The first six terms are common to all Mechanical Engineering students. Senior I through Senior III representative programs are given for each concentration.

A Mechanical Engineering concentration provides students a depth of study in preparation for a career within an industrial sector and/or as a foundation for graduate study. However, the student's degree is Mechanical Engineering and the selected concentration does not prevent students from working within any industry. The primary advantage is to provide a "jump start" over mechanical engineering graduates from other schools with traditional degree programs. Courses are subject to cancellation due to low enrollment.

Alternative Energy Concentration

Code	Title	Credit Hours
MECH-495	Senior Design Project	4
MECH-426	Fuel Cell Science and Engineering	4
MECH-427	Energy and the Environment	4
MECH-428	Bio and Renewable Energy	4

MECH-445	Hybrid Electric Vehicle Propulsion	4
<i>Credit Hours Subtotal:</i>		20

Automotive Engineering Design Concentration

Code	Title	Credit Hours
MECH-448	Vehicle Design Project	4
Select four of the following:		16
MECH-416	Introduction to Finite Element Analysis with Structural Applications	
MECH-426	Fuel Cell Science and Engineering	
MECH-440	Introduction to Internal Combustion Engines	
MECH-441	Advanced Automotive Power Systems	
MECH-442	Chassis Systems	
MECH-444	Introduction to Automotive Powertrains	
MECH-445	Hybrid Electric Vehicle Propulsion	
MECH-446	Vehicle Systems Dynamics	
MECH-450	Automotive Bioengineering: Occupant Protection and Safety	
MECH-451	Vehicular Crash Dynamics and Accident Reconstruction	
<i>Credit Hours Subtotal:</i>		20
Other courses with the approval of the automotive faculty		

Bioengineering Applications Concentration

Code	Title	Credit Hours
Required Courses		
MECH-350	Introduction to Bioengineering Applications	4
MECH-495	Senior Design Project	4
Electives		
Select three of the following:		12
BIOL-141 & BIOL-142	General Biology and General Biology Lab	
BIOL-241 & BIOL-242	Human Biology and Human Biology Lab	
BIOL-341	Anatomy and Physiology	
MECH-450	Automotive Bioengineering: Occupant Protection and Safety	
MECH-451	Vehicular Crash Dynamics and Accident Reconstruction	
PHYS-354	Medical Physics Principles	
<i>Credit Hours Subtotal:</i>		20

Machine Design & Advanced Materials Concentration

Code	Title	Credit Hours
MECH-416	Introduction to Finite Element Analysis with Structural Applications	4
MECH-482	Mechanics and Design Simulation of Fiber-Reinforced Composite Materials	4

MECH-495	Senior Design Project	4
Two MDAM Concentration Related Electives		8

Course	Title	Credit Hours
--------	-------	--------------

Freshman I

CILE-101	First Year Foundations	1
CHEM-135	Principles of Chemistry	3
CHEM-136	Principles of Chemistry Lab	1
COMM-101	Rhetoric & Writing	4
MATH-101	Calculus I	4
MECH-100	Engineering Graphical Communication ¹	4

Credit Hours 17

Freshman II

IME-100	Interdisciplinary Design and Manufacturing ¹	4
LS-201	Sophomore Seminar: Exploring the Human Condition	4
MATH-102	Calculus II	4
PHYS-114	Newtonian Mechanics	3
PHYS-115	Newtonian Mechanics Laboratory	1

Credit Hours 16

Sophomore I

ECON-201	Economic Principles	4
MATH-203	Multivariate Calculus	4
MECH-210	Statics	4
PHYS-224	Electricity and Magnetism	3
PHYS-225	Electricity and Magnetism Laboratory	1

Credit Hours 16

Sophomore II

EE-212	Applied Electrical Circuits	3
MECH-231L	Signals for Mechanical Systems Lab	1
MATH-204	Differential Equations & Laplace Transforms	4
MECH-212	Mechanics of Materials	4
Math/Science Elective ³		4

Credit Hours 16

Junior I

MATH-305	Numerical Methods and Matrices	4
MECH-307	Materials Engineering	4
MECH-311	Introduction to Mechanical System Design	4
MECH-312	Mechanical Component Design I	4
Advanced Humanities or Social Science Elective		4

Credit Hours 20

Junior II

MATH-258	Probability and Statistics	4
MECH-300	Computer Aided Engineering ²	4
MECH-310	Dynamics	4
MECH-320	Thermodynamics	4
Advanced Humanities or Social Science Elective		4

Credit Hours 20

Senior I

MECH-322	Fluid Mechanics	4
MECH-330 & MECH-331	Dynamic Systems with Vibrations and Dynamic Sys w Vibrations Lab	4
Advanced Humanities or Social Science Elective		4
Free Elective		4
ME Elective ³		4

Credit Hours 20

Senior II

LS-489	Senior Seminar: Leadership, Ethics, and Contemporary Issues	4
MECH-420	Heat Transfer	4
MECH-430 & MECH-431	Dynamic Systems with Controls and Dynamic Systems with Controls Lab	4
ME Elective ³		4

Credit Hours 16

Senior III

MECH-422	Energy Systems Laboratory	4
Advanced Humanities or Social Science Elective		4
Free Elective		4
ME Senior Design Project ⁴		4

Credit Hours 16

Any Term

CILE-400	Culminating Undergraduate Experience: Thesis ⁵	4
----------	---	---

Credit Hours 4

Total Credit Hours 161

¹ Approximately one-half of the students take MECH-100 Freshman I and IME-100 Freshman II, the other one-half take IME-100 Freshman I and MECH-100 Freshman II.

² Approximately one-half of students take MECH-300 Junior II and MECH-311 Junior I, the other one-half take MECH-311 Junior II and MECH-300 Senior I.

³ Elective courses may vary in lecture and/or laboratory credits and terms from those shown. Math/Science electives are any level MATH, BIOL, CHEM, or PHYS course that is not used to complete core degree requirements.

⁴ ME Senior Design Projects may vary in lecture and/or laboratory credits and terms from those shown.

⁵ Students are automatically registered for CILE-400 in a co-op term when they reach Junior II status.

Bachelor of Science in Mechanical Engineering Curriculum by Concentration

Alternative Energy Concentration

Freshman I through Junior II Representative Program Credit Total: 105

Course	Title	Credit Hours
--------	-------	--------------

Senior I

MECH-322	Fluid Mechanics	4
MECH-330 & MECH-331	Dynamic Systems with Vibrations and Dynamic Sys w Vibrations Lab	4

MECH-427	Energy and the Environment	4
Advanced Humanities or Social Science Elective		4
Credit Hours		16

Senior II

LS-489	Senior Seminar: Leadership, Ethics, and Contemporary Issues	4
MECH-420	Heat Transfer	4
MECH-430 & MECH-431	Dynamic Systems with Controls and Dynamic Systems with Controls Lab	4
MECH-428	Bio and Renewable Energy	4
MECH-445	Hybrid Electric Vehicle Propulsion	4
Credit Hours		20

Senior III

MECH-422	Energy Systems Laboratory	4
MECH-426	Fuel Cell Science and Engineering	4
MECH-495	Senior Design Project	4
Advanced Humanities or Social Science Elective		4
Credit Hours		16

Any Term

CILE-400	Culminating Undergraduate Experience: Thesis ¹	4
Credit Hours		4
Total Credit Hours		56

(Minimum) Total Credits Required for Program: 161

¹ Students are automatically registered for CILE-400 in a co-op term when they reach Junior II status.

Automotive Engineering Design ConcentrationFreshman I through Junior II Rep. Program Credit Total: **105**

Course	Title	Credit Hours
Senior I		
MECH-322	Fluid Mechanics	4
MECH-330 & MECH-331	Dynamic Systems with Vibrations and Dynamic Sys w Vibrations Lab	4
Advanced Humanities or Social Science Elective		4
Automotive Concentration Electives ^{1,2}		8
Credit Hours		20
Senior II		
LS-489	Senior Seminar: Leadership, Ethics, and Contemporary Issues	4
MECH-420	Heat Transfer	4
MECH-430 & MECH-431	Dynamic Systems with Controls and Dynamic Systems with Controls Lab	4
Automotive Concentration Elective		4
Credit Hours		16
Senior III		
MECH-422	Energy Systems Laboratory	4
MECH-448	Vehicle Design Project	4

Advanced Humanities or Social Science Elective		4
Automotive Concentration Elective		4
Credit Hours		16

Any Term

CILE-400	Culminating Undergraduate Experience: Thesis ³	4
Credit Hours		4
Total Credit Hours		56

(Minimum) Total Credits Required for Program: 161

- ¹ Elective courses may vary in lecture and/or laboratory credits and terms from those shown.
- ² Students select a Concentration related elective or Concentration related ME elective with approval of their ME Concentration Advisor.
- ³ Students are automatically registered for CILE-400 in a co-op term when they reach Junior II status.

Bioengineering Applications ConcentrationFreshman I through Junior I Representative Program Credit Total: **85**

Course	Title	Credit Hours
Junior II		
MECH-300	Computer Aided Engineering	4
MECH-310	Dynamics	4
MECH-320	Thermodynamics	4
MECH-350	Introduction to Bioengineering Applications	4
Advanced Humanities or Social Science Elective		4
Credit Hours		20
Senior I		
MATH-258	Probability and Statistics	4
MECH-322	Fluid Mechanics	4
MECH-330 & MECH-331	Dynamic Systems with Vibrations and Dynamic Sys w Vibrations Lab	4
Advanced Humanities or Social Science Elective		4
Bioengineering Concentration Related Elective ^{1,2}		4
Credit Hours		20
Senior II		
LS-489	Senior Seminar: Leadership, Ethics, and Contemporary Issues	4
MECH-420	Heat Transfer	4
MECH-430 & MECH-431	Dynamic Systems with Controls and Dynamic Systems with Controls Lab	4
Bioengineering Concentration Related Elective ^{1,2}		4
Credit Hours		16
Senior III		
MECH-422	Energy Systems Laboratory	4
MECH-495	Senior Design Project	4
Advanced Humanities or Social Science Elective		4
Bioengineering Concentration Related Elective ^{1,2}		4
Credit Hours		16

Any Term

CILE-400	Culminating Undergraduate Experience: Thesis ³	4
Credit Hours		4
Total Credit Hours		76

- ² Students select a Concentration related elective or Concentration related ME elective with approval of their ME Concentration Advisor.
- ³ Students are automatically registered for CILE-400 in a co-op term when they reach Junior II status.

(Minimum) Total Credits Required for Program: 161

- ¹ Elective courses may vary in lecture and/or laboratory credits and terms from those shown.
- ² Students select a Concentration related elective or Concentration related ME elective with approval of their ME Concentration Advisor.
- ³ Students are automatically registered for CILE-400 in a co-op term when they reach Junior II status.

Machine Design & Advanced Materials Concentration

Freshman I through Junior II Representative Program Credit Total: 105

Course	Title	Credit Hours
Senior I		
MECH-322	Fluid Mechanics	4
MECH-330 & MECH-331	Dynamic Systems with Vibrations and Dynamic Sys w Vibrations Lab	4
MECH-416	Introduction to Finite Element Analysis with Structural Applications	4
MECH-482	Mechanics and Design Simulation of Fiber-Reinforced Composite Materials	4
Advanced Humanities or Social Science Elective		4
Credit Hours		20
Senior II		
LS-489	Senior Seminar: Leadership, Ethics, and Contemporary Issues	4
MECH-420	Heat Transfer	4
MECH-430 & MECH-431	Dynamic Systems with Controls and Dynamic Systems with Controls Lab	4
Machine Design Concentration Elective ^{1,2}		4
Credit Hours		16
Senior III		
MECH-422	Energy Systems Laboratory	4
MECH-495	Senior Design Project	4
Advanced Humanities or Social Science Elective		4
Machine Design Concentration Elective ^{1,2}		4
Credit Hours		16
Any Term		
CILE-400	Culminating Undergraduate Experience: Thesis ³	4
Credit Hours		4
Total Credit Hours		56

(Minimum) Total Credits Required for Program: 161

- ¹ Elective courses may vary in lecture and/or laboratory credits and terms from those shown.