

MECHANICAL ENGINEERING, B.S. (BEHREND)

Begin Campus: Any Penn State Campus

End Campus: Erie

Program Description

Built upon a broad foundation in physics, chemistry, and mathematics, this major has the objective of educating graduates to be problem solvers. Graduates of this program will have had opportunities to learn about applying scientific principles, engineering analysis, and engineering design to solve unstructured problems that are typical of those found in mechanical engineering. The major helps prepare graduates for a lifelong productive career, whether they choose professional practice, graduate school, or some other career path. Graduates will have had opportunities to learn how to work with others toward a common goal, to clearly express their ideas in written and verbal form, and to be independent and capable of adapting to the continuously changing technology of the work environment.

After completing the fundamental science core, students may pursue their interest in mechanical engineering by studying fluid and solid mechanics, engineering materials and their properties, thermodynamics and heat transfer, computer-aided design, kinematics and dynamics of machine elements, machine design, finite elements, control systems, electricity, and electronic instrumentation and machinery. The students will be required to analyze and solve a significant mechanical engineering design problem during their senior year.

What is Mechanical Engineering?

Mechanical engineering is the largest and broadest engineering discipline. It uses a combination of physics, chemistry, mathematics, and materials science to study mechanical, fluid, and thermal systems. Mechanical engineers are problem solvers: They use their foundational knowledge to apply scientific and engineering methods to the design, construction, and testing of products and components to ensure that they are safe, reliable, and cost effective. Mechanical engineering differs from mechanical engineering technology in that it emphasizes the math and science behind the theoretical development of engineering analysis and design process principles rather than the application of these principles. Mechanical engineers design everything from athletic equipment, medical devices, theme park rides, and personal computers to engines and power plants.

You Might Like This Program If...

- You are a curious, creative problem solver.
- You are interested in engineering, math, chemistry, and physics.
- You are looking for a broad discipline with career flexibility.
- You enjoy working on team-based projects.

Entrance to Major

In addition to the Carnegie unit and minimum GPA requirements¹ described by University policies, all students applying for entrance to any of the engineering majors at Behrend, Berks, or Capital college must have at least a 2.0 cumulative GPA by the end of the semester prior to applying for entrance to the major and have completed, with a minimum grade of C: CHEM 110, MATH 140, MATH 141, and PHYS 211. These courses must

be completed by the end of the semester during which the admission to major process is carried out.

¹ In the event that the major is under enrollment control, a higher minimum cumulative grade-point average is likely to be needed.

Degree Requirements

For the Bachelor of Science degree in Mechanical Engineering, a minimum of 131 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	107-108

21 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 3 credits of GWS courses.

Per Senate Policy 83.80.5, the college dean or campus chancellor and program faculty may require up to 24 credits of coursework in the major to be taken at the location or in the college or program where the degree is earned.

Requirements for the Major

Each student must earn at least a grade of C in each 300- and 400-level course in the major field.

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Code	Title	Credits
Prescribed Courses		
CMPSC 200	Programming for Engineers with MATLAB	3
EDSGN 100S	Introduction to Engineering Design	3
EE 211	Electrical Circuits and Power Distribution	3
ENGL 202C	Effective Writing: Technical Writing	3
MATH 230	Calculus and Vector Analysis	4
PHYS 212	General Physics: Electricity and Magnetism	4
<i>Prescribed Courses: Require a grade of C or better</i>		
CHEM 110	Chemical Principles I	3
EMCH 211	Statics	3
EMCH 212	Dynamics	3
EMCH 213	Strength of Materials	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 220	Matrices	2-3
MATH 251	Ordinary and Partial Differential Equations	4
MATSE 259	Properties and Processing of Engineering Materials	3
ME 300	Engineering Thermodynamics I	3
ME 320	Fluid Flow	3
ME 345W	Instrumentation, Measurements, and Statistics	4
ME 349	Intermediate Mechanics of Materials	3
ME 357	System Dynamics	3

ME 365	Materials Testing Laboratory	1
ME 367	Machine Design	3
ME 380	Machine Dynamics	3
ME 410	Heat Transfer	3
ME 448	Engineering Design Concepts	3
ME 449	Mechanical Design Projects	3
ME 468	Engineering for Manufacturing	3
PHYS 211	General Physics: Mechanics	4

Additional Courses

ECON 102	Introductory Microeconomic Analysis and Policy	3
or ECON 104	Introductory Macroeconomic Analysis and Policy	

Select one of the following: 3

CHEM 111 & PHYS 214	Experimental Chemistry I and General Physics: Wave Motion and Quantum Physics	
CHEM 112	Chemical Principles II	
BIOL 141	Introduction to Human Physiology	

Supporting Courses and Related Areas

Supporting Courses and Related Areas: Require a grade of C or better

Select 13 credits of program elective courses from school-approved list ¹ 13

¹ These credits must be selected to fulfill the thematic requirements of the major.

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (<https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/>) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 3 credits
- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

Exploration

- **GN**, may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher: 6 credits

University Degree Requirements**First Year Engagement**

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The

advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/>)

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2023-24 academic year. To access previous years' suggested academic plans, please visit the archive (<https://bulletins.psu.edu/undergraduate/archive/>) to view the appropriate Undergraduate Bulletin edition (*Note: the archive only contains suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

Mechanical Engineering, B.S. at Erie Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits Spring	Credits
CHEM 110 ^{*#†}	3 CMPSC 200 [†]	3
CHEM 111 ^{†6}	1 ECON 102 or 104 [†]	3
EDSGN 100S ^{†3,5}	3 MATH 141 ^{*#††}	4
ENGL 15 or 30H [†]	3 MATH 220 ^{*†}	2
MATH 140 ^{*#††}	4 PHYS 211 ^{*#†}	4
General Education Course (GA/GH/GS)	3	

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16

Second Year

Fall	Credits Spring	Credits
EMCH 211 [*]	3 EE 211	3
MATH 230	4 EMCH 212 [*]	3
MATH 251 [*]	4 EMCH 213 [*]	3
PHYS 212 [†]	4 ME 300 [*]	3
General Education Course (GHW)	1.5 PHYS 214 ^{†6}	2
	General Education Course (GA/GH/GS)	3
	16.5	17

Third Year

Fall	Credits Spring	Credits
ENGL 202C ^{††}	3 CAS 100 ^{††}	
ME 320 [*]	3 ME 357 [*]	3
ME 345W ^{*4}	4 ME 365 ^{*7}	1
ME 349 [*]	3 ME 367 [*]	3
ME 380 ^{*7}	3 ME 410 [*]	3
	MATSE 259 ^{*7}	3
	16	13

Fourth Year

Fall	Credits Spring	Credits
ME 448 ^{*1}	3 ME 449 ^{*2}	3
ME 468 [*]	3 Program Elective (School Approved List) [*]	3
Lab Elective (300, 400-Level) [*]	1 Program Elective (School Approved List) [*]	3
Program Elective (School Approved List) [*]	3 General Education Course (GA/GH/GS)	3
Program Elective (School Approved List) [*]	3 General Education Course (GA/GH/GS)	3
General Education Course (GA/GH/GS)	3 General Education Course (GHW)	1.5
	16	16.5

Total Credits 128

* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

¹ The following course is only offered in the **FALL** semester: ME 448

² The following courses are only offered in the **SPRING** semester: ME 449

³ Course will satisfy First-Year Seminar requirement.

⁴ Course will satisfy Writing Across the Curriculum requirement.

⁵ Students starting at a location other than Penn State Behrend must take EDSGN 100 plus a seminar course.

⁶ Interested students may substitute BIOL 141 or CHEM 112 for both CHEM 111 and PHYS 214.

⁷ ME 380 or the combination of MATSE 259 and ME 365 can be taken in either semester of the Third Year.

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

School-Approved Electives for Mechanical Engineering: This elective list is subject to change.

Mechanical Engineering students at Behrend are required to take four 3-credit courses and one 1-credit lab (13 total credits) of technical electives. The courses must be selected from one of the following two thematic areas:

Technical

Take one Lab Course:

- ME 308 Fluid Flow and Heat Transfer Laboratory
- ME 424 Additive Manufacturing Lab
- ME 465 Introduction to Manufacturing Laboratory
- ME 492

Take two courses from Group 1:

- BME 402 Biomedical Instrumentation and Measurements
- BME 443 Biomedical Materials
- EMCH 471 Engineering Composite Materials
- ME 370 Vibration of Mechanical Systems
- ME 401 Refrigeration and Air Conditioning
- ME 408 Energy Systems
- ME 428 Applied Computational Fluid Dynamics
- ME 467 Applied Finite Element Analysis
- ME 469 Metallic Manufacturing Processes
- ME 491 Bioengineering Applications of Mechanical Engineering

Take one course from Group 2:

- Any course in Group 1
- BME 406 Medical Imaging
- IE 405 Deterministic Models in Operations Research
- IE 456 Industrial Robot Applications
- IE 470 Manufacturing System Design and Analysis
- MATH 412 Fourier Series and Partial Differential Equations
- MATH 449 Applied Ordinary Differential Equations
- MATH 455 Introduction to Numerical Analysis I
- MATH 456 Introduction to Numerical Analysis II
- MATH 482 Mathematical Methods of Operations Research
- PHYS 400 Intermediate Electricity and Magnetism
- PHYS 419 Theoretical Mechanics

- PHYS 458 Intermediate Optics
- STAT 414 Introduction to Probability Theory

Take one course from Group 3:

- Any course in Group 1 or 2
- IE 302 Engineering Economy
- ME 494 Research Project*
- ME 495 Internship* (2 rotations required)
- ME 496 Independent Studies*
- ME 497 Special Topics*
- MET 457 Lean Manufacturing
- MGMT 409 Project Management for Non-business Majors
- PSYCH 444 Engineering Psychology (fall, NOTE: requires PSYCH 100)
- QC 450 Quality Control and Quality Improvement

*Selection of ME 494-ME 497 courses require written approval of the program coordinator.

Engineering Management

Take one Lab Course:

- ME 308 Fluid Flow and Heat Transfer Laboratory
- ME 424 Additive Manufacturing Lab
- ME 465 Introduction to Manufacturing Laboratory
- ME 492

Take the following two courses:

- MGMT 409 Project Management for Non-business Majors
- IE 302 Engineering Economy

Take two additional courses from the following list:

- BME 402 Biomedical Instrumentation and Measurements
- BME 406 Medical Imaging
- BME 443 Biomedical Materials
- EMCH 471 Engineering Composite Materials
- IE 405 Deterministic Models in Operations Research
- IE 456 Industrial Robot Applications
- IE 470 Manufacturing System Design and Analysis
- MATH 482 Mathematical Methods of Operations Research
- ME 370 Vibration of Mechanical Systems
- ME 401 Refrigeration and Air Conditioning
- ME 408 Energy Systems
- ME 428 Applied Computational Fluid Dynamics
- ME 467 Applied Finite Element Analysis
- ME 469 Metallic Manufacturing Processes
- ME 491 Bioengineering Applications of Mechanical Engineering

Students in the Engineering Management thematic who also complete either the Operations and Supply Chain Management minor or the Technical Sales minor may substitute 400-level SCM courses for the 6 additional credits of 400-level IE, MATH or ME courses.

Advising Notes:

- Only students who have gone through the entrance-to-major process and have been accepted into this major may register for junior and senior-level ME courses.

Career Paths

Because every industry values a mechanical engineer's problem-solving capabilities, you'll enjoy tremendous career flexibility in disciplines as varied as research, manufacturing, product and systems design and testing, health care, energy, the military, transportation, and consumer products. A mechanical engineering education also is excellent preparation for technical management, business, law, or technical sales.

Careers

Typical entry-level careers for mechanical engineering graduates are applications engineer, design engineer and mechanical design engineer, test engineer, equipment installation engineering, facilities technician, stress analysis engineer, product development engineer, and project engineer.

Opportunities for Graduate Studies

Graduate programs in mechanical engineering delve more deeply into areas of specialization such as automotive engineering, robotics, advanced manufacturing, thermal science, computational fluid mechanics, combustion modeling, or biomechanical engineering.

Professional Resources

- American Society of Mechanical Engineers (<https://www.asme.org>)
- Society of Women Engineers (<https://swe.org>)
- National Society of Black Engineers (<https://www.nsbe.org>)

Accreditation

The Bachelor of Science in Mechanical Engineering at Penn State Behrend is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the General Criteria and the Mechanical Engineering Program Criteria.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

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