

MECHANICAL ENGINEERING, B.S. (ALTOONA)

Begin Campus: Any Penn State Campus

End Campus: Altoona

Program Description

Mechanical Engineering is one of the broadest engineering disciplines and is central in many new technological developments. Mechanical engineers create things that help improve the health, happiness and safety of our everyday lives such as biomedical devices, aircraft and cars, and ways to store renewable energies. Mechanical engineering is divided into two broad areas: mechanical systems and thermal systems. Mechanical systems include the design of mechanisms and the analysis of the strength and wear of materials. Thermal systems include methods of energy conversions, heat transfer and fluid flow.

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 think outside the box to develop solutions to everyday problems. Mechanical engineers contribute to our health, happiness and safety, and often change the way we think about the world.

Entrance to Major

In order to be eligible for entrance to this major, students must satisfy the following requirements by the end of the semester during which the admission to major process is carried out:

- 29-55 cumulative credits (excludes transfer and AP credits)
- completed with a grade of C or better: CHEM 110, EDSGN 100, MATH 140, MATH 141, and PHYS 211
- earned a minimum cumulative grade-point average (GPA) of 2.60

* In the event that the major is under enrollment control, a higher minimum cumulative grade-point average is likely to be needed and students must be enrolled in the College of Engineering or Division of Undergraduate Studies at the time of confirming their major choice.

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	113-114

27 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; 9 credits of GWS courses.

Requirements for the Major

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		
IE 312	Product Design and Manufacturing Processes	3
MATH 231	Calculus of Several Variables	2
MATSE 259	Properties and Processing of Engineering Materials	3
ME 390	Academic and Career Development for Mechanical Engineers	0.5
ME 490	Professional Development for Mechanical Engineers	0.5

Prescribed Courses: Require a grade of C or better

CHEM 110	Chemical Principles I	3
EDSGN 100	Cornerstone Engineering Design	3
EMCH 211	Statics	3
EMCH 212	Dynamics	3
EMCH 213	Strength of Materials	3
ENGL 202C	Effective Writing: Technical Writing	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
ME 300	Engineering Thermodynamics I	3
ME 320	Fluid Flow	3
ME 330	Computational Tools	3
ME 340	Mechanical Engineering Design Methodology	3
ME 348	Circuit Analysis, Instrumentation, and Statistics	3
ME 360	Mechanical Design	3
ME 370	Vibration of Mechanical Systems	3
ME 410	Heat Transfer	3
ME 435	Mechanical Engineering Systems Lab	3
ME 450	Modeling of Dynamic Systems	3
ME 454	Mechatronics	3
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4

Additional Courses

Select 1 credit of First-Year Seminar		1
CMPSC 200	Programming for Engineers with MATLAB	3
or CMPSC 201	Programming for Engineers with C++	
ME 440W	Mechanical Systems Design Project	3
or ME 441W	Thermal Systems Design Project	

Select 3 credits from the following: 3

BIOL 141	Introduction to Human Physiology	
BIOL 161	Human Anatomy and Physiology I - Lecture	
CHEM 111 & PHYS 214	Experimental Chemistry I and General Physics: Wave Motion and Quantum Physics	
CHEM 112	Chemical Principles II	

Select 3 credits from the following: 3

ECON 14	Principles of Economics	
ECON 102	Introductory Microeconomic Analysis and Policy	
ECON 104	Introductory Macroeconomic Analysis and Policy	

Additional Courses: Require a grade of C or better

CAS 100A or CAS 100B	Effective Speech	3
ENGL 15 or ENGL 30H	Rhetoric and Composition Honors Rhetoric and Composition	3

Supporting Courses and Related Areas

Select 3 credits in a 400-level ME Technical Elective course from department list excluding ME 410, ME 435, ME 440W, ME 441W, ME 442W, ME 443W, ME 450, ME 454, ME 490, ME 494, and ME 496 3

Select 6 credits in Engineering Technical Elective courses from department list 6

Select 3 credits in General Technical Elective courses from department list ^{1,2} 3

¹ Three rotations of Engr Co-op (ENGR 295, ENGR 395, and ENGR 495) can be used as 3 credits of GTE.

² Students who complete Basic ROTC may substitute 6 ROTC credits for 3 credits of GTE and 3 credits of GHW.

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 Altoona 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
First-Year Seminar	1	Science Elective (see below)	3
ENGL 15 ^{‡†}	3	ECON 102 or 104 (GS)	3

EDSGN 100 ^{*#}	3	MATH 141 ^{*‡#†}	4
General Education Course (GA, GH, or GS) [†]	3	General Education Course (GA, GH, or GS) [†]	3
MATH 140 ^{*‡#†}	4	PHYS 211 ^{*#†}	4
CHEM 110 ^{*#†}	3		
	17		17

Second Year

Fall	Credits	Spring	Credits
CMPSC 200	3	EMCH 212 [*]	3
CAS 100A or 100B ^{‡†}	3	EMCH 213 [*]	3
EMCH 211 [*]	3	ME 300 [*]	3
MATH 251 [*]	4	MATH 231	2
PHYS 212 ^{*†}	4	MATH 220	2
		General Education Course (GA, GH, GS) [†]	3
	17		16

Third Year

Fall	Credits	Spring	Credits
IE 312	3	ME 454 [*]	3
MATSE 259	3	ENGL 202C ^{‡†}	3
ME 330 [*]	3	ME 340 [*]	3
ME 370 [*]	3	ME 360 [*]	3
ME 348 [*]	4	ME 320 [*]	3
ME 390	0.5	ME 490	0.5
		General Education Course (GHW) [†]	1.5
	16.5		17

Fourth Year

Fall	Credits	Spring	Credits
Engineering Technical Elective (ETE)	3	ME 440W	3
ME 410 [*]	3	General Education Course (GA, GH, or GS) [†]	3
ME 450 [*]	3	General Education Course (GA, GH, or GS) [†]	3
Mechanical Engineering Technical Elective (METE)	3	General Technical Elective (GTE)	3
ME 315, 325, 355, 375, or EMCH 316 (Mechanical Engineering Lab)	1	ME 315, 325, 355, 375, or EMCH 316 (Mechanical Engineering Lab)	1
General Education Course (GHW) [†]	1.5	Engineering Technical Elective (ETE)	3
	14.5		16

Total Credits 131

- * 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

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.

All incoming Schreyer Honors College first-year students at University Park will take ENGL 137H/CAS 137H in the fall semester and ENGL 138T/CAS 138T in the spring semester. These courses carry the GWS designation and satisfy a portion of that General Education requirement. If the student's program prescribes GWS these courses will replace both ENGL 15/ENGL 30H and CAS 100A/CAS 100B/CAS 100C. Each course is 3 credits.

College Notes:

- Science elective choices: CHEM 112, BIOL 141, or CHEM 111 **and** PHYS 214 (3 credits total)
- An Engineering Technical Elective (<https://www.me.psu.edu/students/undergraduate/curriculum-electives.aspx>) is any three credit, 400-level engineering course NOT required for the major.
- To graduate, two of the following lab courses must be taken: ME 315, ME 325, ME 355, ME 375, and EMCH 316.
- A Mechanical Engineering Technical Elective (METE) is any three# credit, 400#level ME course that is not required for the major. ME 494 or ME 496 may not be used.
- Three credits of co-op may also be used for the GTE after completion of three co-op rotations, internships, or a combination of both.
- Students must take 3 credits of United States Cultures (US) and 3 credits of International Cultures (IL) and 6 credits integrative studies (Inter-Domain or Linked) in conjunction with General Education GA, GH, GS courses courses.

Career Paths

University Park: Penn State's mechanical engineering curriculum offers many opportunities to gain hands-on experience in the profession. At the University Park campus, our experiential laboratory components and design course sequence are tailored to prepare you to enter industry or graduate school. The design component of the curriculum culminates in an industry-sponsored senior design project, in which you'll work in a multidisciplinary team to solve a real-world issue. Our laboratory course encourages higher-order thinking skills. Students explore fundamental mechanical engineering knowledge through the lens of solving real-world problems in topics such as energy and sustainability, autonomy and robotics, and machine learning.

Penn State Scranton: Penn State Scranton is one of only five campuses that offer the mechanical engineering major. The Bachelor of Science in Mechanical Engineering provides students with the necessary training and education to become technical leaders in various industrial, commercial, consulting, and governmental organizations.

Careers

University Park: Penn State's mechanical engineering program at the University Park campus has had a long and successful history. Mechanical engineering was introduced at Penn State in 1881. Graduates from our department go on to work in a diverse range of industries for large multinational companies and small local firms. Mechanical engineers are well prepared to work as managers due to their broad backgrounds and creative problem-solving skills. Historically, our graduates regularly accept positions at Fortune 500 companies, such as Ingersoll Rand, Boeing, Toshiba-Westinghouse, General Electric, Lockheed Martin, Northrop Grumman, Dow Chemical, ExxonMobil, Procter & Gamble, United Technologies Corporation, and Johnson & Johnson.

Penn State Scranton: The mechanical engineering program at Penn State Scranton prepares you for entering the mechanical engineering industry or going on to graduate school. Mechanical engineering is called "*the mother of all engineering majors*" for a reason; it gives the student exposure to many different disciplines. Mechanical engineering graduates get jobs in many different types of industries both locally, nationally, and globally. Examples of career opportunities for mechanical engineers are:

- design engineers
- research engineers
- biomedical equipment
- analyst
- entrepreneur
- test engineer
- rocket engineer
- project manager
- sales engineer

According to the Bureau of Labor Statistics mechanical engineers earn an average starting salary of \$70,000 and mid-career salary of \$100,000.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE MECHANICAL ENGINEERING PROGRAM (<https://www.me.psu.edu/students/undergraduate/what-is-an-engineer.aspx#MechanicalEngineer>)

Opportunities for Graduate Studies

University Park: If you want to work with renowned faculty, scientists, and engineers, the Department of Mechanical Engineering located at the University Park campus is a great place for you. We are one of the nation's largest engineering departments with more than 60 full-time faculty, numerous research staff, visiting faculty, scientists, and more than 300 graduate students. Research funding comes from industry and government sources, including the Department of Energy, the National Science Foundation, the Army, the Air Force, and NASA. Our graduates are known for their ability to find high-level positions in national research centers and laboratories as well as postdoctoral and tenure-track positions in top-tier research universities.

Penn State Scranton: Mechanical Engineering graduates of Penn State Scranton campus are eligible to continue for a master's degree at many US colleges and universities.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<https://www.me.psu.edu/research/>)

Professional Resources

- American Society of Mechanical Engineers (ASME) (<https://sites.psu.edu/asmeuniversitypark/>)
- Professional Licensure/Certification Disclosures by State (<https://app.powerbi.com/view/?r=eyJrljoiNjAxYmU1N2MtNzRmZC00NjRmLWJIMzAtYmQ1NDliYjU1MjUzliwidCI6IjdjZjQ4ZDQ1LTNkZGItdm40S1h0WMxLWMxMTU1MjZlYjUyZSIsImMiOjF9>)

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