

POLYMER ENGINEERING AND SCIENCE, B.S.

Begin Campus: Any Penn State Campus

End Campus: Erie

Program Description

The PES degree will be built upon the established Penn State University Engineering Baccalaureate degree foundations, with emphasis in the behavior and manipulation of bulk polymer materials. The relationships between polymer processing and chemical and micro structure/property development will be emphasized and a comprehensive understanding of bulk, micro and nano polymer characterization techniques will be stressed. Polymer composite formulation, including polymer/filler interfacial chemistry and failure analysis of polymer products are also important aspects of the PES graduate principal knowledge.

What is Polymer Engineering and Science?

Simply put, polymer engineers and scientists study the materials that make up our world. With the B.S. in Polymer Engineering and Science, you'll learn to analyze the character and structure of materials and use that knowledge to design innovative new products.

You Might Like This Program If...

- You like chemistry, math, and physics.
- You like working on team-based projects.
- You're curious about why materials behave the way they do.
- You've ever wondered how polymers are made and then used to create other things.

Entrance to Major

To be eligible for entrance to the Polymer Engineering and Science major, a student must have:

1. attained at least a 2.00 cumulative grade-point average
2. completed MATH 140 and MATH 141, CHEM 110, and PHYS 211 and earned a grade of C or better in each of these courses

Degree Requirements

For the Bachelor of Science degree in Polymer and Engineering Science, a minimum of 130 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	112-113

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

A grade of C or better is required for all courses in the major. To graduate, a student enrolled in the major must earn at least a C grade 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		
<i>Prescribed Courses: Require a grade of C or better</i>		
CAS 100	Effective Speech	3
CHEM 110	Chemical Principles I	3
CHEM 111	Experimental Chemistry I	1
CHEM 112	Chemical Principles II	3
CHEM 113	Experimental Chemistry II	1
CHEM 210	Organic Chemistry I	3
CMPSC 200	Programming for Engineers with MATLAB	3
EDSGN 100S	Introduction to Engineering Design	3
EMCH 211	Statics	3
EMCH 213	Strength of Materials	3
EMCH 315	Mechanical Response of Engineering Materials	2
ENGL 15	Rhetoric and Composition	3
ENGL 202C	Effective Writing: Technical Writing	3
IE 424	Process Quality Engineering	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 220	Matrices	2-3
MATH 231	Calculus of Several Variables	2
MATH 251	Ordinary and Partial Differential Equations	4
MATSE 202	Introduction to Polymer Materials	3
MATSE 445	Thermodynamics, Microstructure, and Characterization of Polymers	3
MATSE 447	Rheology and Processing of Polymers	3
PES 213	Polymer Chemistry Lab	2
PES 305	Fluids/Heat Transfer	3
PES 320	Polymer Sustainability	3
PES 323	Rheology Lab	2
PES 340	Polymer Characterization	2
PES 341	Polymer Characterization Lab	1
PES 351	Polymer Processing Lab	1
PES 365	Processing for Polymer Product Performance	3
PES 440	Failure Analysis and Characterization	3
PES 441	Failure Analysis Lab	1
PES 446W	Senior Project 1	1
PES 447W	Senior Project 2	1
PES 448W	Senior Project 3	1
PES 460	Polymer Formulation for Processing and Design	3
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4

Additional Courses

<i>Additional Courses: Require a grade of C or better</i>		
ECON 102	Introductory Microeconomic Analysis and Policy	3
or ECON 104	Introductory Macroeconomic Analysis and Policy	

Supporting Courses and Related Areas

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

Students majoring in Polymer Engineering and Science must complete a total of 12 credits (4 courses) of 400-level PES technical electives from the approved list. (Except where noted, courses taken to satisfy General Education requirements may not be used to satisfy PES technical elective requirements.) 12

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/>)

Erie

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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 2024-25 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.

Polymer Engineering and Science, 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 CHEM 112 ^{*†}	3
CHEM 111 ^{*†}	1 CHEM 113 ^{*†}	1
ECON 102 or 104 ^{*†}	3 CMPSC 200 ^{*††}	3
EDSGN 100S [*]	3 MATH 141 ^{*†#†}	4
ENGL 15 ^{*††}	3 PHYS 211 ^{*#†}	4
MATH 140 ^{*†#†}	4 General Education Course (GA/GH/GS)	3
	17	18

Second Year

Fall	Credits Spring	Credits
CAS 100 ^{*††}	3 EMCH 211 [*]	3
CHEM 210 [*]	3 IE 424 [*]	3
MATH 251 [*]	4 MATH 220 ^{*††}	2
PHYS 212 ^{*†}	4 MATH 231 [*]	2
General Education Course (GA/GH/GS)	3 MATSE 202 [*]	3
	PES 213 [*]	2
	17	15

Third Year

Fall	Credits Spring	Credits
EMCH 213 [*]	3 EMCH 315 [*]	2
MATSE 445 [*]	3 ENGL 202C ^{*††}	3
PES 320 [*]	3 MATSE 447 [*]	3
PES 340 [*]	2 PES 305 [*]	3
PES 341 [*]	1 PES 323 [*]	2
PES 365 [*]	3 PES 351 [*]	1
General Education Course (GHW)	1.5 PES 446W [*]	1
	General Education Course (GA/GH/GS)	3
	16.5	18

Fourth Year

Fall	Credits Spring	Credits
PES 440 [*]	3 PES 448W [*]	1
PES 441 [*]	1 Technical Elective [*]	3
PES 447W [*]	1 Technical Elective [*]	3
PES 460 [*]	3 General Education Course (GA/GH/GS)	3
Technical Elective [*]	3 General Education Course (GA/GH/GS)	3

Technical Elective [*]	3 General Education Course (GHW)	1.5
	14	14.5

Total Credits 130

* 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.

School-Approved Electives for Polymer Engineering and Science

- Students majoring in Polymer Engineering and Science must complete a total of 12 credits (4 courses) of 300- or 400-level PES technical electives from the approved list with a grade of C or better. (Except where noted, courses taken to satisfy General Education requirements may not be used to satisfy PES technical elective requirements.)
- 300- and 400-level courses can be selected from the following subjects – BIOL, BMB, BME, CHEM, CMPEN, CMPET, CMPSC, EE, EET, MATH, ME, MET, MCRB, PES, PHYS, PLET, STAT, and SWENG.

Career Paths

The global polymers market is growing—and so is the demand for polymer engineers and scientists. Polymers are needed in a broad variety of industries, including medicine, manufacturing, and sustainability.

Careers

Polymer Engineering and Science graduates work in a variety of industries. With a B.S. degree, they can work as polymer engineers, polymer scientists, process engineers, quality engineers, manufacturing engineers, product failure analysts, material engineers, and polymer test specialists. They are employed at organizations like GM, GE, Avient, Boeing, Shell, Abbott Laboratories, and the U.S. Department of Energy.

MORE INFORMATION ABOUT POTENTIAL CAREER PATHS FOR GRADUATES OF THE POLYMER ENGINEERING AND SCIENCE PROGRAM (<https://behrend.psu.edu/school-of-engineering/academic-programs/polymer-engineering-and-science/>)

Opportunities for Graduate Studies

With the hands-on research experiences you'll get while pursuing Penn State Behrend's B.S. in Polymer Engineering and Science, you'll be well-prepared for future academic pursuits. You'll build your resume, work

alongside of established engineers solving real-world problems, and set yourself apart from your peers, leaving you ready to pursue an advanced degree.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES
(<https://behrend.psu.edu/school-of-engineering/academic-programs/polymer-engineering-and-science/>)

Contact

Erie

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