ENVIRONMENTAL SYSTEMS ENGINEERING, B.S.

Begin Campus: Any Penn State Campus

End Campus: University Park

Program Description

The program is unique as it is designed to address critical environmental, safety and health problems of the basic industries such as those involved in the extraction, conversion, and utilization of energy and mineral resources. The courses are sequenced so that students acquire an appropriate blend of theory, applications, and design and are equipped with the fundamentals necessary to maintain lifelong professional growth. Graduates are prepared to enter both the private and public sectors as environmental systems engineers or health and safety engineers or to pursue further education at the graduate level.

During the first two years, the program shares many common features with other more traditional engineering disciplines. Students then take a series of special courses that introduce engineering concepts in the extractive and process industries. Process engineering and a variety of solid-solid, solid-fluid, and fluid-fluid separations play a major and often dominant role in the prevention and/or remediation of environmental damage or the prevention of health and safety hazards resulting from industrial activity. Students can specialize in particular problems associated with air, land, water or environmental health and safety engineering through selection from an extensive list of relevant elective courses. The curriculum is structured so as to integrate design concepts into the various subject areas covered in the program.

The human, societal, economic, ethical, and regulatory aspects of the industrial impact on the environment and on the workers themselves are addressed through a combination of specific courses and components of other more general courses. This aspect of the program is designed to provide students with a deeper understanding, both of the impact of environmental degradation on society and of the effects on industrial activity of society's demands for protection of workers and the environment. The program culminates with the capstone design course, which is an integrated, problem-based, multi-faceted project in which students, working in a team setting, utilize fundamental concepts to design an environmental remediation system or an environmental health and safety protection system (or incorporate these design requirements into other associated designs).

What is Environmental Systems Engineering?

Protecting the health of workers and the environment, often during challenging projects, is the job of an environmental systems engineer. They understand, demonstrate, and apply systems engineering principles to environmental issues related to industrial activities and to the extraction of energy and mineral resources. These engineers work closely with project leaders, utilizing process systems engineering and environmental systems approaches, to evaluate and address the environmental impact of projects. Often these engineers work in the government sector and offer expertise in big-picture projects facing cities, regions, nations, and the globe.

You Might Like This Program If...

- You want to minimize the environmental impact of industrial activities and protect the health of workers.
- You have strong math, science, and engineering skills and want to apply that to improving worker and environmental safety.

Entrance to Major

In addition to the minimum grade point average (GPA) requirements described in the University Policies, the Environmental Systems Engineering entrance-to-major requirement must also be completed with a minimum grade of C: MATH 140, MATH 141, MATH 251, PHYS 211, PHYS 212, CHEM 110.

Degree Requirements

For the Bachelor of Science degree in Environmental Systems Engineering, a minimum of 128 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	110

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; 9 credits of GN courses; 3 credits of GS 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/students/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/).

Code	Title	Credits
Prescribed Courses		
CHEM 111	Experimental Chemistry I	1
CHEM 112	Chemical Principles II	3
EGEE 470	Air Pollutants from Combustion Sources	3
EMCH 211	Statics	3
EMCH 212	Dynamics	3
EME 210	Data Analytics for Energy Systems	3
EME 460	Geo-resource Evaluation and Investment Analysis	3
ENVSE 400	Safety Engineering	3
ENVSE 404W	Surface and Interfacial Phenomena in Environmental Systems	4
ENVSE 406	Sampling and Monitoring of the Geo-Environment	3
ENVSE 408	Contaminant Hydrology	3
ENVSE 412	Environmental Systems Engineering Laboratory	1
ENVSE 450	Environmental Health and Safety	3
ENVSE 470	Engineering Risk Analysis	3
ENVSE 480	Environmental Systems Engineering Process Design	3
GEOSC 452	Hydrogeology	3
MICRB 106	Elementary Microbiology	3
Prescribed Courses: Require a grade of C or better		
CE 370	Introduction to Environmental Engineering	3
CHEM 110	Chemical Principles I	3

EME 301	Thermodynamics in Energy and Mineral Engineering	3
EME 303	Fluid Mechanics in Energy and Mineral Engineering	3
EMSC 100S	Earth and Mineral Sciences First-Year Seminar [1]	3
ENGL 202C	Effective Writing: Technical Writing	3
ENVSE 427	Pollution Control in the Process Industries	3
GEOSC 1	Physical Geology	3
MATH 251	Ordinary and Partial Differential Equations	4
MNPR 301	Elements of Mineral Processing	3
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4
Additional Courses		
CHEM 202	Fundamentals of Organic Chemistry I	3
or CHEM 210	Organic Chemistry I	
GEOG 160	Mapping Our Changing World	3
or GEOG 260	Geographic Information in a Changing World: Introduction to GIScience	
Additional Courses: Require a grade of C or better		
ESL 15	ESL Composition for American Academic Communication II	3
or ENGL 30H	Honors Rhetoric and Composition	
or ENGL 15	Rhetoric and Composition	
MATH 140	Calculus With Analytic Geometry I	4
or MATH 140G	Calculus with Earth and Mineral Sciences Applications I	
MATH 141	Calculus with Analytic Geometry II	4
or MATH 141G	Calculus with Earth and Mineral Sciences Applications II	
Supporting Courses and Related Areas		
Select 6 credits in consultation with adviser. Students who complete Basic ROTC may substitute 6 credits of ROTC for 3 credits of GHW courses and 3 credits of Supporting Courses and Related Areas.		6

[1] The following substitutions are allowed for students attending campuses where the indicated course is not offered: CAS 100 can be substituted for EMSC 100S.

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/students/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/)). For more information, check the Suggested Academic Plan for your intended program.

Integrated B.S. in Environmental Systems Engineering and M.S. in Energy and Mineral Engineering

Undergraduate degree available at the following campuses: University Park

Graduate degree available at the following campuses: University Park

Requirements for the Integrated B.S. in Environmental Systems Engineering and M.S. in Energy and Mineral Engineering can be found in the Graduate Bulletin (https://bulletins.psu.edu/graduate/programs/majors/energy-mineral-engineering/#integratedundergradgradprogramstext).

Program Educational Objectives

Our graduates will attain one or more of the following:

- Careers as practicing environmental systems engineers engaged in the identification and mitigation of a broad range of environmental, health, and safety risks associated with the resource recovery, process, and general industries, through the effective design and implementation of economic engineering systems.
- Advancement to management and leadership positions devoted to addressing critical environmental-related challenges of the basic industries, especially those involved with the extraction, recovery, conversion, and utilization of energy and mineral resources.
- Advanced degrees, training, and professional licensure or certification in environmental systems engineering or related technical disciplines

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Environmental Systems Engineering program is designed to enable students to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. 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
3. Communicate effectively with a range of audiences
4. 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
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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/students/policies-and-rules-for-undergraduate-students/32-00-advising-policy/)

University Park

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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 2025-26 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.

Environmental Systems Engineering, B.S. at All Campuses

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
MATH 140 or 140G (GQ)[*‡#†]	4	MATH 141 or 141G (GQ)[*‡#†]	4
CHEM 110 (GN)[*#†]	3	CHEM 112 (GN)	3
CHEM 111[†]	1	PHYS 211 (GN)[*#†]	4
EMSC 100S (or CAS 100 by substitution) (GWS)[‡†1]	3	ENGL 15, 30H, or ESL 15 (GWS)[‡†]	3
General Education Knowledge Domain	3		
	14		**14**

Second Year

Fall	Credits	Spring	Credits
PHYS 212 (GN)*†#	4	CHEM 202	3
EMCH 211	3	EME 210 (Take through DLC if not at UP)	3
MATH 251*#	4	EMCH 212	3
GEOSC 1*	3	MICRB 106	3
GEOG 160 or 260 (GS)†	3	General Education Knowledge Domain (GA;IL) (GH;IL) (GS;IL)	3
	17		**15**

Third Year

Fall	Credits	Spring	Credits
EME 301*	3	MNPR 301 (SPRING ONLY)*	3
EME 303 (FALL ONLY)*	3	ENGL 202C (GWS)*‡†	3
GEOSC 452	3	EGEE 470 (SPRING ONLY)	3
CE 370*	3	ENVSE 406 (SPRING ONLY)	3
ENVSE 400 (FALL ONLY)	3	EME 460	3
General Education Knowledge Domain (GA;US) (GH;US) (GS;US)	3	ENVSE 412 (SPRING ONLY)	1
		General Education Health and Wellness (GHW)[2]	1.5
	18		**17.5**

Fourth Year

Fall	Credits	Spring	Credits
ENVSE 404W (WAC) (FALL ONLY)	4	ENVSE 480 (SPRING ONLY)	3
ENVSE 427 (FALL ONLY)*	3	ENVSE 470 (SPRING ONLY)	3
ENVSE 450 (FALL ONLY)	3	ENVSE 408 (SPRING ONLY)	3
Supporting Course from approved department list[2]	3	Supporting course from approved department list[2]	3
General Education Knowledge Domain	3	General Education Knowledge Domain	3
General Education Health and Wellness (GHW)[2]	1.5		
	17.5		**15**

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] Students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100A, CAS 100B, or CAS 100C (GWS) for EMSC 100S (GWS). EMSC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.

[2] Students who complete Basic ROTC may substitute 6 credits of ROTC for 3 credits of GHW courses and 3 credits of Supporting Courses and Related Areas.

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.

Advising Notes:

- To enter the major, students need a minimum 2.00 grade point average, third semester standing, and a C or better grade in MATH 140, MATH 141, MATH 251, CHEM 110, PHYS 211, and PHYS 212.
- Courses required for the major may be offered fall semester only, spring semester only, or both fall and spring semesters. Consult with your adviser and department to discuss your academic progress and course sequencing.
- Approved Electives for "Related Areas": https://www.eme.psu.edu/undergraduate/academics/undergraduate-programs/envse (https://www.eme.psu.edu/undergraduate/academics/undergraduate-programs/envse/).

Career Paths

Graduates are prepared to enter both the private and public sector as environmental systems engineers, or health and safety engineers or to pursue further education at the graduate level.

Careers

Our graduates may be candidates for careers in a wide range of industries in both the private and public sector. They may be employed to address the environmental or health and safety problems related to extraction, conversion, and utilization of energy and mineral resources while being stewards of the environment.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE ENVIRONMENTAL SYSTEMS ENGINEERING PROGRAM (https://www.eme.psu.edu/recruiting-careers/)

Opportunities for Graduate Studies

Graduates may be well suited to pursue graduate-level studies. Further study toward an M.S. or Ph.D. can lead to research, university, or management positions.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (https://www.eme.psu.edu/graduate/)

Professional Resources

- Society of Environmental Systems Engineers (SESE) (https://orgcentral.psu.edu/organization/society-of-environmental-systems-engineers/)
- Engineers Without Borders (https://sites.psu.edu/psuewb/)

Accreditation

The Bachelor of Science in Environmental Systems Engineering at University Park is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Environmental Engineering and Similarly Named Engineering Programs.

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://opair.psu.edu/plc/dashboard/) interactive map.

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