You Might Like This Program If...

- You are interested in, and excel at, science and math, and want to use your skills in these areas to research, develop, and design new products and processes in a wide variety of fields.
- You are interested in merging multidisciplinary resources to propose and develop innovative, enduring solutions and transforming the latest scientific discoveries into enabling new technologies.
- You’re seeking to link science with the engineering disciplines such as electrical, mechanical, chemical, civil, and biomedical.
- You want an engineering curriculum and degree that you can tailor to your interests including research at the undergraduate level.
- You are in the Schreyer Honors College and want a curriculum that will automatically satisfy all requirements of the Honors College.

Entrance to Major

In order to be eligible for entrance to this major, students must satisfy the following requirements:

- 29-55 cumulative credits (excludes transfer and AP credits)
- completed with a grade of C or better: EDSGN 100, CHEM 110, MATH 140, MATH 141, PHYS 211
- earned a minimum cumulative grade-point average (GPA) of 3.0

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.

Since Engineering Science is an honors program, admission is limited to students who attain a cumulative GPA of at least 3.0 by the end of the entrance to major semester. 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 Engineering Science, a minimum of 131 credits is required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>113</td>
</tr>
</tbody>
</table>

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.

For the non-Honors B.S. degree in Engineering Science, 131 credits and a 2.50 grade-point average are required. The Honors degree requires the same number of total credits but a minimum of 16 honors Jr./Sr. year credits and a higher grade-point average as determined by the faculty.

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

Knowledge Domains
- Arts (GA): 6 credits
- Health and Wellness (GHW): 3 credits
- Humanities (GH): 6 credits
- Social and Behavioral Sciences (GS): 6 credits
- Natural Sciences (GN): 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)
- Inter-Domain or Approved Linked Courses: 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 (http://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.

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 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 111</td>
<td>Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>EE 210</td>
<td>Circuits and Devices</td>
<td>4</td>
</tr>
<tr>
<td>EMCH 302H</td>
<td>Thermodynamics, Heat Conduction, and Principles of Modeling, Honors</td>
<td>4</td>
</tr>
<tr>
<td>ESC 312</td>
<td>Engineering Applications of Wave, Particle, and Ensemble Concepts</td>
<td>3</td>
</tr>
<tr>
<td>ESC 409</td>
<td>Senior Research and Design Project Preparation, Honors</td>
<td>1</td>
</tr>
<tr>
<td>ESC 410</td>
<td>Senior Research and Design Project II, Honors</td>
<td>3</td>
</tr>
<tr>
<td>ESC 411</td>
<td>Engineering Science Research Laboratory Experience</td>
<td>2</td>
</tr>
<tr>
<td>MATH 220</td>
<td>Matrices</td>
<td>2</td>
</tr>
<tr>
<td>MATH 230</td>
<td>Calculus and Vector Analysis</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 214</td>
<td>General Physics: Wave Motion and Quantum Physics</td>
<td>2</td>
</tr>
</tbody>
</table>

Prescribed Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110</td>
<td>Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>EDSGN 100</td>
<td>Cornerstone Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 202C</td>
<td>Effective Writing: Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>ESC 404</td>
<td>Analysis in Engineering Science</td>
<td>3</td>
</tr>
<tr>
<td>ESC 407</td>
<td>Computer Methods in Engineering Science, Honors</td>
<td>3</td>
</tr>
<tr>
<td>ESC 414M</td>
<td>Elements of Material Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Calculus With Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 251</td>
<td>Ordinary and Partial Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 211</td>
<td>General Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 212</td>
<td>General Physics: Electricity and Magnetism</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional Courses
Select 1 credit of First-Year Seminar

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPSC 201</td>
<td>Programming for Engineers with C++</td>
<td>3</td>
</tr>
<tr>
<td>or ESC 261M</td>
<td>Computational Methods in Engineering</td>
<td></td>
</tr>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 14</td>
<td>Principles of Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 102</td>
<td>Introductory Microeconomic Analysis and Policy</td>
<td></td>
</tr>
<tr>
<td>ECON 104</td>
<td>Introductory Macroeconomic Analysis and Policy</td>
<td></td>
</tr>
</tbody>
</table>

Additional Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS 100A</td>
<td>Effective Speech</td>
<td>3</td>
</tr>
<tr>
<td>or CAS 100B</td>
<td>Effective Speech</td>
<td></td>
</tr>
<tr>
<td>EMCH 210H</td>
<td>Statics and Strength of Materials, Honors</td>
<td>5</td>
</tr>
<tr>
<td>or EMCH 210</td>
<td>Statics and Strength of Materials</td>
<td></td>
</tr>
</tbody>
</table>
designed to enable students to:

able to do by the time of graduation. The Engineering Science program is

Student Outcomes

The expected accomplishments of Engineering Science graduates in the

Program Educational Objectives

The expected accomplishments of Engineering Science graduates in the

1. acquire and apply new knowledge through lifelong learning activities
   including, but not limited to, masters, doctorate, medical, and law
   degrees, continuing education, leadership development, management
   training, innovation/entrepreneurship, and global involvement/
   awareness;
2. engage in practice in a wide variety of fields including, but not limited
to, electrical systems, electronics, mechanical systems, materials
   development, forensics, biomaterials, medicine, law, and business in
   industry, academia and government;
3. research, develop, design and/or utilize new products, processes,
   materials, devices, systems, and/or tools;
4. communicate findings and best practices, at conferences and
   meetings, to the general public through presentations, technical
   publications (journals, reports, memoranda), patents, and other
   media;
5. apply ethically and professionally the principles and latest tools of
   engineering, science, and mathematics for the benefit of society;
6. participate in and promote the values of diversity and sustainability in
   society; and
7. encourage and foster future generations of engineers through
   mentoring, service, and outreach.

Student Outcomes

Student outcomes describe what students are expected to know and be
able to do by the time of graduation. The Engineering Science 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.

Integrated B.S. in Engineering Science
and M.S. in Engineering Science and
Mechanics

Requirements for the Integrated B.S. in Engineering Science
and M.S. in Engineering Science and Mechanics can be
found in the Graduate Bulletin (https://bulletins.psu.edu/
graduate/programs/majors/engineering-science-mechanics/
#integratedundergradgradprogramtext).

Program Educational Objectives

The expected accomplishments of Engineering Science graduates in the
first several years following graduation are:

1. acquire and apply new knowledge through lifelong learning activities
   including, but not limited to, masters, doctorate, medical, and law
   degrees, continuing education, leadership development, management
   training, innovation/entrepreneurship, and global involvement/
   awareness;
2. engage in practice in a wide variety of fields including, but not limited
to, electrical systems, electronics, mechanical systems, materials
   development, forensics, biomaterials, medicine, law, and business in
   industry, academia and government;
3. research, develop, design and/or utilize new products, processes,
   materials, devices, systems, and/or tools;
4. communicate findings and best practices, at conferences and
   meetings, to the general public through presentations, technical
   publications (journals, reports, memoranda), patents, and other
   media;
5. apply ethically and professionally the principles and latest tools of
   engineering, science, and mathematics for the benefit of society;
6. participate in and promote the values of diversity and sustainability in
   society; and
7. encourage and foster future generations of engineers through
   mentoring, service, and outreach.

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/)

University Park
Gary L. Gray
Associate Professor
212 Earth and Engineering Sciences Building
University Park, PA 16802
814-863-1778
gray@psu.edu

Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that
are in effect during the 2021-22 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 contain suggested
academic plans beginning with the 2018-19 edition of the Undergraduate
Bulletin).

Engineering Science, B.S. at University Park 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.

If you are starting at a campus other than the one this plan is ending
at, please refer to: http://advising.engr.psu.edu/degree-requirements/
academic-plans-by-major.aspx
### First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110 (GN)†</td>
<td>3</td>
<td>CHEM 111</td>
<td>1</td>
</tr>
<tr>
<td>ECON 102 or 104 (GS)†</td>
<td>3</td>
<td>ENGL 15, 30H, or ESL 15 (GWS)‡</td>
<td>3</td>
</tr>
<tr>
<td>EDSGN 100*</td>
<td>3</td>
<td>ESC 261M or CMPSC 201</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140 or 140E (GQ)†‡</td>
<td>4</td>
<td>MATH 141 or 141E (GQ)†‡</td>
<td>4</td>
</tr>
<tr>
<td>General Education Course†</td>
<td>3</td>
<td>PHYS 211 (PHYS 211L &amp; PHYS 211R (GN))‡†</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>First Year Seminar†</td>
<td>1</td>
</tr>
</tbody>
</table>

| Credits | 16 | 16 |

### Second Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMCH 210H*</td>
<td>5</td>
<td>CAS 100A or 100B (GWS)‡†</td>
<td>3</td>
</tr>
<tr>
<td>MATH 220</td>
<td>2</td>
<td>2 EMCH 212H‡</td>
<td>3</td>
</tr>
<tr>
<td>MATH 251†</td>
<td>4</td>
<td>ME 302</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 212 (PHYS 212L &amp; PHYS 212R (GN))††</td>
<td>4</td>
<td>MATH 230</td>
<td>4</td>
</tr>
<tr>
<td>General Education Course†</td>
<td>3</td>
<td>PHYS 214</td>
<td>2</td>
</tr>
</tbody>
</table>

| Credits | 18-19 | 16 |

### Third Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 210</td>
<td>4</td>
<td>ESC 409</td>
<td>1</td>
</tr>
<tr>
<td>ESC 312</td>
<td>3</td>
<td>Foundational Elective</td>
<td>3</td>
</tr>
<tr>
<td>ESC 407*</td>
<td>3</td>
<td>Foundational Elective</td>
<td>3</td>
</tr>
<tr>
<td>ESC 414M*</td>
<td>3</td>
<td>Foundational Elective</td>
<td>3</td>
</tr>
<tr>
<td>ESC 433</td>
<td>1</td>
<td>1 Foundational Elective</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course†</td>
<td>3</td>
<td>Foundational Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

| Credits | 17 | 16 |

### Fourth Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 202C (GWS)‡†</td>
<td>3</td>
<td>ESC 411</td>
<td>2</td>
</tr>
<tr>
<td>ESC 404*</td>
<td>3</td>
<td>Technical Elective</td>
<td>3</td>
</tr>
<tr>
<td>ESC 410</td>
<td>3</td>
<td>Technical Elective</td>
<td>3</td>
</tr>
<tr>
<td>Technical Elective</td>
<td>3</td>
<td>General Education Course†</td>
<td>3</td>
</tr>
<tr>
<td>Technical Elective</td>
<td>3</td>
<td>General Education Course†</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course (GHW)†</td>
<td>1.5</td>
<td>General Education Course (GHW)†</td>
<td>1.5</td>
</tr>
</tbody>
</table>

| Credits | 16.5 | 15.5 |

Total Credits 131-132

* 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:

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of “C” or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

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 replace both ENGL 30H and CAS 100. Each course is 3 credits.

### College Notes:

- **CMPSC 201**: Students are expected to complete the version of CMPSC that is required for their intended major. The requirement varies across College of Engineering majors. Students should plan the CMPSC course requirement carefully with the assistance of an academic adviser.

- **Foundational Elective**: Select from department list.

- **Health and Physical Activity**: Students who complete the ROTC program may substitute 3 ROTC credits for the GHW requirement.

- **Technical Elective**: Select from department list. A student may use only one of the following as a substitute for a Technical Elective: 3 co-op credits, provided the student completes three Cooperative Education Program rotations; 3 ROTC credits, provided the student completes the ROTC Program; or one 3-credit course required for a minor but not otherwise included in degree requirements, provided the student completes all the requirements of the minor.

- **These courses offered at University Park in fall semester only**:
  - EE 210
  - EMCH 210H
  - ESC 312
  - ESC 404
  - ESC 407
  - ESC 414M
  - ESC 433

- **These courses offered at University Park in spring semester only**:
  - EMCH 212H
  - ESC 261M
  - ME 302

### Career Paths

Career opportunities for engineering science graduates are limited only by their imagination. Because of the breadth of their training, engineering scientists are well prepared to lead national and international interdisciplinary teams in a diverse array of science and engineering endeavors, in addition to careers in law, medicine, business, politics, and government service. Engineering science graduates are extremely well prepared for graduate study in most engineering disciplines, including mechanical, electrical, aerospace, industrial, and materials, as well as graduate study in physics and mathematics.
Careers
Penn State engineering science and mechanics alumni are successful entrepreneurs, business executives, captains of industry, leaders in national laboratories, startup founders, physicians, professors, and academic officials. Starting salaries for engineering science graduates in past years have been among the highest for all graduates in the College of Engineering.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE ENGINEERING SCIENCE PROGRAM (http://www.esm.psu.edu/academics/resources/career-resources.aspx)

Opportunities for Graduate Studies
The ESM department offers the following graduate degree options:

- Master of Engineering (M.Eng.) in Engineering Mechanics
- Master of Engineering (M.Eng.) in Additive Manufacturing
- Master of Science (M.S.) in Engineering at the Nano-scale
- Master of Science (M.S.) in Engineering Science and Mechanics
- Master of Science (M.S.) in Additive Manufacturing
- Doctor of Philosophy (Ph.D.) in Engineering Science and Mechanics
- Doctor of Medicine and Doctor of Philosophy in Engineering Science and Mechanics (M.D./Ph.D.)
- Graduate Certificate in Laser-Materials Processing and Laser-Based Manufacturing

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (http://www.esm.psu.edu/academics/graduate/prospective-students.aspx)

Accreditation
The baccalaureate program in Engineering Science is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org/.

MORE INFORMATION ABOUT ABET ACCREDITATION (https://www.abet.org/)

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://psu.edu/state-licensure-disclosures/) interactive map.

Contact
University Park
DEPARTMENT OF ENGINEERING SCIENCE AND MECHANICS
212 Earth and Engineering Sciences Building
University Park, PA 16802
814-865-4523
undergradassistant@esm.psu.edu

https://www.esm.psu.edu/