BIOLOGICAL ENGINEERING, B.S.

Begin Campus: Any Penn State Campus

End Campus: University Park

Program Description

This major helps prepare students for careers involving the application of engineering principles to agricultural and biological production systems, processing systems, and conservation of land and water resources. Education in mathematics, physics, and engineering sciences common to all engineering disciplines is provided along with specialized training in biological and agricultural sciences. The curriculum covers all areas of biological engineering, including development of machines for biological processing and agriculture, postharvest handling and processing, natural resource management and utilization, biological processes, food engineering, and structures and their environmental modifications. A student must select the Agricultural Engineering option, Food and Biological Processing Engineering option or the Natural Resources Engineering option.

Principles of engineering design experiences are integrated throughout the junior-year curriculum by having students solve problems typical of those encountered in the agricultural and biological engineering profession. A year-long major design experience in the senior year emphasizes that Biological engineers must learn not only how to develop engineering solutions to unique, practical problems using the newest technology, but also to assess and integrate the social and ethical implications of their solutions.

Careers for graduates include design, development, and research engineering positions involving biological processes, machinery development, natural resources management, materials handling, biological product development, and structural systems for animals, plants, and crop storage. Biological engineers are employed in industry, consulting firms, and governmental agencies in the United States and abroad. Graduates deal with the various engineering aspects associated with production and processing of food, fiber, and other biological materials, within the constraints of environmental protection and natural resource conservation.

What is Biological Engineering?

Biological Engineering involves the study of engineering fundamentals, very similar to traditional engineering disciplines like chemical, civil, or mechanical engineering. What makes Biological Engineering unique is the integration of these engineering fundamentals with biological, agricultural, and environmental sciences and the holistic approach taken to studying agricultural production, processing of food and other bio-based materials, and natural resource protection. Problem-solving skills are developed and then applied to grand engineering challenges such as sustainably providing safe food and clean water.

You Might Like This Program If...

• You enjoy quantitative problem solving and working with your hands and/or working outdoors.

• You are interested in a career where you address challenges related to fundamental societal needs, like food, water, fiber, and renewable energy.

• You are passionate about sustainability.

• You want to take application-focused classes with interactive labs and hands-on learning opportunities.

Entrance to Major

In addition to the minimum grade-point average (GPA) requirements described in the University Policies, all College of Engineering entrance-to-major course requirements must also be completed with a minimum grade of C: CHEM 110, MATH 140, MATH 141, MATH 250 or MATH 251, PHYS 211, and PHYS 212. All of 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 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 Biological Engineering, a minimum of 129 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>111-112.5</td>
</tr>
</tbody>
</table>

27-28.5 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; and 1.5 credits of GHW courses.

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 (http://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). 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.

Common Requirements for the Major (All Options)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 391</td>
<td>Contextual Integration of Communication Skills for the Technical Workplace</td>
<td>2</td>
</tr>
<tr>
<td>BE 392</td>
<td>Contextual Integration of Leadership Skills for the Technical Workplace</td>
<td>2</td>
</tr>
</tbody>
</table>

Prescribed Courses

BE 460 Biological Engineering Design I 1
BE 466 Biological Engineering Design II 3
CHEM 111 Experimental Chemistry I 1
EDSGN 100 Introduction to Engineering Design 3
ENGL 15 Rhetoric and Composition 3
MATH 231 Calculus of Several Variables 2

Prescribed Courses: Require a grade of C or better

BE 301 Mathematical Modeling of Biological and Physical Systems 3
BE 302 Heat and Mass Transfer in Biological Systems 4
BE 304 Engineering Properties of Food and Biological Materials 3
BE 305 Agricultural Measurements and Control Systems 3
BE 308 Engineering Elements of Biochemistry and Microbiology 3
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 251 Ordinary and Partial Differential Equations 4
ME 300 Engineering Thermodynamics I 3
PHYS 211 General Physics: Mechanics 4
PHYS 212 General Physics: Electricity and Magnetism 4

Additional Courses

CAS 100A Effective Speech 3
or CAS 100B Effective Speech 3
Select 1 credit of First-Year Seminar 1
Select one of the following:
AGBM 101 Economic Principles of Agribusiness Decision Making 3
ECON 102 Introductory Microeconomic Analysis and Policy
ECON 104 Introductory Macroeconomic Analysis and Policy

Requirements for the Option

Select an option 36-37.5

Requirements for the Option

Agricultural Engineering Option (36 credits)

<table>
<thead>
<tr>
<th>Code</th>
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</tr>
</thead>
<tbody>
<tr>
<td>IE 424</td>
<td>Process Quality Engineering</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 401</td>
<td>Experimental Methods</td>
<td></td>
</tr>
</tbody>
</table>

Additional Courses

CE 360 Fluid Mechanics 3
or ME 320 Fluid Flow 3

Supporting Courses and Related Areas

Select 3 credits in math/basic science 1 3
Select 6 credits in engineering science/design 1 6
Select 3 credits in agricultural/biological science 1 3
Select 6 credits in biological engineering 1 6
Select 6 credits in technical selection 1,2 6

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

Select 6 credits of the following: 6
Courses to be selected from a list approved by the Agricultural and Biological Engineering faculty. These courses must be chosen so that the engineering design and engineering science requirements for the major are met.

2 Students may apply 3 credits of ROTC to the technical selection category and 3 credits to the GHW category upon completion of the ROTC program.

Food and Biological Processing Engineering Option (37.5 credits)

<table>
<thead>
<tr>
<th>Code</th>
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</tr>
</thead>
<tbody>
<tr>
<td>BE 465</td>
<td>Food and Biological Process Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BE 468</td>
<td>Microbiological Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BMB 211</td>
<td>Elementary Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 202</td>
<td>Fundamentals of Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>IE 424</td>
<td>Process Quality Engineering</td>
<td>3</td>
</tr>
<tr>
<td>NUTR 100</td>
<td>Nutrition Applications for a Healthy Lifestyle</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Additional Courses

*Additional Courses: Require a grade of C or better*

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<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>CE 360</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>or ME 320</td>
<td>Fluid Flow</td>
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Supporting Courses and Related Areas

1 Select 6 credits in emphasis technical elective

2 Select 6 credits in engineering science/design

3 Select 6 credits in technical selection

1 Courses to be selected from a list approved by the Agricultural and Biological Engineering faculty. These courses must be chosen so that the engineering design and engineering science requirements for the major are met.

2 Students may apply 3 credits of ROTC to the technical selection category and 3 credits to the GHW category upon completion of the ROTC program.

Natural Resources Engineering Option (36 credits)

<table>
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<tr>
<th>Code</th>
<th>Title</th>
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</tr>
</thead>
<tbody>
<tr>
<td>BE 467</td>
<td>Design of Stormwater and Erosion Control Facilities</td>
<td>3</td>
</tr>
<tr>
<td>BE 477</td>
<td>Land-Based Waste Disposal</td>
<td>3</td>
</tr>
<tr>
<td>BE 487</td>
<td>Watershed Modeling for Water Quality Design</td>
<td>3</td>
</tr>
<tr>
<td>SOILS 101</td>
<td>Introductory Soil Science</td>
<td>3</td>
</tr>
</tbody>
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*Prescribed Courses: Require a grade of C or better*

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<tbody>
<tr>
<td>ASM 309</td>
<td>Measurement &amp; Monitoring of Hydrologic Systems</td>
<td>3</td>
</tr>
<tr>
<td>BE 307</td>
<td>Principles of Soil and Water Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CE 360</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
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Supporting Courses and Related Areas

1 Select 6 credits in engineering science/design

1 Courses to be selected from a list approved by the Agricultural and Biological Engineering faculty. These courses must be chosen so that the engineering design and engineering science requirements for the major are met.

2 Students may apply 3 credits of ROTC to the technical selection category and 3 credits to the GHW category upon completion of the ROTC program.

Program Educational Objectives

Early career Biological Engineering graduates will be expected to:

1. Demonstrate proficiency in basic and engineering sciences related to biological processing, natural resource, and agricultural engineering fields;
2. Effectively identify, analyze and design sustainable solutions to address issues and opportunities throughout the world;
3. Work in teams and effectively communicate within and outside the profession;
4. Demonstrate strong leadership skills, ethical integrity, and professional engagement

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Biological 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
Suggested Academic Plan

Agricultural Engineering Option Ending 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 here:

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**University Park**

Megan Marshall
Associate Teaching Professor
305 Agricultural Engineering Building
University Park, PA 16802
814-865-3392
mmn11@psu.edu

**First Year**

**Fall** | **Credits** | **Spring** | **Credits**
--- | --- | --- | ---
CHEM 110 (GN)†† | 3 | CHEM 111 (GN) | 1
ECON 102, 104, or AGBM 101 (GS)† | 3 | ENGL 15, 30, or ESL 15 (GWS)† | 3
EDSGN 100 | 3 | MATH 141 or 141E (GQ)†† | 4
MATH 140 or 140E (GQ)†† | 4 | PHYS 211 (GN, PHYSICS 211L & PHYSICS 211R)† | 4
BE 1 (or First year Seminar)† | 1 | General Education Course† | 3
General Education Course† | 3 | 17 | 15

**Second Year**

**Fall** | **Credits** | **Spring** | **Credits**
--- | --- | --- | ---
CAS 100A or 100B (GWS)†† | 3 | EMCH 212* | 3
EMCH 211† | 3 | EMCH 213* | 3
MATH 251* | 4 | MATH 231 | 2
PHYS 212 (GN, PHYSICS 211L & PHYSICS 211R)†† | 4 | ME 300* | 3
General Education Course† | 3 | Math/Basic Science Selection | 3
General Education Course† | 3 | 17 | 17

**Third Year**

**Fall** | **Credits** | **Spring** | **Credits**
--- | --- | --- | ---
BE 301* | 3 | BE 302* | 4
BE 304* | 3 | BE 305* | 3

BE 308* | 3 | BE 392 (GWS)†† | 2
BE 391 (GWS)†† | 2 | BE 30X-Junior BE Selection† | 3
CE 360 or ME 320* | 3 | BE 30X-Junior BE Selection† | 3
General Education Course† | 3 | 17 | 15

**Fourth Year**

**Fall** | **Credits** | **Spring** | **Credits**
--- | --- | --- | ---
BE 460 | 2 | BE 466 | 2
IE 424 or STAT 401 | 3 | BE 4XX-Biological Engineering Selection | 3
BE 4XX-Biological Engineering Selection | 3 | Engineering Science/Design Selection | 3
BIO/AG Selection | 3 | Technical Selection | 3
Engineering Science/Design Selection | 3 | 15.5 | 15.5
General Education Course† | 1.5 | General Education Course (GHW)† | 1.5
| 15.5 | 15.5 |

* 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 University 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.

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/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

**College Notes**

Junior BE Selection: BE 303 - Structural Systems in Agriculture; BE 306 - Machines for Agricultural and Biological Processing; or BE 307 - Principles of Soil and Water Engineering.

Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for a Technical Selection.
BE 391 & BE 392 fulfill General Writing and Speaking requirements (taken instead of ENGL 202C).

See selection lists in BE Advising Manual at http://abe.psu.edu/documents/be-advising-manual.pdf for the following:

- BE 4XX - Biological Engineering Selection
- BIO/AG Selection
- Engineering Science/Design Selection
- Math/Basic Science Selection
- Technical Selection

These courses offered at University Park in fall semester only:

- BE 301
- BE 304
- BE 308
- BE 392
- BE 460

These courses offered at University Park in spring semester only:

- BE 302
- BE 303
- BE 305
- BE 306
- BE 307
- BE 391
- BE 466

Food & Biological Process Engineering Option Ending 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.

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<table>
<thead>
<tr>
<th>First Year</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDSGN 100</td>
<td>3 CHEM 111 (GN)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CHEM 110 (GN)†‡</td>
<td>3 ENGL 15, 30, or ESL 15 (GWS)†‡</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ECON 102, 104, or AGBM 101 (GQ)†</td>
<td>3 MATH 141 or 141E (GQ)†‡</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>MATH 140 or 140E (GQ)†‡</td>
<td>4 PHYS 211 (GN, PHYSICS 211L &amp; PHYSICS 211R)†‡</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>BE 1 (or First Year Seminar)†</td>
<td>1 General Education Course‡</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>General Education Course‡</td>
<td></td>
<td>3</td>
<td></td>
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<table>
<thead>
<tr>
<th>Second Year</th>
<th>Credits</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Spring</td>
<td></td>
</tr>
<tr>
<td>CAS 100A or 100B (GWS)†‡</td>
<td>3 CHEM 202</td>
<td>3</td>
</tr>
<tr>
<td>EMCH 211†</td>
<td>3 EMCH 212†</td>
<td>3</td>
</tr>
<tr>
<td>MATH 251†#</td>
<td>4 MATH 231†</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 212 (GN, PHYSICS 212L &amp; PHYSICS 212R)†‡</td>
<td>4 MATH 231</td>
<td>2</td>
</tr>
<tr>
<td>General Education Course‡</td>
<td>3 ME 300†</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course‡</td>
<td></td>
<td>3</td>
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</table>

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<table>
<thead>
<tr>
<th>Third Year</th>
<th>Credits</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Spring</td>
<td></td>
</tr>
<tr>
<td>BE 301†</td>
<td>3 BE 302†</td>
<td>4</td>
</tr>
<tr>
<td>BE 304†</td>
<td>3 BE 305†</td>
<td>3</td>
</tr>
<tr>
<td>BE 308†</td>
<td>3 BE 392 (GWS)‡†</td>
<td>2</td>
</tr>
<tr>
<td>BE 391 (GWS)‡†</td>
<td>2 BMB 211</td>
<td>3</td>
</tr>
<tr>
<td>ME 320 or CE 360†</td>
<td>3 IE 424</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course‡</td>
<td>3</td>
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<tbody>
<tr>
<td>Fall</td>
<td>Spring</td>
<td></td>
</tr>
<tr>
<td>BE 460</td>
<td>2 BE 466</td>
<td>2</td>
</tr>
<tr>
<td>BE 465</td>
<td>3 BE 468</td>
<td>3</td>
</tr>
<tr>
<td>NUTR 100 (GHW)†</td>
<td>1.5 Emphasis Technical Selection</td>
<td>3</td>
</tr>
<tr>
<td>Emphasis Technical Selection</td>
<td>3 Engineering Science/Design Selection</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Science/Design Selection</td>
<td>3 Technical Selection</td>
<td>3</td>
</tr>
<tr>
<td>Technical Selection</td>
<td>3 General Education Course (GHW)†</td>
<td>1.5</td>
</tr>
</tbody>
</table>

15.5 15.5

Total Credits 129

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College Notes
Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for a Technical Selection.

BE 391 & BE 392 will satisfy General Education Writing and Speaking requirements (taken instead of ENGL 202C).

See selection lists in B E Advising Manual at http://abe.psu.edu/documents/be-advising-manual.pdf for the following:

- Emphasis Technical Selection
- Engineering Science/Design Selection
- Technical Selection

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- BE 301
- BE 304
- BE 308
- BE 392
- BE 460
- BE 465

These courses offered at University Park in spring semester only:

- BE 302
- BE 305
- BE 391
- BE 466
- BE 468

Natural Resource Engineering Option Ending at University Park Campus

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<tr>
<th>First Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>CHEM 110 (GN)†</td>
</tr>
<tr>
<td>ECON 102, 104, or AGBM 101 (GS)†</td>
</tr>
<tr>
<td>EDSGN 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>CAS 100A or 100B (GWS)†+</td>
</tr>
<tr>
<td>EMCH 211*</td>
</tr>
<tr>
<td>MATH 251†</td>
</tr>
<tr>
<td>PHYS 212 (GN, PHYSICS 212L &amp; PHYSICS 212R)†</td>
</tr>
<tr>
<td>General Education Course†</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Third Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>ASM 309*</td>
</tr>
<tr>
<td>BE 301†</td>
</tr>
<tr>
<td>BE 304†</td>
</tr>
<tr>
<td>BE 308†</td>
</tr>
<tr>
<td>BE 391 (GWS)†</td>
</tr>
<tr>
<td>CE 360*</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Fourth Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>BE 460</td>
</tr>
<tr>
<td>BE 467</td>
</tr>
<tr>
<td>IE 424 or STAT 401</td>
</tr>
<tr>
<td>BIO/ENV Selection</td>
</tr>
<tr>
<td>Engineering Science/Design Selection</td>
</tr>
<tr>
<td>General Education Course (GHW)†</td>
</tr>
</tbody>
</table>

| Total Credits 129 |
|                   |
| * 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 University 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.

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,
Biological Engineering, B.S.

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/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

College Note
Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for a technical selection.

BE 391 & BE 392 will satisfy General Education Writing and Speaking requirements (instead of taking ENGL 202C).

See selection lists in B E Advising Manual at http://abe.psu.edu/documents/be-advising-manual.pdf for the following:

• BIO/ENV Selection
• Engineering Science/Design Selection
• Technical Selection

These courses offered at University Park in fall semester only:

• ASM 309
• BE 301
• BE 304
• BE 308
• BE 392
• BE 460
• BE 467

These courses offered at University Park in spring semester only:

• BE 302
• BE 305
• BE 307
• BE 391
• BE 466
• BE 477
• BE 487

Career Paths
With a bachelor of science in Biological Engineering, you can gain a broad background in engineering fundamentals and specialized training needed to succeed in industry, government, or graduate education. Specific career paths vary by option within the Biological Engineering major: Agricultural Engineering, Food and Biological Processing Engineering, and Natural Resources Engineering.

Careers
Agricultural Engineering
You can learn power and machinery systems and structural analysis, with a focus on the design of off-road equipment for agricultural production, construction, and food processing. You might work as a design or test engineer for agricultural or construction equipment companies.

Food and Biological Processing Engineering
You can learn to design microbiological systems for production of pharmaceuticals, renewable fuels, and vitamins and to engineer processing systems for production of safe, high-quality food. You might work as a process engineer or project manager for food, pharmaceutical, commodity, or consumer goods companies.

Natural Resources Engineering
You can learn to apply best management practices to minimize non-point source pollution, such as sediment loss or nutrient runoff, and to apply low-impact development strategies for stormwater management. You might work as a design engineer in a government agency or an engineering consulting/design firm.

Opportunities for Graduate Studies
As a Biological Engineering graduate, you may pursue an advanced degree in agricultural and biological engineering or related science and engineering disciplines, such as biomedical engineering, civil and environmental engineering, or food science. You may also pursue licensure as a professional engineer by passing the appropriate examinations and gaining practical engineering experience.

Professional Resources
• American Society of Agricultural and Biological Engineers (http://www.asabe.org)

Accreditation
The baccalaureate program in Biological Engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://www.abet.org).

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

Contact
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University Park, PA 16802
814-865-1524
wjt11@psu.edu
http://abe.psu.edu