BIOLOGICAL ENGINEERING, MINOR

Requirements for a minor may be completed at any campus location offering the specified courses for the minor. Students may not change from a campus that offers their major to a campus that does not offer their major for the purpose of completing a minor.

Program Description
This minor provides students with an opportunity to apply engineering principles to agricultural and biological production and processing systems and to the management of our natural resources. Courses may be selected by students to gain a better understanding of soil conservation and water quality, food and biological process engineering, structures and their environments, power and machinery, or microbiological engineering.

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 are pursuing an engineering major and want to complement it with an engineering minor that offers a different perspective on the connections between agriculture, food, and environment.
• You want to take application-focused classes with interactive labs and hands-on learning opportunities.
• You are interested in solving problems related to fundamental societal needs, like food, water, fiber, and renewable energy.
• You are passionate about sustainability.

Program Requirements

Requirements for the Minor
A grade of C or better is required for all courses in the minor, as specified by Senate Policy 59-10 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/59-00-minors-and-certificates/#59-10).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>BE 300</td>
<td>Heat and Mass Transfer in Biological Systems</td>
<td>3</td>
</tr>
<tr>
<td>BE 301</td>
<td>Mathematical Modeling of Biological and Physical Systems</td>
<td>3</td>
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<tr>
<td>BE 303</td>
<td>Structural Systems in Agriculture</td>
<td>3</td>
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<tr>
<td>BE 304</td>
<td>Engineering Properties of Food and Biological Materials</td>
<td>3</td>
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<tr>
<td>BE 305</td>
<td>Agricultural Measurements and Control Systems</td>
<td>3</td>
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<tr>
<td>BE 306</td>
<td>Machines for Agricultural and Biological Processing</td>
<td>3</td>
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<tr>
<td>BE 307</td>
<td>Principles of Soil and Water Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BE 308</td>
<td>Engineering Elements of Biochemistry and Microbiology</td>
<td>3</td>
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Select 9-10 credits from one of the following areas:

Power and Machinery Systems
- ASM 420 Principles of Off-Road Machines
- ASM 424 Selection and Management of Agricultural Machinery
- BE 461 Design of Fluid Power Systems
- ME 431 Internal Combustion Engines
- ME 480 Mechanism Design and Analysis

Biological Systems
- BE 468 Microbiological Engineering
- CHE 340 Introduction to Biomolecular Engineering
- CHE 438 Bioprocess Engineering
- CHE 449 Bioseparations
- ESC 484 Biologically Inspired Nanomaterials

Natural Resource Systems
- ASM 309 Measurement & Monitoring of Hydrologic Systems
- BE 467 Design of Stormwater and Erosion Control Facilities
- BE 477 Land-Based Waste Disposal
- BE 487 Watershed Modeling for Water Quality Design
- CE 370 Introduction to Environmental Engineering
- CE 371 Water and Wastewater Treatment
- CE 461 Water-resource Engineering

Food Process Systems
- BE 465 Food and Biological Process Engineering
- BE 468 Microbiological Engineering
- CHE 410 Mass Transfer Operations
- FDSC 430 Unit Operations in Food Processing
- IE 312 Product Design and Manufacturing Processes

Structural Systems
- AE 308 Introduction to Structural Analysis
- BE 462 Design of Wood Structures
- CE 340 Structural Analysis
- CE 341 Design of Concrete Structures
- CE 342 Design of Steel Structures

One of these five courses must be selected.

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 need to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy)

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