# Biological Engineering (BS): Environmental Engineering Concentration

The BE curriculum is jointly administered by the College of Agriculture and Life Sciences and the College of Engineering and combines the fields of engineering, biology, chemistry, and agriculture. The Biological Engineering program is accredited by the Engineering Accreditation Commission of ABET, [https://www.abet.org](https://www.abet.org). BE graduates are qualified to become registered professional engineers by passing the appropriate examinations and upon completing the engineering experience requirements. Specific curriculum requirements are available online.

BAE faculty, in concert with program constituencies, has developed the following undergraduate program objectives. Within the first five years following graduation, NC State's Biological Engineering graduates will:

- Excel in their careers by applying their engineering knowledge, critical-thinking skills, systematic approach to problem solving, and innovation to improve biological and agricultural systems;
- Work effectively both independently and as part of professional teams and demonstrate leadership potential in project management;
- Display professionalism, ethics, equity, and inclusivity in the practice of engineering to safeguard life, health, and public welfare;
- Communicate effectively in a professional environment; and
- Be engaged in life-long learning and professional development.

## Plan Requirements

### First Year

#### Fall Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 101</td>
<td>Chemistry - A Molecular Science</td>
<td>3</td>
</tr>
<tr>
<td>CH 102</td>
<td>General Chemistry Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>E 101</td>
<td>Introduction to Engineering &amp; Problem Solving</td>
<td>1</td>
</tr>
<tr>
<td>E 115</td>
<td>Introduction to Computing Environments</td>
<td>1</td>
</tr>
<tr>
<td>ENG 101</td>
<td>Academic Writing and Research</td>
<td>2</td>
</tr>
<tr>
<td>MA 141</td>
<td>Calculus I</td>
<td>4</td>
</tr>
</tbody>
</table>

**Hours** 14

#### Spring Semester

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 201</td>
<td>Chemistry - A Quantitative Science and Qualitative Chemistry Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CH 220</td>
<td>Introductory Organic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CH 221</td>
<td>Organic Chemistry I and Organic Chemistry I Lab</td>
<td>4</td>
</tr>
<tr>
<td>MA 241</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>PY 205</td>
<td>Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory</td>
<td>4</td>
</tr>
</tbody>
</table>

**Hours** 14

### Second Year

#### Fall Semester

<table>
<thead>
<tr>
<th>Course</th>
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<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAE 200</td>
<td>Computer Methods in Biological Engineering</td>
<td>2</td>
</tr>
<tr>
<td>CE 214</td>
<td>Engineering Mechanics-Statics or Engineering Statics</td>
<td>3</td>
</tr>
<tr>
<td>MA 242</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>PY 208</td>
<td>Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>BIO 181</td>
<td>Introductory Biology: Ecology, Evolution, and Biodiversity or Introductory Biology: Cellular and Molecular Biology</td>
<td>4</td>
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</tbody>
</table>

**Hours** 17

#### Spring Semester

<table>
<thead>
<tr>
<th>Course</th>
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<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAE 203</td>
<td>Introduction to AutoCAD Civil 3D for Environmental &amp; Ecological Engineers</td>
<td>2</td>
</tr>
<tr>
<td>BAE 204</td>
<td>Introduction to Environmental and Ecological Engineering</td>
<td>2</td>
</tr>
<tr>
<td>MAE 208</td>
<td>Engineering Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>MA 341</td>
<td>Applied Differential Equations I</td>
<td>3</td>
</tr>
<tr>
<td>MAE 201</td>
<td>Thermal-Fluid Sciences</td>
<td>3</td>
</tr>
<tr>
<td>SSC 200</td>
<td>Soil Science</td>
<td>3</td>
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</table>

**Hours** 16

### Third Year

#### Fall Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAE 325</td>
<td>Introductory Geomatics</td>
<td>3</td>
</tr>
<tr>
<td>BAE 302</td>
<td>Transport Phenomena</td>
<td>3</td>
</tr>
<tr>
<td>BAE 371</td>
<td>Fundamentals of Hydrology for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>CE 282</td>
<td>Hydraulics 2</td>
<td>3</td>
</tr>
<tr>
<td>BAE 305</td>
<td>Biological Engineering Circuits</td>
<td>4</td>
</tr>
</tbody>
</table>

**Hours** 16

#### Spring Semester

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<tr>
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<tbody>
<tr>
<td>BAE 401</td>
<td>Sensors and Controls</td>
<td>3</td>
</tr>
<tr>
<td>BAE 472</td>
<td>Irrigation and Drainage</td>
<td>3</td>
</tr>
<tr>
<td>CE 225</td>
<td>Mechanics of Solids 2 or Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ST 370</td>
<td>Probability and Statistics for Engineers</td>
<td>3</td>
</tr>
</tbody>
</table>

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<thead>
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<tbody>
<tr>
<td>AEC 360</td>
<td>Ecology</td>
<td>3</td>
</tr>
<tr>
<td>PB 321</td>
<td>Introduction to Whole Plant Physiology</td>
<td>3</td>
</tr>
<tr>
<td>PB 360</td>
<td>Ecology</td>
<td>3</td>
</tr>
<tr>
<td>SSC 332</td>
<td>Environmental Soil Microbiology</td>
<td>3</td>
</tr>
</tbody>
</table>

**Hours** 15
Fourth Year
Fall Semester
BAE 478 Circular Approach to Manure Management 3
BAE 451 Engineering Design I 2
Select one of the following: 3
  BAE 473 Introduction to Hydrologic and Water Quality Modeling
  BAE 481 Structures & Environment
  BAE 573 Introduction to Hydrologic and Water Quality Modeling
  SSC 473 Introduction to Hydrologic and Water Quality Modeling
  SSC 573 Introduction to Hydrologic and Water Quality Modeling
Select one of the following: 3
  IDS 201 Environmental Ethics
  STS 301 Science and Civilization
  STS 304 Ethical Dimensions of Progress
  ENG 331 or ENG 333 Communication for Engineering and Technology or Communication for Science and Research 3

Spring Semester
BAE 452 Engineering Design II 2
Select one of the following: 3
  BAE 322 Introduction to Food Process Engineering
  BAE 361 Analytical Methods in Engineering Design
  BAE 481 Structures & Environment

Total Hours 112

Semester Sequence

This is a sample.

First Year
Fall Semester
CH 101 Chemistry - A Molecular Science 3
CH 102 General Chemistry Laboratory 1
E 101 Introduction to Engineering & Problem Solving 1
E 115 Introduction to Computing Environments 1
ENG 101 Academic Writing and Research 4
MA 141 Calculus I 4
Select one of the following: 3
  EC 201 Principles of Microeconomics
  EC 205 Fundamentals of Economics
  ARE 201 Introduction to Agricultural & Resource Economics

Hours 15

Spring Semester
Select one of the following: 4
  CH 221 Organic Chemistry I & CH 222 and Organic Chemistry I Lab
  CH 220 Introductory Organic Chemistry & CH 222 and Organic Chemistry I Lab
  CH 221 Organic Chemistry I & CH 222 and Organic Chemistry I Lab
  MA 241 Calculus II 1
  PY 205 Physics for Engineers and Scientists I 3
  PY 206 Physics for Engineers and Scientists I Laboratory 1
Select one of the following: 3
  EC 201 Principles of Microeconomics
  EC 205 Fundamentals of Economics
  ARE 201 Introduction to Agricultural & Resource Economics

Hours 15

Second Year
Fall Semester
BAE 200 Computer Methods in Biological Engineering 2

1 A grade of C or higher is required.
2 A grade of C or higher is required.
### Third Year

#### Fall Semester
- BAE 325 Introduction to Geomatics 3
- BAE 371 Fundamentals of Hydrology for Engineers 3
- MAE 204 Introduction to Environmental and Ecological Engineering 2
- MAE 341 Applied Differential Equations I 3
- MAE 201 Thermal-Fluid Sciences 3
- SSC 200 Soil Science 3

#### Hours: 16

#### Spring Semester
- BAE 401 Sensors and Controls 3
- BAE 472 Irrigation and Drainage 3
- MAE 214 Solid Mechanics 3
- or CE 225 Mechanics of Solids 3
- ST 370 Probability and Statistics for Engineers 3
- Advanced Biology Elective (p. 1) 3

#### Hours: 16

### Fourth Year

#### Fall Semester
- BAE 451 Engineering Design I 2
- BAE 478 Circular Approach to Manure Management 3
- Engineering Elective 3
- Ethics (p. 1) 3
- GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/) 3

#### Hours: 15

#### Spring Semester
- BAE 452 Engineering Design II 2
- BAE Elective (p. 1) 3

#### Hours: 17

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**Career Opportunities**

BE students learn to solve a wide variety of engineering problems and will have opportunities for specialization through selection of a specific concentration. Scientific and engineering principles are applied: to conserve and manage air, energy, soil and water resources; to manage, protect and restore natural ecosystems; to understand and utilize biological, chemical and physical processes for the production and conversion of biomass to bio energy; to analyze, understand and utilize mechanical properties of biological materials; to design and develop machinery systems for all phases of agricultural and food production; to design and evaluate structures and environmental control systems for housing animals, plant growth, and biological product storage; to develop improved systems for processing and marketing food and agricultural products; and to design sensor-based instrumentation and control systems for biological and agricultural applications.

Graduates of the BE curriculum receive a Bachelor’s of Engineering in Biological Engineering, qualifying them for positions in design, development, and research in industry, government and public institutions. The curriculum also prepares students for post-graduate work leading to advanced degrees. Typical positions filled by recent BE graduates include: stream and wetlands restoration project manager; product design; development and testing engineer; plant engineering and management; engineering analysis and inspection for federal and state agencies; engineering consultant and research engineer. Entry-level salary ranges for BE graduates are similar to those of Civil, Industrial, and Mechanical Engineering graduates.

The BAET curriculum provides graduates opportunities in technical analysis, application and evaluation of agricultural production systems and environmental systems. The curriculum’s flexibility enables students to specialize technologically in agriculture, the environment, or business management. Careers include technical jobs in production agriculture, environmental systems, agribusiness sales and service, and agricultural extension.

### Career Titles

- Stream and wetlands restoration project manager
- Product designer
- Development and testing engineer
- Plant engineering and management
• Engineering analyst and inspector for federal and state agencies
• Engineering consultant
• Research engineer

Learn More About Careers

NCareers.org (https://nccareers.org/)
Explore North Carolina’s central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (https://www.bls.gov/ooh/)
Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (https://www.careeronestop.org/)
View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (https://careers.dasa.ncsu.edu/explore-careers/career-assessments/) (NC State student email address required)
This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (https://careers.dasa.ncsu.edu/about/hours-appointments/) to discuss the results.

American Society of Agricultural and Biological Engineers (https://www.asabe.org/)
Career Cornerstone Center-Engineering (https://www.careercornerstone.org/eng/eng.htm)
National Society of Professional Engineers (https://www.nspe.org/)