Biological Engineering (BS): Agricultural Engineering Concentration

To see more about what you will learn in this program, visit the Learning Outcomes website (https://apps.oirp.ncsu.edu/pgas/).

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 BE curriculum is accredited by the Engineering Accreditation Commission (EAC) of ABET (http://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

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 101</td>
<td>3</td>
</tr>
<tr>
<td>CH 102</td>
<td>1</td>
</tr>
<tr>
<td>E 101</td>
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</tr>
<tr>
<td>E 115</td>
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</tr>
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<td>ENG 101</td>
<td>4</td>
</tr>
<tr>
<td>MA 141</td>
<td>4</td>
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<tr>
<td>Select one of the following:</td>
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</tr>
<tr>
<td>ARE 201</td>
<td>3</td>
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<tr>
<td>ARE 201A</td>
<td></td>
</tr>
<tr>
<td>EC 201</td>
<td>4</td>
</tr>
<tr>
<td>EC 205</td>
<td>4</td>
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</tbody>
</table>

| Hours          | 17     |

Spring Semester

Select one of the following:

- CH 201 & CH 202
- CH 220 & CH 222
- CH 221 & CH 222
- MA 241
- PY 205 & PY 206

Second Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Months</th>
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<tbody>
<tr>
<td>BAE 200</td>
<td>2</td>
</tr>
<tr>
<td>CE 214 or MAE 206</td>
<td>3</td>
</tr>
<tr>
<td>MA 242</td>
<td>4</td>
</tr>
<tr>
<td>PY 208 &amp; PY 209</td>
<td>4</td>
</tr>
<tr>
<td>BIO 181 or BIO 183</td>
<td>4</td>
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</tbody>
</table>

| Hours          | 12     |

Spring Semester

- BAE 202
- CE 215 or MAE 208
- MA 341
- MAE 201
- PB 321 or SSC 200

| Hours          | 16     |

Third Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Months</th>
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<tbody>
<tr>
<td>BAE 325</td>
<td>3</td>
</tr>
<tr>
<td>BAE 302</td>
<td>3</td>
</tr>
<tr>
<td>BAE 305</td>
<td>4</td>
</tr>
<tr>
<td>CE 282 or MAE 308</td>
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</tr>
<tr>
<td>ENG 331 or ENG 333</td>
<td>3</td>
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</tbody>
</table>

| Hours          | 13     |

Spring Semester

- BAE 401
- BAE 361
- ST 370
- CE 225 or MAE 214
- Advanced Biology Elective (p. 2)

| Hours          | 12     |
### Fourth Year

#### Fall Semester
- BAE 451 Engineering Design I 2
- BAE 462 Machinery Design and Applications 3
- Select one of the following: 3
  - IDS 201 Environmental Ethics
  - STS 301 Science and Civilization
  - STS 304 Ethical Dimensions of Progress

#### Hours
- 8

#### Spring Semester
- BAE 452 Engineering Design II 2
- BAE 481 Structures & Environment 3
- BAE 488 Postharvest Engineering 3
- BAE 322 or BAE 371 Introduction to Food Process Engineering or Fundamentals of Hydrology for Engineers 3

#### Hours
- 11

### Total Hours
- 106

1. A grade of C or higher is required.
2. A grade of C- or higher is required.

### Advanced Biology Elective

<table>
<thead>
<tr>
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<th>Hours</th>
<th>Counts towards</th>
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<tbody>
<tr>
<td>FS 462</td>
<td>Postharvest Physiology</td>
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<td></td>
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<tr>
<td>FS 562</td>
<td>Postharvest Physiology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>HS 462</td>
<td>Postharvest Physiology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>HS 562</td>
<td>Postharvest Physiology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MB 351</td>
<td>General Microbiology</td>
<td>3</td>
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<tr>
<td>SSC 332</td>
<td>Environmental Soil Microbiology</td>
<td>3</td>
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</tbody>
</table>

### Semester Sequence

This is a sample.

### First Year

#### Fall Semester
- BAE 200 Computer Methods in Biological Engineering 2

#### Hours
- 16

### Second Year

#### Fall Semester
- BAE 200 Computer Methods in Biological Engineering 2

#### Spring Semester
- Chemistry Elective (p. 1) 4
- MA 241 Calculus II 1 4
- PY 205 Physics for Engineers and Scientists I 1 3
- PY 206 Physics for Engineers and Scientists I Laboratory 1

#### Hours
- 16

### Foreign Language Proficiency

[verify requirement]

### GEP Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
<th>Counts towards</th>
</tr>
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<tbody>
<tr>
<td>GEP Humanities</td>
<td>(verify requirement)</td>
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<tr>
<td>GEP Social Sciences</td>
<td>(verify requirement)</td>
<td>3</td>
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</tr>
<tr>
<td>GEP Health and Exercise Studies</td>
<td>(verify requirement)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>GEP Additional Breadth</td>
<td>(verify requirement)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEP Interdisciplinary Perspectives</td>
<td>(verify requirement)</td>
<td>2</td>
<td></td>
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<tr>
<td>GEP U.S. Diversity</td>
<td>(verify requirement)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GEP Global Knowledge</td>
<td>(verify requirement)</td>
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<td></td>
</tr>
</tbody>
</table>

[verify requirement]
MAE 206 or CE 214  Engineering Statics \(^1\) or Engineering Mechanics-Statics 3
MA 242  Calculus III 4
PY 208  Physics for Engineers and Scientists II 3
PY 209  Physics for Engineers and Scientists II Laboratory 1
BIO 181 or BIO 183  Introductory Biology: Ecology, Evolution, and Biodiversity or Introductory Biology: Cellular and Molecular Biology 4

**Hours** 17

### Spring Semester

BAE 202  Introduction to Biological and Agricultural Engineering Methods 4
MAE 208  Engineering Dynamics \(^1\) 3
MA 341  Applied Differential Equations I 3
MAE 201  Engineering Thermodynamics I 3
SSC 200  Soil Science 3

**Hours** 16

### Third Year

#### Fall Semester

BAE 325  Introductory Geomatics 3
BAE 302  Transport Phenomena 3
MAE 308 or CE 282  Fluid Mechanics \(^1\) or Hydraulics 3
BAE 305  Biological Engineering Circuits 4
ENG 331 or ENG 333  Communication for Engineering and Technology or Communication for Science and Research 3

**Hours** 16

#### Spring Semester

BAE 401  Sensors and Controls 3
BAE 361  Analytical Methods in Engineering Design 3
MAE 214 or CE 225  Solid Mechanics \(^1\) or Mechanics of Solids 3
ST 370  Probability and Statistics for Engineers 3
Advanced Biology Elective (p. 2) 3

**Hours** 15

### Fourth Year

#### Fall Semester

BAE 451  Engineering Design I 2
BAE 462  Machinery Design and Applications 3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)

Ethics (p. 1) 3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)

**Hours** 15

#### Spring Semester

BAE 452  Engineering Design II 2
BAE 488  Postharvest Engineering 3
BAE 481  Structures & Environment 3
BAE Elective (p. 1) 3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)
GEP Additional Breadth (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)(Humanities/Social Sciences/Visual and Performing Arts) 3

**Hours** 16

**Total Hours** 128

\(^1\) A grade of C- or higher is required.

### Career Opportunities

BE students learn to solve a wide variety of engineering problems and will have opportunities for specialization though 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.