**BIOLOGICAL ENGINEERING | PACKAGING ENGINEERING**

Biological engineering (BE) applies engineering principles to the biological sciences to produce biofuels, food and fiber products and other agricultural products from renewable bio-resources. In addition, it evaluates packaging systems and designs, and introduces new technologies and methods to enhance agricultural production of crops and livestock. It also aims to protect the environment and conserve and replenish our natural resources.

**About this Program**

- **College:** Herbert Wertheim College of Engineering
- **Degree:** Bachelor of Science in Biological Engineering
- **Credits for Degree:** 128
- **Specializations:** Agricultural Production Engineering | Biosystems Engineering | Land and Water Resources Engineering | Packaging Engineering
- **Additional Information**
- **Related Biological Engineering Programs**

To graduate with this major, students must complete all university, college, and major requirements.

Biological engineers pioneer new designs and techniques in such areas as agricultural robotics, remote sensing, bioprocessing, biofuels, precision agriculture, plant space biology, sustainability of our natural resources, and packaging product design and development.

Graduates are educated in the biological and environmental sciences as well as in engineering. They will address critical problems involving land and water resources, biological systems, production agriculture and innovations in packaging. Students can choose a focus area based on their courses of specialization and individual selection of electives. Areas of specialization are biosystems engineering, land and water resources engineering, packaging engineering, and agricultural production engineering.

In addition to abundant job opportunities in Florida’s agricultural industry, graduates have career opportunities in biotechnology and in fields related to Florida’s water quality and water resources, including water management districts, environmental companies, consulting firms, equipment manufacturers, bio-energy, food engineering and the packaging industry.

The BE curriculum can also fulfill requirements for admission to professional programs as well as to graduate programs including biomedical engineering, civil engineering and mechanical engineering.

**Goals**

To develop biological engineering professionals with technical proficiency and societal responsibility.

**Mission**

The department will develop professionals, create and disseminate knowledge, and promote the application of engineering and management principles to meet societal needs with respect to agriculture, packaging, land and water resources, and biological systems.

**Related Biological Engineering Programs**

- Combined Degree

**Packaging Engineering**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMA 3010</td>
<td>Materials</td>
<td>3</td>
</tr>
<tr>
<td>EMA 3066</td>
<td>Introduction to Organic Materials</td>
<td>3</td>
</tr>
<tr>
<td>PKG 3001</td>
<td>Principles of Packaging</td>
<td>3</td>
</tr>
<tr>
<td>PKG 3103</td>
<td>Food Packaging</td>
<td>3</td>
</tr>
<tr>
<td>PKG 4008</td>
<td>Distribution and Transport Packaging</td>
<td>3</td>
</tr>
<tr>
<td>PKG 4101C</td>
<td>Computer Tools for Packaging</td>
<td>3</td>
</tr>
<tr>
<td>PKG 4011</td>
<td>Packaging Production and Processing</td>
<td>3</td>
</tr>
</tbody>
</table>

**Technical Electives**

Select 3 credits

Total Credits 24

**Critical Tracking**

Critical Tracking records each student's progress in courses that are required for entry to each major. Please note the critical-tracking requirements below on a per-semester basis.

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites may be used for transfer students.

**Semester 1**

- Complete 1 of 8 tracking courses with a minimum grade of C within two attempts: CHM 2045 or CHM 2095, CHM 2046 or CHM 2096, MAC 2311, MAC 2312, MAC 2313, MAP 2302, PHY 2048, PHY 2049
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

**Semester 2**

- Complete 1 additional tracking course with a minimum grade of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

**Semester 3**

- Complete 2 additional tracking courses with minimum grades of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required
### Semester 4
- Complete 2 additional tracking courses with minimum grades of C within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

### Semester 5
- Complete all 8 critical-tracking courses with minimum grades of C in each course within two attempts
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

## Model Semester Plan
To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student’s academic record and scheduling availability of courses. Prerequisites still apply.

### Course Title Credits
<table>
<thead>
<tr>
<th>Course</th>
<th>Semester One</th>
<th>Select one:</th>
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<tbody>
<tr>
<td>CHM 2045</td>
<td>General Chemistry 1 (Critical Tracking; Gen Ed Biological Sciences and Physical Sciences)</td>
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<tr>
<td>CHM 2095</td>
<td>Chemistry for Engineers 1 (Critical Tracking; Gen Ed Biological Sciences and Physical Sciences)</td>
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<td>CHM 2045L</td>
<td>General Chemistry Laboratory (Gen Ed Biological and Physical Sciences)</td>
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<tr>
<td>MAC 2311</td>
<td>Analytic Geometry and Calculus 1 (Critical Tracking; State Core Gen Ed Mathematics)</td>
<td>4</td>
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<tr>
<td>State Core Gen Ed Humanities with Diversity or International</td>
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<tr>
<td>State Core Gen Ed Social and Behavioral Sciences with Diversity or International</td>
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</table>

### Credits
- 14

### Semester Two
- ABE 2062 or BSC 2010
- Select one: 3
- CHM 2046 | General Chemistry 2 (Critical Tracking; State Core Gen Ed Biological and Physical Sciences) | 3 |  |
- CHM 2096 | Chemistry for Engineers 2 (Critical Tracking; State Core Gen Ed Biological and Physical Sciences) | 3 |  |
- CHM 2046L | General Chemistry Laboratory (Gen Ed Biological and Physical Sciences) | 1 |  |
- IUF 1000 | What is the Good Life (Gen Ed Humanities) | 3 |  |
- MAC 2312 | Analytic Geometry and Calculus 2 (Critical Tracking; Gen Ed Mathematics) | 4 |  |

### Credits
- 14

### Semester Three
- ABE 2012C
- Select one: 3
- ENC 1101 | Expository and Argumentative Writing (State Core Gen Ed Composition) | 3 |  |

### Course Title Credits
<table>
<thead>
<tr>
<th>Course</th>
<th>Semester Four</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC 1102</td>
<td>Argument and Persuasion (State Core Gen Ed Composition)</td>
<td></td>
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<tr>
<td>MAC 2313</td>
<td>Analytic Geometry and Calculus 3 (Critical Tracking; Gen Ed Mathematics)</td>
<td>4</td>
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<tr>
<td>PHY 2048</td>
<td>Physics with Calculus 1 (Critical Tracking; Gen Ed Biological and Physical Sciences)</td>
<td>3</td>
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<td>PHY 2048L</td>
<td>Laboratory for Physics with Calculus 1 (Gen Ed Biological and Physical Sciences)</td>
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<td>Semester Four</td>
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<tr>
<td>EGM 2511</td>
<td>Engineering Mechanics: Statics</td>
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<tr>
<td>EML 3007</td>
<td>Elements of Thermodynamics and Heat Transfer</td>
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<tr>
<td>MAP 2302</td>
<td>Elementary Differential Equations (Critical Tracking; Gen Ed Mathematics)</td>
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<td>PHY 2049</td>
<td>Physics with Calculus 2 (Critical Tracking; Gen Ed Biological and Physical Sciences)</td>
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<td>PHY 2049L</td>
<td>Laboratory for Physics with Calculus 2 (Gen Ed Biological and Physical Sciences)</td>
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<td>Gen Ed Social and Behavioral Sciences with Diversity or International</td>
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</table>

### Summer After Semester Four
- CGN 3710 or EEL 3003
- Select one: 3-4
- CHM 2200 or BCH 3023
- EGM 3520 | Mechanics of Materials | 3 |  |
| Technical elective | | 3 |  |

### Credits
- 12

### Semester Six
- ABE 3612C | Heat and Mass Transfer in Biological Systems | 4 |  |
- Select one: 3-4
- CGN 3421 | Computer Methods in Civil Engineering | 3 |  |
- ENV 3040C | Computational Methods in Environmental Engineering | 3 |  |
- ESI 4327C | Matrix and Numerical Methods in Systems Engineering | 3 |  |
- EGM 3400 | Elements of Dynamics | 2 |  |
- ENC 3246 | Professional Communication for Engineers (Gen Ed Composition) | 3 |  |
- PKG 3001 | Principles of Packaging | 3 |  |

### Credits
- 15-16

### Semester Seven
- ABE 3000C | Applications in Biological Engineering | 3 |  |
- ABE 4033 or ABE 4413C
- EMA 3010 | Materials | 3 |  |
- PKG 4101C | Computer Tools for Packaging | 3 |  |
- PKG 4011 | Packaging Production and Processing | 3 |  |

### Credits
- 15

### Semester Eight
- ABE 4042C | Biological Engineering Design 1 | 2 |  |
- ABE 4171 | Power and Machines for Biological Systems | 3 |  |
- EGN 3353C or CWR 3201
- EMA 3066 | Introduction to Organic Materials | 3 |  |
PKG 3103  Food Packaging  3
Elective  1

Semester Nine
ABE 4043C  Biological Engineering Design 2  2
ABE 4931  Professional Issues in Agricultural and Biological Engineering  1
PKG 4008  Distribution and Transport Packaging  3
Engineering elective  3
Technical electives  4

Credits  15-16

Approved Electives

Packaging Engineering Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tr>
<td>Technical Electives</td>
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<tr>
<td>AEB 3300</td>
<td>Agricultural and Food Marketing</td>
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<td>AEB 3133</td>
<td>Principles of Agribusiness Management</td>
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<td>AEC 3414</td>
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<td>AEC 3070C</td>
<td>Digital Media Production in Agricultural and Life Sciences</td>
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<td>AEC 4036</td>
<td>Advanced Agricultural Communication Production</td>
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<td>AOM 4062</td>
<td>Principles of Food Engineering</td>
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<td>FOS 3042</td>
<td>Introductory Food Science</td>
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<td>FOS 4427C</td>
<td>Principles of Food Processing</td>
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<td>FOS 4731</td>
<td>Government Regulations and the Food Industry</td>
<td>2</td>
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<tr>
<td>PKG 4941</td>
<td>Work Experience in Packaging Engineering</td>
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</table>

| Engineering Electives |
| EGN 4641   | Engineering Entrepreneurship                   | 3       |
| EGN 4643   | Engineering Innovation                          | 3       |
| EGN 4912   | Engineering Directed Independent Research       | 3       |
| EMA 3011   | Fundamental Principles of Materials             | 3       |
| EMA 3513C  | Analysis of the Structure of Materials          | 4       |
| EMA 3800   | Error Analyses and Optimization Methodologies in Materials Research | 3 |
| EMA 4062   | Biopolymers: Manufacture, Stability and Biocompatibility | 3 |
| EMA 4223   | Mechanical Behavior of Materials                | 3       |
| EMA 4666   | Polymer Processing                              | 3       |
| PKG 4941   | Work Experience in Packaging Engineering        | 3       |

Credits  13
Total Credits  128

Academic Learning Compact

The curriculum emphasizes engineering solutions to problems associated with biological and agricultural systems that often are related to renewable natural resources. Students gain knowledge through formal courses, laboratory experimentation and individual experience. Students will learn to utilize math, science and engineering principles to analyze and interpret data, to design and conduct experiments, systems and components and to effectively communicate results within an appropriate presentation style.

This program is accredited by the Engineering Accreditation Commission of ABET.

Before Graduating Students Must

- Pass assessment by two or more faculty and/or industry practitioners of student performance on a major design experience.
- Complete an exit interview in your final semester.
- Complete requirements for the baccalaureate degree, as determined by faculty.

Students in the Major Will Learn to

Student Learning Outcomes (SLOs)

Content

1. Apply knowledge of mathematics, science and engineering principles to biological engineering problems. Students will be able to apply fundamental concepts, skills and processes in biological engineering.
2. Design and conduct biological and/or agricultural engineering experiments, analyzing and interpreting the data in biological engineering.

Critical Thinking

3. Design a biological and/or agricultural system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints in biological engineering.

Communication

4. Communicate technical data and design information effectively in writing and in speech to other engineers in biological engineering.

Curriculum Map

<table>
<thead>
<tr>
<th>Courses</th>
<th>SLO 1</th>
<th>SLO 2</th>
<th>SLO 3</th>
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Assessment Types

- Assignments
- Exams
- Design projects and reports