

# BIOSYSTEMS ENGINEERING

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Biological Engineering (BE) applies engineering principles to protect natural resources and to produce food, biofuels, pharmaceuticals, and other biobased products. BE incorporates foundations of biology with engineering theory and practice to develop sustainable solutions to problems facing a broad range of industries.

## About this Program

- **College:** Herbert Wertheim College of Engineering (<http://catalog.ufl.edu/UGRD/colleges-schools/UGENG/>)
- **Degree:** Bachelor of Science in Biological Engineering
- **Specializations:** Agricultural Production Engineering ([http://catalog.ufl.edu/UGRD/colleges-schools/UGENG/BE\\_BSBE/BE\\_BSBE01/](http://catalog.ufl.edu/UGRD/colleges-schools/UGENG/BE_BSBE/BE_BSBE01/)) | Biosystems Engineering (p. 1) | Land and Water Resources Engineering ([http://catalog.ufl.edu/UGRD/colleges-schools/UGENG/BE\\_BSBE/BE\\_BSBE03/](http://catalog.ufl.edu/UGRD/colleges-schools/UGENG/BE_BSBE/BE_BSBE03/)) | Packaging Engineering ([http://catalog.ufl.edu/UGRD/colleges-schools/UGENG/BE\\_BSBE/BE\\_BSBE04/](http://catalog.ufl.edu/UGRD/colleges-schools/UGENG/BE_BSBE/BE_BSBE04/))
- **Credits for Degree:** 128
- **More Info**

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

## Department Information

The Department of Agricultural and Biological Engineering is founded on developing, teaching, and applying engineering principles to improve and sustain agricultural and biological systems for current and future generations.

More Info (<https://abe.ufl.edu/>) | 352.392.1864 (tel) | 352.392.4092 (fax)

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Map (<http://campusmap.ufl.edu/#/index/0474>)

## Curriculum

- Agricultural Operations Management
- Biological Engineering
- Combination Degrees
- Packaging Engineering Certificate
- Packaging Science Minor
- Precision Agriculture Minor

Biological engineers pioneer new designs and techniques in such areas as agricultural robotics, remote sensing, bioprocessing, biofuels, precision agriculture, plant space biology, sustainability of 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.

## Educational Objectives

Graduates from the University of Florida's undergraduate degree program in biological engineering will be prepared for at least one of the following:

- Successful careers in the profession of biological engineering or other related fields.
- Gaining admission to a graduate and/or professional degree program.

## 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.

## Biosystems Engineering

Code	Title	Credits
<b>Required Courses</b>		
ABE 4662	Quantification of Biological Processes	3
<b>Electives</b>		
Department Electives (minimum)		8
Engineering Elective (minimum)		3
Technical Electives (minimum)		6
<b>Total Credits</b>		<b>20</b>

### Critical Tracking

courses that are required for progress toward 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 (<https://cpm.flvc.org/advance-search/>) 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
- Complete EGM 3520
- 2.5 GPA required for all critical-tracking courses
- 2.0 UF GPA required

## Semester 6

- Complete ENC 3246

## Semester 7

- Complete ABE 3000C

## Semester 8

- Complete ABE 4042C

## Semester 9

- Complete ABE 4043C

### 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
<b>Semester One</b>		
Quest 1 (Writing Requirement, if needed)		3
Gen Ed Biological Sciences and Physical Sciences; <b>Critical Tracking</b> . Select one:		4
CHM 2045 & 2045L	General Chemistry 1 and General Chemistry 1 Laboratory	
CHM 2095 & CHM 2045L	Chemistry for Engineers 1 and General Chemistry 1 Laboratory	
MAC 2311	Analytic Geometry and Calculus 1 ( <b>Critical Tracking</b> ; State Core Gen Ed Mathematics)	4
State Core Gen Ed Humanities with Diversity or International; Writing Requirement, if needed		3
State Core Gen Ed Social and Behavioral Sciences with Diversity or International; Writing Requirement, if needed		3
<b>Credits</b>		<b>17</b>
<b>Semester Two</b>		
Quest 2 (Writing Requirement, if needed)		3
Gen Ed Biological and Physical Sciences. Select one:		3
ABE 2062	Biology for Engineers	
BSC 2010	Integrated Principles of Biology 1	
State Core Gen Ed Biological and Physical Sciences; <b>Critical Tracking</b> . Select one:		4
CHM 2046 & 2046L	General Chemistry 2 and General Chemistry 2 Laboratory	
CHM 2096 & CHM 2046L	Chemistry for Engineers 2 and General Chemistry 2 Laboratory	
MAC 2312	Analytic Geometry and Calculus 2 ( <b>Critical Tracking</b> ; Gen Ed Mathematics)	4
State Core Gen Ed Social and Behavioral Sciences with Diversity or International; Writing Requirement, if needed		3
<b>Credits</b>		<b>17</b>
<b>Semester Three</b>		
ABE 2012C	Introduction to Biological Engineering (Writing Requirement; 2,000 words)	3
CGN 2328 or EML 2023	Technical Drawing and Visualization or Computer Aided Graphics and Design	3
MAC 2313	Analytic Geometry and Calculus 3 ( <b>Critical Tracking</b> ; Gen Ed Mathematics)	4
PHY 2048 & 2048L	Physics with Calculus 1 and Laboratory for Physics with Calculus 1 ( <b>Critical Tracking</b> ; Gen Ed Biological Sciences and Physical Sciences)	4
State Core Gen Ed Composition; Writing Requirement: 6,000 words. Select one:		3
ENC 1101	Expository and Argumentative Writing (State Core Gen Ed Composition ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> ))	
ENC 1102	Argument and Persuasion (State Core Gen Ed Composition ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> ))	
<b>Credits</b>		<b>17</b>
<b>Semester Four</b>		
EGM 2511	Engineering Mechanics: Statics	3
EGN 2020C	Engineering Design & Society	2
EML 3007	Elements of Thermodynamics and Heat Transfer	3
MAP 2302	Elementary Differential Equations ( <b>Critical Tracking</b> ; Gen Ed Mathematics)	3
PHY 2049 & 2049L	Physics with Calculus 2 and Laboratory for Physics with Calculus 2 ( <b>Critical Tracking</b> ; Gen Ed Biological Sciences and Physical Sciences)	4
<b>Credits</b>		<b>15</b>

**Semester Five**

ABE 3612C	Heat and Mass Transfer in Biological Systems	4
Select one:		3-4
CGN 3421	Computer Methods in Civil Engineering	
COP 2271 & 2271L	Computer Programming for Engineers and Computer Programming for Engineers Laboratory	
ENV 3040C	Computational Methods in Environmental Engineering	
CGN 3710 or EEL 3003	Experimentation and Instrumentation in Civil Engineering or Elements of Electrical Engineering	3
EGM 3400	Elements of Dynamics	2
EGM 3520	Mechanics of Materials ( <b>Critical Tracking</b> )	3
<b>Credits</b>		<b>15-16</b>

**Semester Six**

ABE 3000C	Applications in Biological Engineering ( <b>Critical Tracking</b> )	3
ABE 3652C or CGN 3501C	Physical and Rheological Properties of Biological Materials or Civil Engineering Materials	3-4
CHM 2200 or BCH 3023	Fundamentals of Organic Chemistry or Elementary Organic and Biological Chemistry	3
EGN 3353C or CWR 3201	Fluid Mechanics or Hydrodynamics	3-4
Engineering elective		3
<b>Credits</b>		<b>15-17</b>

**Semester Seven**

ABE 4042C	Biological Engineering Design 1 ( <b>Critical Tracking</b> )	2
ABE 4171	Power and Machines for Biological Systems	3
ABE 4662	Quantification of Biological Processes	3
ENC 3246	Professional Communication for Engineers ( <b>Critical Tracking</b> ; Gen Ed Composition)	3
Department electives		5
<b>Credits</b>		<b>16</b>

**Semester Eight**

ABE 3212C	Land and Water Resources Engineering	4
ABE 4043C	Biological Engineering Design 2 ( <b>Critical Tracking</b> )	2
Select one:		1
ECH 2934	Professional Development of Chemical Engineers	
EGS 4034	Engineering Ethics and Professionalism	
EML 2920	Department and Professional Orientation	
Department elective		3
Technical electives		6
<b>Credits</b>		<b>16</b>
<b>Total Credits</b>		<b>128</b>

**Department Electives**

Code	Title	Credits
ABE 3212C	Land and Water Resources Engineering	4
ABE 4033	Fundamentals and Applications of Biosensors	3
ABE 4034	Remote Sensing in Engineering: Science, Sensors and Applications	3
ABE 4231C	Irrigation and Drainage Engineering	4
ABE 4413C	Post-Harvest Operations Engineering	3
ABE 4655C	Bio-Based Products from Renewable Resources	3
ABE 4812	Food and Bioprocess Engineering Unit Operations	4
ABE 4932	Special Topics	1-4
ABE 4949	Work Experience in Biological Engineering	1-3
Course with a prefix of AOM or PKG		3

**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.

The Biological Engineering BS Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://nam10.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.abet.org%2F&data=05%7C01%7CDMAYH%40eng.ufl.edu%7C71f1da0d2bb2405acf0908db1519ea82%7C0d4da0f84a314d76ace60a62331e1b84%7C0%7C0%7C638126973271417574%7CUnknown%7CTWFPbGZsb3d8eyJWljojMC4wLjAwMDAiLCJQljojV2luMzliLCJBtIl6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=IS6uc6S7lvXdX9QyR6L%2B9EJPkbAYPGg3OA7DmEOluN4%3D&reserved=0>), under the General Criteria and the Program Criteria for Biological and Similarly Named Engineering Programs.

## Before Graduating Students Must

- Pass assessment by two or more faculty and/or industry practitioners of student performance on a major design experience.
- Pass assessment in two courses of individual assignments targeted to each learning outcome.
- 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

*I = Introduced; R = Reinforced; A = Assessed*

Courses	SLO 1	SLO 2	SLO 3	SLO 4
ABE 2012C	I, A	I, A		
ABE 3612C		R, A		
ABE 4042C	R, A		I, A	I
ABE 4043C	R, A		R, A	R, A

## Assessment Types

- Assignments
  - Exams
  - Design projects and reports
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