

# Department of Agricultural and Biological Engineering

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Department Head: Professor Jonathan Pote

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## Biological Engineering (BE)

Biological Engineering is that branch of the engineering profession which deals with engineering problems encountered in biological systems. The responsibilities of the Biological Engineer may include finding solutions to address the need for more complex food-producing systems, controlling and monitoring the deterioration of the earth's environment, the replacement of living organs, design and testing of artificial and engineered tissues, the use of new technologies to assist the disabled, and the creation of new engineering designs based on the inherently creative characteristics of living systems.

The curriculum in Biological Engineering is designed to give the student a thorough grounding in the basic sciences of mathematics, physics, chemistry, taken with and followed by a series of courses in the engineering and biological sciences and biological engineering.

The educational objectives of the program are as follows:

1. To educate students in the academic discipline of Biological Engineering so that they can formulate and solve engineering problems involving biological systems.
2. To ensure that students develop effective written and oral communication skills.
3. To educate students in the use of the latest computer-based technology in engineering and engineering tools.
4. To develop the students' ability to work individually and in teams to complete engineering and design projects.
5. To prepare students for employment in engineering jobs or for study in graduate and professional schools and for continual professional development.

**Ecological and Environmental Engineering Emphasis.** This emphasis addresses environmental problems through the application of basic engineering in concert with principles of ecology and biology. Man has shown repeatedly that working opposition to natural processes leads either to failure or to expensive and energy-intensive temporary solutions. Ecological engineering attempts to apply and emulate the rules that govern natural systems in order to meet human needs in ways that are sustainable.

**Bioenergy Emphasis.** Biological engineers can engage in environmental conservation and Bioenergy technologies use renewable biomass resources to produce an array of energy-related products including electricity, liquid, solid, and gaseous fuels, heat, chemicals, and other high volume materials. Students in this emphasis area gain knowledge in the fundamentals of energy production, thermodynamics, alternative energy sources and biomass conversion into biofuels. The Bioenergy program prepares students to take up a career in the energy sector industry or government agencies, as well as pursue research in energy production from renewable sources.

**Premedical Emphasis.** The Biological Engineering curriculum offers a premedical emphasis which not only leads to a degree in Biological Engineering but also prepares students for acceptance into most medical, dental, and veterinary schools. Students completing this program have demonstrated their ability to tackle tough subjects, perform well under stressful conditions, work together in teams, learn new material, and achieve ambitious goals - characteristics desired by the best medical, dental, and veterinary schools.

## Biomedical Engineering (BME)

Biomedical Engineering is a growing interdisciplinary field of engineering that integrates engineering and life sciences to solve problems associated with the human body and human health. The curriculum is built on a core of fundamental math/physics/engineering courses which is similar across all engineering disciplines. It is distinguished by a wide range of life science courses and specialized biomedical engineering courses such as computational modeling, biomechanics, biomaterials, and bioinstrumentation. The curriculum also includes a two-semester capstone design course. It is designed to comply with current requirements for ABET accreditation. Apart from preparing students to work in biomedical industry, the B.S. in Biomedical Engineering is an excellent foundation for graduate study in many fields, including further study of biomedical engineering. It is also good preparation for entry into professional schools, including medical school, dental school, veterinary school, and law school. Although there are no concentrations, a student may emphasize in an area of interest through deliberate selection of engineering electives.

The Biological Engineering and the Biomedical Engineering curricula are offered by the Department of Agricultural and Biological Engineering which is jointly administered by the College of Engineering and the College of Agricultural and Life Sciences.

The Biological Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

## Biological Engineering

### English Composition

EN 1103	English Composition I	3
EN 1113	English Composition II	3
or EN 1173	Accelerated Composition II	

### Mathematics

See Major Core

### Science

See Major Core

### Humanities

See approved list of Humanities electives

### Fine Arts

See approved list of Fine Arts electives

### Social/Behavioral Sciences

See approved list of Social/Behavioral electives

### Major Core

Math and Basic Science		40
MA 1713	Calculus I	
MA 1723	Calculus II	
MA 2733	Calculus III	
MA 2743	Calculus IV	
MA 3253	Differential Equations I	
CH 1213	Chemistry I	
CH 1211	Investigations in Chemistry I	
CH 1223	Chemistry II	
CH 1221	Investigations in Chemistry II	
CH 2503	Elementary Organic Chemistry	
or CH 4513	Organic Chemistry I	
CH 2501	Elementary Organic Chemistry Laboratory	
or CH 4511	Organic Chemistry Laboratory I	
PH 2213	Physics I	
PH 2223	Physics II	
BIO 3304	General Microbiology	
BCH 4013	Principles of Biochemistry	
Engineering Topics		39
ABE 1911	Engineering in the Life Sciences	
ABE 1921	Introduction to Engineering Design	
ABE 4803	Biosystems Simulation	
ABE 3413	Bioinstrumentation I	
ABE 3303	Transport in Biological Engineering	
ABE 4423	Bioinstrumentation II	
ABE 3813	Biophysical Properties of Materials	
ABE 4813	Principles of Engineering Design	
ABE 4833	Practices of Engineering Design	
ABE 4911	Engineering Seminar	
MA 3123	Introduction to Statistical Inference	
EM 2413	Engineering Mechanics I	
EM 2433	Engineering Mechanics II	
EM 3213	Mechanics of Materials	
EM 3313	Fluid Mechanics	

### Oral Communication Requirement

Satisfied by successful completion of GE 3513

**Writing Requirement**

GE 3513	Technical Writing	3
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**Computer Literacy**

Fulfilled in Engineering Topics courses

**Major Requirements and Engineering Electives for non-BME Concentration** 25

ABE 4313	Biological Treatment of Nonpoint Source Pollutants
or ABE 4323	Physiological Systems in Biomedical Engineering
BIO Science Elective	
BIO Science Elective or Engineering elective	
Approved Engineering Electives	
ABE Elective	

**Major Requirements and Engineering Electives for Biomedical Engineering Concentration (BME)** 25

ABE 4323	Physiological Systems in Biomedical Engineering
BIO 1134	Biology I
Restricted BIO Science Elective <sup>1</sup>	
12 hours of Restricted Engineering Elective (at least 6 hours MUST BE ABE electives) <sup>2</sup>	
3 Hours of Restricted Engineering Electives or Restricted Math/Physics Electives <sup>3</sup>	

**Total Hours** 128

<sup>1</sup> Restricted BIO Science Electives. Select from: BIO 2103, BIO 3504, BIO 4114, BIO 4405, BIO 4413, BIO 4433, BIO 4503, BIO 4504, BIO 4514, ADS 4613, BCH 4113, CVM 2443.

<sup>2</sup> Restricted Engineering Electives. Select from: ABE 4523, ABE 4533, ABE 4613, ABE 4624, ABE 4723, EM 4123, EM 4133, EM 4213, ME 3113, ME 3163, ME 3313, ME 4123, ME 4743, ME 4833, EG 1143, CSE 4613, CSE 4623, IE 4113, IE 4173, IE 4553, IE 4733, IE 4743, ECE 3714, ECE 3443

<sup>3</sup> Restricted Math/Physics Electives. Select from: MA 3113, MA 3353, MA 4143, MA 4373, PH 2233

**Biomedical Engineering****English Composition** 6

EN 1103	English Composition I
or EN 1163	Accelerated Composition I
EN 1113	English Composition II
or EN 1173	Accelerated Composition II

**Fine Arts** 3

See General Education courses

**Natural Science**

See Major Core

**Extra Science (if appropriate)**

See Major Core

**Mathematics**

See Major Core

**Humanities** 6

See General Education courses

**Social/Behavioral Sciences** 6

See General Education courses

**Major Core****Math and Basic Science** 44

MA 1713	Calculus I
MA 1723	Calculus II
MA 2733	Calculus III
MA 2743	Calculus IV
MA 3253	Differential Equations I
CH 1213	Chemistry I
CH 1211	Investigations in Chemistry I

CH 1223	Chemistry II	
CH 1221	Investigations in Chemistry II	
CH 2503	Elementary Organic Chemistry	
or CH 4513	Organic Chemistry I	
CH 2501	Elementary Organic Chemistry Laboratory	
or CH 4511	Organic Chemistry Laboratory I	
PH 2213	Physics I	
PH 2223	Physics II	
BIO 1134	Biology I	
BIO 3304	General Microbiology	
BCH 4013	Principles of Biochemistry	
or BCH 4603	General Biochemistry I	
<b>Engineering Topics</b>		<b>42</b>
ABE 1911	Engineering in the Life Sciences	
ABE 1921	Introduction to Engineering Design	
ABE 4803	Biosystems Simulation	
ABE 3413	Bioinstrumentation I	
ABE 3303	Transport in Biological Engineering	
ABE 4323	Physiological Systems in Biomedical Engineering	
ABE 4423	Bioinstrumentation II	
ABE 3813	Biophysical Properties of Materials	
ABE 4813	Principles of Engineering Design	
ABE 4833	Practices of Engineering Design	
ABE 4911	Engineering Seminar	
MA 3123	Introduction to Statistical Inference	
EM 2413	Engineering Mechanics I	
EM 2433	Engineering Mechanics II	
EM 3213	Mechanics of Materials	
EM 3313	Fluid Mechanics	
<b>Oral Communication Requirement</b>		
Satisfied by successful completion of GE 3513		
<b>Writing Requirement</b>		<b>3</b>
GE 3513	Technical Writing	
<b>Computer Literacy</b>		
Fulfilled in Engineering Topics courses		
<b>Restricted Electives</b>		
Biological Science Elective <sup>1</sup>		
Engineering Electives (at least 6 hours must be ABE electives) <sup>2</sup>		<b>12</b>
Engineering Elective OR Math/Physics Elective <sup>3</sup>		<b>3</b>
<b>Total Hours</b>		<b>128</b>

<sup>1</sup> Biological Science Electives. Select from: BIO 2103, BIO 3004, BIO 3014, BIO 3103, BIO 3504, BIO 3524, BIO 4113, BIO 4114, BIO 4133, BIO 4143, BIO 4405, BIO 4413, BIO 4433, BIO 4503, BIO 4504, BIO 4514, ADS 4613, BCH 4113, CVM 2443.

<sup>2</sup> Engineering Electives. Select from: ABE 4523, ABE 4613, ABE 4723, ABE 4624, ABE 4533, EM 4123, EM 4133, EM 4213, ME 3113, ME 4123, ME 4743, ME 4833, EG 1143, CSE 4613, CSE 4623, IE 3913, IE 4113, IE 4173, IE 4553, IE 4733, IE 4743, ECE 3714, ECE 3443

<sup>3</sup> **Math/Physics Electives. Select from:** MA 3113, MA 3353, MA 4143, MA 4373, PH 2233, PH 3613, PH 4113