

Department of Agricultural and Biological Engineering

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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, autonomy in agriculture and biological systems, the use of new technologies in robotics and artificial intelligence, 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.

The educational objectives of the program are as follows:

1. To educate students in the academic discipline of Biological and Biomedical 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. This emphasis prepares students to take up careers in the environmental sector or government agencies.

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 emphasis 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.

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. 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, and 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.

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.

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 or EN 1104	English Composition I Expanded English Composition I	3
EN 1113 or EN 1173	English Composition II Accelerated Composition II	3

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 or CH 4513	Elementary Organic Chemistry Organic Chemistry I	
CH 2501 or CH 4511	Elementary Organic Chemistry Laboratory 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

Computer Literacy

Fulfilled in Engineering Topics courses

Major Requirements and Engineering Electives

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

Total Hours 128**Biomedical Engineering****English Composition** 6

EN 1103 English 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

Engineering Topics		42
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	
Oral Communication Requirement		
Satisfied by successful completion of GE 3513		
Writing Requirement		3
GE 3513	Technical Writing	
Computer Literacy		
Fulfilled in Engineering Topics courses		
Restricted Electives		
Biological Science Elective ¹		
Engineering Electives (at least 6 hours must be ABE electives) ²		12
Engineering Elective OR Math/Physics Elective ³		3
Total Hours		128

¹ 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.

² 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

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