

Biosystems Engineering

Accredited by the Engineering Accreditation Commission of ABET, www.abet.org

1. University Requirements: (23)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience: BS 161 Cell and Molecular Biology	3

2. College Requirements: (30)

CEM 141 General Chemistry	4
EGR 100 Introduction to Engineering Design	2
EGR 102 Introduction to Engineering Modeling	2
MTH 132 Calculus I	3
MTH 133 Calculus II	4
MTH 234 Multivariable Calculus	4
MTH 235 Differential Equations	3
PHY 183 Physics for Scientists & Engineers I	4
PHY 184 Physics for Scientists & Engineers II	4

3. Major Requirements: (67-69)

a. Complete all of the following courses: (47)

BE 101 Introduction to Biosystems Engineering	1
BE 230 Engineering Analysis of Biological Systems	3
BE 332 Engineering Properties of Biological Materials	3
BE 334 Biosystems Engineering Laboratory Practice	3
BE 350 Heat and Mass Transfer in Biosystems	3
BE 351 Thermodynamics for Biological Engineering	3
BE 360 Microbial Systems Engineering	3
BE 385 Egr Design & Optimization for Biological Sys	3
BE 485 Biosystems Design Techniques	3
BE 487 Biosystems Design Project (W)	3
BS 162 Organismal and Population Biology	3
CE 221 Statics	3
CE 321 Introduction to Fluid Mechanics	4
CEM 143 Survey of Organic Chemistry	4
CEM 161 Chemistry Laboratory I	1

b. Select one of the following courses: (2)

BS 171 Cell and Molecular Biology Laboratory	2
BS 172 Organismal and Population Biology Laboratory	2

c. Select one of the following courses: (3-4)

MMG 301 Introductory Microbiology	3
PLB 301 Introductory Plant Physiology	3
PSL 250 Introductory Physiology	4
ZOL 341 Fundamental Genetics	4
ZOL 355 Ecology	3

d. Select one of the following courses: (3-4)

BLD 450 Eukaryotic Pathogens	3
CSS 442 Agricultural Ecology	3
FOR 404 Forest Ecology	3
FSC 440 Food Microbiology	3
MMG 425 Microbial Ecology	3
MMG 445 Microbial Biotechnology (W)	3
PLB 402 Biology of Fungi	3
PLB 424 Algal Biology	4
PSL 425 Physiological Biophysics	3

e. Select four of the following courses: (12)

BE 445 Biosensors for Medical Diagnostics	3
BE 456 Electric Power and Control	3
BE 469 Sustainable Bioenergy Systems	3
BE 477 Food Engineering: Fluids	3
BE 478 Food Engineering: Solids	3
BE 481 Water Resources Sys Anlys & Modeling	3
BE 482 Diffuse-Source Pollution Engineering	3
CHE 468 Biomass Conversion Engineering	3
ECE 445 Biomedical Instrumentation	3

Optional Concentrations

The department offers concentrations for students who wish to focus on a specific application area in the discipline. The concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree program in Biosystems Engineering. Courses completed to satisfy requirement 3. above may also be used to satisfy the requirements of a concentration. The concentration will be noted on the student's transcript.

Bioenergy Engineering Concentration

To earn a Bachelor of Science degree in Biosystems Engineering with a bioenergy engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

1. All of the following courses: (9)

BE 469 Sustainable Bioenergy Systems	3
CHE 468 Biomass Conversion Engineering	3
CSS 467 Bioenergy Feedstock Production	3

2. One of the following courses: (3-4)

MMG 445 Microbial Biotechnology (W)	3
PLB 402 Biology of Fungi	3
PLB 424 Algal Biology	4

3. One of the following courses: (3-4):

CHE 481 Biochemical Engineering	3
CHE 882 Advanced Biochemical Engineering	3
CHE 883 Multidisciplinary Bioprocessing Laboratory	3
GLG 471 Applied Geophysics	4
MC 450 International Environmental Law & Policy	3
ME 417 Design of Alternative Energy Systems	3
ME 422 Introduction to Combustion	3
MMG 445 Microbial Biotechnology (W)	3
PLB 402 Biology of Fungi	3
PLB 424 Algal Biology	4

Courses used to fulfill requirement 2. in this concentration may not be used to fulfill requirement 3.

Biomedical Engineering Concentration

To earn a Bachelor of Science degree in Biosystems Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

1. The following course: (3)

BE 445 Biosensors for Medical Diagnostics 3

2. One of the following courses: (3)

ECE 445 Biomedical Instrumentation 3

ME 494 Biofluid Mechanics and Heat Transfer 3

3. One of the following courses: (3)

BLD 450 Eukaryotic Pathogens 3

PSL 425 Physiological Biophysics 3

4. Two of the following: (5-6)

BLD 204 Mechanisms of Disease 3

BLD 430 Molecular Laboratory Diagnostics 2

BLD 434 Clinical Immunology 3

BLD 450 Eukaryotic Pathogens 3

ECE 445 Biomedical Instrumentation 3

ME 494 Biofluid Mechanics and Heat Transfer 3

MSE 425 Biomaterials and Biocompatibility 3

PLB 400 Introduction to Bioinformatics 3

PSL 425 Physiological Biophysics 3

Courses used to fulfill requirements 2. and 3. in this concentration may not be used to fulfill requirement 4.

Ecosystems Engineering Concentration

To earn a Bachelor of Science degree in Biosystems Engineering with an ecosystems engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

1. All of the following courses: (9)

BE 481 Water Resources Systems Analysis and Modeling 3

BE 482 Diffuse-Source Pollution Engineering 3

MMG 425 Microbial Ecology 3

2. Two of the following courses: (5-6)

CE 422 Applied Hydraulics 3

CSS 210 Fundamentals of Soil Science 3

CSS 330 Soil Chemistry 2

CSS 360 Soil Biology 3

CSS 442 Agricultural Ecology 3

CSS 455 Pollutants in the Soil Environment 3

FOR 404 Forest Ecology 3

FW 417 Wetland Ecology and Management 3

FW 420 Stream Ecology 3

FW 443 Restoration Ecology 3

Food Engineering Concentration

To earn a Bachelor of Science degree in Biosystems Engineering with a food engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

All of the following courses: (9)

BE 477 Food Engineering: Fluids 3

BE 478 Food Engineering: Solids 3

FSC 440 Food Microbiology 3

Two of the following courses, one of which must be at the 400-level: (6-7)

BMB 200 Introduction to Biochemistry 4

FSC 211 Principles of Food Science 3

FSC 401 Food Chemistry 3

FSC 430 Food Processing: Fruits & Vegetables 3

FSC 431 Food Processing: Cereals 3

FSC 432 Food Processing: Dairy Foods 3

FSC 433 Food Processing: Muscle Foods 3

Other Electives (Variable)

Total Credits Required for Degree

128

These requirements are effective for students admitted to the Biosystems Engineering major beginning Fall 2011. The Department of Biosystems and Agricultural Engineering (BAE) constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Biosystems Engineering should contact the Biosystems Engineering Advising Office, 103 B Farrall Hall, phone (517) 355-3274. For scheduling academic advising appointments visit: <https://www.egr.msu.edu/adcalendar/>

Last revised February, 2012

Biosystems Engineering

Sample Program

Freshman Year				Sophomore Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
BE 101	1	BS 161	3	BS 162	3	BE 230	3
CEM 141	4	EGR 102	2	IAH 201-210 (A)	4	CE 221	3
CEM 161	1	ISS 2XX	4	MTH 234	4	CEM 143	4
EGR 100	2	MTH 133	4	PHY 184	4	IAH 211 or higher (B)	4
MTH 132	3	PHY 183	4	BE Choice B	2	MTH 235	3
WRA 1XX	4						
Total	15	Total	17	Total	17	Total	17

Junior Year				Senior Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
BE 332	3	BE 350	3	BE 485	3	BE 487	3
BE 334	3	BE 360	3	BE Choice D	3-4	BE Choice E	3
BE 351	3	BE 385	3	BE Choice E	3	BE Choice E	3
CE 321	4	BE Choice C	3-4	Elective	3	Elective	3
ISS 3XX	4	Elective	3	BE Choice E	3	Elective	3
Total	17	Total	15-16	Total	15-16	Total	15

PROGRAM EDUCATIONAL OBJECTIVES

The overall purpose of the MSU Biosystems Engineering Undergraduate Program is to prepare graduates who will integrate and apply principles of engineering and biology to a wide variety of globally important problems. To achieve that purpose, the primary objectives of the Biosystems Engineering Program are to prepare graduates to:

- identify and solve problems at the interface of biology and engineering, using modern engineering techniques and the systems approach, and
- analyze, design, and control components, systems, and processes that involve critical biological components.

Additionally, the Biosystems Engineering Program is designed to help graduates succeed in diverse careers by developing a professional foundation that includes vision, adaptability, creativity, a practical mindset, effective communication skills for technical and non-technical audiences, the ability to work in diverse, cross-disciplinary teams, and a commitment to sustainability, continuing professional growth, and ethical conduct.

Approved by the Biosystems Engineering faculty (26 February 2010), the Biosystems Engineering Industry Advisory Board (15 April 2010), and the Biosystems Engineering Student Group (30 April 2010).