

# Biosystems Engineering

## 1. University Requirements: (23)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities, IAH 201-210 and IAH 211 or>	8
Integrative Studies in Social Sciences, ISS 2XX and ISS 3XX	8
Bioscience: BS 161 Cell and Molecular Biology	3

## 2. College Requirements: (30) \*College Admission Requirement

*CEM 151 General and Descriptive 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: (64-66)

### a. Complete all of the following courses: (44)

BE 101 Introduction to Biosystems Engineering	1
BE 201 Drafting in 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 (W)	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 Engineering Design & Optimization for Biological Sys	3
BE 485 Biosystems Design Techniques (W)	3
BE 487 Biosystems Design Project	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)

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

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

CSS 442 Agricultural Ecology	3
CSS 451 Biotechnology Apps for Plant Breeding & Genetics	3
FOR 406 Applied Forest Ecology: Silviculture	3
FSC 440 Food Microbiology	3
MMG 365 Medical Microbiology	3
MMG 404 Human Genetics	3
MMG 425 Microbial Ecology	3
MMG 445 Microbial Biotechnology (W)	3

## Choice d. continued

PLB 402 Biology of Fungi	4
PSL 425 Physiological Biophysics	3

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

BE 444 Biosensors for Medical Diagnostics	3
BE 449 Human Health Risk Analysis for Eng Controls	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 Systems Analysis & Modeling	3
BE 482 Engineering Ecological Treatment Systems	3
BE 484 Water Resource Recovery Engineering	3
CHE 468 Biomass Conversion Engineering	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 and Bioproduct Engineering Concentration: (15-17)

To earn a Bachelor of Science degree in Biosystems Engineering with a bioenergy and bioproduct 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. Two of the following courses: (6-8):

CHE 481 Biochemical Engineering	3
CSS 442 Agricultural Ecology	3
CSS 451 Biotechnology Apps for Plant Breeding & Genetics	3
FOR 406 Applied Forest Ecology: Silviculture	3
FOR 427 Biomass and Bioproducts Chemistry	3
FOR 466 Natural Resource Policy	3
FW 444 Conservation Biology	3
GLG 435 Geomicrobiology	4
MC 450 International Environmental Law & Policy	3
ME 417 Design of Alternative Energy Systems	3
ME 422 Introduction to Combustion	3
MMG 425 Microbial Ecology	3
MMG 445 Microbial Biotechnology (W)	3
PLB 402 Biology of Fungi	4

# Biosystems Engineering

## Biomedical Engineering Concentration: (14-15)

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. All of the following courses: (6)

BE 444	Biosensors for Medical Diagnostics	3
BE 449	Human Health Risk Analysis for Eng Controls	3

### 2. One of the following courses: (3)

MMG 365	Medical Microbiology	3
MMG 404	Human Genetics	3
PSL 425	Physiological Biophysics	3

### 3. Two of the following: (5-6)

BE 440	Entrepreneurial Eng for Innovation in Health & Safety	3
BLD 204	Mechanisms of Disease	3
BLD 313	Quality in Clinical Laboratory Practice	3
BLD 430	Molecular Diagnostics	2
BLD 434	Clinical Immunology	3
ECE 445	Biomedical Instrumentation	3
ME 494	Biofluid Mechanics and Heat Transfer	3
MMG 365	Medical Microbiology	3
MMG 404	Human Genetics	3
MSE 425	Biomaterials and Biocompatibility	3
PLB 400	Introduction to Bioinformatics	3
PSL 425	Physiological Biophysics	3

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

## Ecosystems Engineering Concentration: (14-15)

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	Engineering Ecological Treatment Systems	3
BE 484	Water Resource Recovery Engineering	3

### 2. One of the following courses: (3)

CSS 442	Agricultural Ecology	3
MMG 425	Microbial Ecology	3

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

CSS 210	Fundamentals of Soil Science	3
CSS 330	Soil Chemistry	2
CSS 360	Soil Biology	3
CSS 442	Agricultural Ecology	3
CSS 455	Environmental Pollutants in Soil and Water	3
ENE 422	Applied Hydraulics	3
FOR 340	Forest Ecology	3
FW 417	Wetland Ecology and Management	3
FW 420	Stream Ecology	3
FW 444	Conservation Biology	3
GEO 402	Agricultural Climatology	3
MC 450	International Environmental Law and Policy	3
MMG 425	Microbial Ecology	3
PLB 418	Plant Systematics	3
PLB 443	Restoration Ecology	3

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

## Food Engineering Concentration: (15-16)

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 2023. 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 their advisor to obtain assistance in planning an appropriate schedule of courses.

**Last revised February 2023**

## Biosystems Engineering Sample Program

Freshman Year				Sophomore Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
BE 101	1	BS 161	3	BE 201	1	CEM 143	4
CEM 151	4	EGR 102	2	BS 162	3	BE 230	3
CEM 161	1	ISS 2XX	4	IAH 201-210	4	CE 221	3
EGR 100	2	MTH 133	4	MTH 234	4	MTH 235	3
MTH 132	3	PHY 183	4	PHY 184	4	IAH 211 or >	4
WRA 101	4			BE Choice B	2		
<b>Total</b>	<b>15</b>	<b>Total</b>	<b>17</b>	<b>Total</b>	<b>18</b>	<b>Total</b>	<b>17</b>

  

Junior Year				Senior Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
BE 332	3	BE 350	3	BE 485	3	BE 487	3
CE 321	4	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
BE 334	3	BE Choice C	3-4	BE Choice E	3	Elective	3
ISS 3XX	4	Elective	3	Elective	3	Elective	2
<b>Total</b>	<b>17</b>	<b>Total</b>	<b>15-16</b>	<b>Total</b>	<b>15-16</b>	<b>Total</b>	<b>14</b>

Last revised May 2023

### PROGRAM EDUCATIONAL OBJECTIVES

Graduates of the MSU Biosystems Engineering Undergraduate Program are expected to succeed in diverse careers where they integrate and apply principles of engineering and biology to a wide variety of globally important problems. MSU Biosystems Engineering graduates are expected to attain that success by:

- identifying and solving problems at the interface of biology and engineering, using modern engineering techniques and the systems approach;
- analyzing, designing, and controlling components, systems, and processes that involve critical biological components; and
- demonstrating 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.

Updated and approved by the Biosystems Engineering faculty (May 2016), the Biosystems Engineering Industry Advisory Board (April 2016), and the Biosystems Engineering Student Group (Nov 2014).