Biosystems Engineering

University Requirements (23-24)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing</td>
<td>4</td>
</tr>
<tr>
<td>Integrative Studies in Humanities (IAH)</td>
<td>8</td>
</tr>
<tr>
<td>Integrative Studies in Social Sciences (ISS)</td>
<td>8</td>
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<tr>
<td>Bioscience (one of the following):</td>
<td>3-4</td>
</tr>
<tr>
<td>BS 110, BS 111, ENT 205, MMG 205, MMG 301, PLB 105, PSL 250, ZOL 141</td>
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College Requirements (29)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CEM 141 General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CSE 131 Introduction to Technical Computing</td>
<td>3</td>
</tr>
<tr>
<td>MTH 132 Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>MTH 133 Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MTH 234 Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MTH 235 Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>1PHY 183 Physics for Scientists &amp; Engineers I</td>
<td>4</td>
</tr>
<tr>
<td>1PHY 184 Physics for Scientists &amp; Engineers II</td>
<td>4</td>
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Major Requirements (54-55)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BE 130 Engineering Design Fund for Bio Systems</td>
<td>2</td>
</tr>
<tr>
<td>BE 230 Principles of Biowaste Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BE 331 Machinery Principles in Biowaste Engr</td>
<td>3</td>
</tr>
<tr>
<td>BE 333 Biosystems Engineering Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>BE 350 Heat and Mass Transfer in Biowaste</td>
<td>3</td>
</tr>
<tr>
<td>BE 351 Environmental Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>BE 431 Bio-resource Optimization</td>
<td>3</td>
</tr>
<tr>
<td>BE 485 Biosystems Design Techniques</td>
<td>2</td>
</tr>
<tr>
<td>BE 487 Biosystems Design Project</td>
<td>3</td>
</tr>
<tr>
<td>CE 321 Fluid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>2CEM 143 Survey of Organic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CEM 161 Chemistry Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td>EC 210 Economics Principles Using Calculus</td>
<td>3</td>
</tr>
<tr>
<td>ECE 345 Electronic Instrumentation &amp; Systems</td>
<td>3</td>
</tr>
<tr>
<td>ME 220 Introduction to Solid Mechanics</td>
<td>4</td>
</tr>
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</table>

Select three of the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 430 Power &amp; Control Hydraulics</td>
<td>3</td>
</tr>
<tr>
<td>BE 431 Resource Optimization</td>
<td>3</td>
</tr>
<tr>
<td>BE 438 Principles of Machinery Structures</td>
<td>3</td>
</tr>
<tr>
<td>BE 453 Engr Principles of the Plant Environment</td>
<td>3</td>
</tr>
<tr>
<td>BE 456 Electric Power &amp; Control</td>
<td>3</td>
</tr>
<tr>
<td>BE 457 Postharvest Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BE 477 Food Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BE 481 Land and Water Conservation Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Select two courses with Department Approval

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Electives</td>
<td>6-7</td>
</tr>
</tbody>
</table>

Cognates (15)

The cognate requirement must include a minimum of 15 credits; at least one biological science course (notated with a *), which is in addition to the University biological science requirement. Where no recommendation is given under the cognate, select a second course from the ISB alternative track list under University Requirements; 300-400 level courses to achieve depth in a particular area. Note: Engineering electives cannot simultaneously satisfy the 15-credit cognate and engineering elective requirements.

Agricultural Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ABM 100 Decision-Making in the Agri-Food System</td>
<td>3</td>
</tr>
<tr>
<td>ABM 332 Agribusiness Operations Management</td>
<td>3</td>
</tr>
<tr>
<td>ACS 110 Introductory Animal Agriculture</td>
<td>4</td>
</tr>
<tr>
<td>ANS 480 Animal Systems in International Development</td>
<td>3</td>
</tr>
<tr>
<td>ATM 431 Irrigation, Drainage and Erosion Control Syst</td>
<td>3</td>
</tr>
<tr>
<td>CSS 210 Fund. of Soil &amp; Landscape Science</td>
<td>3</td>
</tr>
<tr>
<td>CSS 370 Agricultural Cropping Systems Mgt</td>
<td>3</td>
</tr>
<tr>
<td>CSS 440 Soil Biophysics</td>
<td>3</td>
</tr>
<tr>
<td>FOR 202 Introduction to Forestry</td>
<td>3</td>
</tr>
<tr>
<td>FSM 330 Farm Business Management</td>
<td>3</td>
</tr>
<tr>
<td>HRT 203 Principles of Horticulture I</td>
<td>2</td>
</tr>
<tr>
<td>HRT 401 Physiology and Mgt of Herbaceous Plants</td>
<td>3</td>
</tr>
<tr>
<td>ME 180 Engineering Graphics Communications</td>
<td>3</td>
</tr>
<tr>
<td>3PLB 301 Introductory Plant Physiology</td>
<td>3</td>
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</table>

Suggested Engineering Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 430 Power and Control Hydraulics</td>
<td>3</td>
</tr>
<tr>
<td>BE 438 Design of Machinery Structures</td>
<td>3</td>
</tr>
<tr>
<td>BE 456 Electric Power and Control</td>
<td>3</td>
</tr>
<tr>
<td>ME 361 Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 423 Intermediate Mech. of Deformable Solids</td>
<td>3</td>
</tr>
<tr>
<td>MSE 250 Material Science &amp; Engineering</td>
<td>3</td>
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</table>

Biomedical Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>4PSL 250 Introductory Physiology</td>
<td>4</td>
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</table>

Select one of the following courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>3BS 110 Organisms and Populations</td>
<td>4</td>
</tr>
<tr>
<td>3BS 111 Cells and Molecules</td>
<td>3</td>
</tr>
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</table>

At least 9 credits from the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ME/BME 495 Tissue Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ME/BME 496 Biodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME/BME 497 Biomechanical Design</td>
<td>3</td>
</tr>
<tr>
<td>ME 492 Special Topics</td>
<td>3 - 12</td>
</tr>
<tr>
<td>MME/BME 424 Biomaterials and Biocompatibility</td>
<td>3</td>
</tr>
<tr>
<td>MSE 490 Independent Study</td>
<td>3-12</td>
</tr>
</tbody>
</table>

Suggested Engineering Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 361 Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 464 Intermediate Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 425 Experimental Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>
Biotechnology

- CSS 350  Introduction to Plant Genetics  3
- OR
- ZOL 341  Fundamental Genetics
- 4
- BMB 401  Basic Biochemistry
- 4
- CSS 451  Cell, Molecular Principles & Tech for Plant Sci
- 4
- HRT 486  Biotech. in Agric.: Appl. and Ethical Issues
- 3

Suggested Engineering Electives

- CHE 481  Biochemical Engineering (CHE must approve)  3

The Biotechnology Cognate requires students to take either the CEM 251/252 series or the CEM 351/352 series as a prerequisite to BMB 401. Students will be allowed to substitute CEM 251 or 351 in place of the CEM 143 major requirements and CEM 252 or 352 will count towards the 15 credit minimum for the cognate.

Environmental Studies

- BS 110  Organisms and Populations
- 4
- GLG 201  Earth Processes and History
- 4
- ISS 310  People and Environment
- 4

Choose one of the following courses (3/4 credits)

- CE 280  Intro to Environmental Engineering
- 3
- CSS 210  Fund. of Soil & Landscape Science
- 3
- CSS 455  Pollutants in the Soil Environment
- 3
- FOR 404  Forest and Agricultural Ecology
- 4
- FW 207  Great Lakes: Biology and Management
- 3
- FW 364  Ecosystem Processes
- 3
- FW 444  Conservation Biology
- 3
- GEO 203  Introduction of Meteorology
- 3
- GEO 206  Physical Geography
- 3
- GLG 421  Environmental Geochemistry
- 4
- RD 324  Water Resource Development
- 3
- ZOL 355  Ecology
- 3

Choose one of the following courses (3 credits)

- ANP 470  Food, Hunger and Society
- 3
- FOR 464  Nat Resource Economics & Social Science
- 3
- PKG 370  Packaging and the Environment
- 3
- PLS 342  Comparative Political Economy
- 3
- PRM 260  World Food, Population and Poverty
- 3
- PRM 320  Environmental Economics
- 3
- PRR 302  Environmental Attitudes & Concepts
- 3
- RD 201  Environmental and Natural Resources
- 3
- RD 336  State Environmental Law
- 3
- RD 430  Law and Resources
- 3
- RD 460  Resource & Environmental Economics
- 3
- SOC 452  Environment and Society
- 3
- UP 323  Land and Environmental Planning
- 3
- ZOL 446  Environmental Issues & Public Policy
- 3

Choose one of the following courses (3 credits)

- PLS 301  American State Government
- 3
- PLS 305  Environmental Politics
- 3
- PLS 310  Public Bureaucracy in the Public Process
- 3
- PLS 313  Public Policy Analysis
- 3
- PLS 324  American Legislative Process
- 3
- PLS 331  Political Parties and Interest Groups
- 3

Seminars (must enroll for three seminars)

- NSC 192  Environmental Issues Seminar
- 1

Suggested Engineering Electives

- BE 481  Agricultural and Small Watershed Hydrology
- 3
- CE 280  Intro to Environmental Engineering
- 3
- CE 485  Solid and Hazardous Waste Management
- 3

Food Engineering

- FSC 211  Principles of Food Science
- 3
- FSC 401  Food Chemistry
- 3
- FSC 421  Food Laws and Regulations
- 3
- FSC 430  Food Processing: Fruits & Vegetables
- 3
- FSC 431  Food Processing: Cereals
- 3
- FSC 432  Food Processing: Dairy Foods
- 3
- FCS 433  Food Processing: Muscle Foods
- 3
- OR
- ANS/FSC 320  Muscle Foods
- 3
- FW/FSC 275  Seafood Systems Management
- 3
- HRT 403  Handling and Storage of Agric Crops
- 3

Suggested Engineering Electives

- BE 456  Electric Power and Control
- 3
- BE 477  Food Engineering
- 3

**Biosystems majors cannot receive credit for BE/FSC 329

Natural Resources / Environmental Engineering

- ATM 431  Irrigation, Drainage & Erosion Cntrl Systems
- 3
- CSS 210  Fund. of Soil and Landscape Science
- 3
- CSS 455  Pollutants in the Soil Environment
- 3
- CSS 470  Soil Resources
- 3
- FW 364  Ecosystem Processes
- 3
- FW/BE 419  Appl of Geogrphc Info Sys to Res Mgt
- 4
- FW/BE 443  Restoration Ecology
- 3
- GEO/BE 402  Agricultural Climatology
- 3
- GLS 411  Hydrogeology
- 4
- ME 180  Engineering Graphic Communications
- 3
- %PLB 105  Plant Biology
- 3
- PRM 255  Ecological Economics
- 3
- PRM 320  Environmental Economics
- 3
- RD/BE 460  Resource and Environmental Economics
- 3

Suggested Engineering Electives

- BE 481  Agricultural and Small Watershed Hydrology
- 3
- CE 280  Introduction to Environmental Engineering
- 3
- CE 483  Water and Wastewater Treatment
- 3
- CE 485  Solid and Hazardous Waste Management
- 3

Other Electives (Variable)

Total Credits Required for Degree

128

The requirements listed above apply to students admitted to the Department of Agricultural Engineering beginning Summer, 2001. The Department of Agricultural Engineering (AE) constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her advisor to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Biosystems Engineering should contact the Agricultural Engineering Department Advising Office, 100 Farrall Hall, phone (517)353-4455.
Biosystems Engineering
Sample Program

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ATL 1XX</td>
<td>4</td>
<td>Bioscience (AT)</td>
<td>3/4</td>
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<tr>
<td>CEM 141</td>
<td>4</td>
<td>ISS 2XX</td>
<td>4</td>
</tr>
<tr>
<td>CEM 161</td>
<td>1</td>
<td>MTH 133</td>
<td>4</td>
</tr>
<tr>
<td>BE 130</td>
<td>2</td>
<td>PHY 183</td>
<td>4</td>
</tr>
<tr>
<td></td>
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<td><strong>Total</strong></td>
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<table>
<thead>
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<th>Fall</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>CSE 131</td>
<td>3</td>
<td>Elective</td>
<td>3</td>
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<tr>
<td>EC 210</td>
<td>3</td>
<td>MTH 235</td>
<td>3</td>
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<tr>
<td>MTH 234</td>
<td>4</td>
<td>BE 206</td>
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<td>PHY 184</td>
<td>4</td>
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<td><strong>Total</strong></td>
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<table>
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<th>Fall</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>BE 331</td>
<td>3</td>
<td>BE 350</td>
<td>2</td>
</tr>
<tr>
<td>BE 333</td>
<td>1</td>
<td>ISS 3XX</td>
<td>4</td>
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<tr>
<td>CE 321</td>
<td>4</td>
<td>Cognate</td>
<td>3</td>
</tr>
<tr>
<td>ECE 345</td>
<td>3</td>
<td>Elective</td>
<td>4</td>
</tr>
<tr>
<td>BE 351</td>
<td>3</td>
<td>Major Elec</td>
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<tr>
<td>IAH XXX</td>
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<td><strong>Total</strong></td>
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<table>
<thead>
<tr>
<th>Fall</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>Cognate</td>
<td>3</td>
<td>BE 487</td>
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</tr>
<tr>
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<td><strong>15</strong></td>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
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</tbody>
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Program Objectives

The objective of the Biosystems Engineering Program at Michigan State University is to produce graduates that have:

(a) An ability to apply knowledge of mathematics, science, and engineering.
(b) An ability 1) to design and conduct experiments, as well as 2) to analyze and interpret data.
(c) An ability to design a system, component, or process to meet desired needs.
(d) An ability to function on multi-disciplinary teams.
(e) An ability to identify, formulate, and solve engineering problems.
(f) An understanding of professional and ethical responsibility.
(g) An ability to communicate effectively.
(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context.
(i) A recognition of the need for, and an ability to engage in life-long learning.
(j) A knowledge of contemporary issues.
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) An understanding of the interface between biology and engineering.
(m) An ability to apply systems concepts and methodology.

The program objective was approved by faculty, students ('98), industry advisory board and alumni in December 1997.