Agricultural and biological engineering is the application of mathematics, physical and biological science, and engineering to agriculture, food systems, energy, natural resources, the environment, and related biological systems. This ABET-accredited program has special emphasis on environmental protection and the biological interface of plants, animals, soils, and microorganisms with the design and performance of environments, machines, mechanisms, processes, and structures.

The Department of Agricultural and Biological Engineering offers programs through the College of ACES and The Grainger College of Engineering.

Students pursuing the B.S. Degree in Agricultural and Biological Engineering choose from one of two concentrations, one of which is the concentration in Biological Engineering. This concentration integrates biology and engineering to provide solutions to problems related to living systems (plants, animals, and microorganisms). Engineered biological systems vary widely in scale. At the molecular level, nanometer-scale devices consist of a few biomolecules inside individual cells. At the other extreme, regionally-scaled complex ecosystems depend upon multiple species of interacting living organisms. Such systems are becoming increasingly important in areas such as bioenergy, bioprocessing, nanotechnology, biosensing, bio-informatics, and bioenvironment. Within this concentration, students are strongly encouraged to select a set of coherent courses that constitutes a specialization in their area of career interest either from the following list or a customized area chosen in consultation with an advisor:

- Bioenvironmental Engineering
- Ecological Engineering
- Food and Bioprocess Engineering
- Nanoscale Biological Engineering

Agricultural & Biological Engineering: Biological Engineering Concentration

Overview of Curricular Requirements
The curriculum requires 128 hours for graduation and is organized as follows.

Orientation and Professional Development
These courses introduce the opportunities and resources that your college, department, and curriculum can offer you as you work to achieve your career goals. They also provide the skills to work effectively and successfully in the engineering profession.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 100</td>
<td>Intro Agric &amp; Biological Engrg</td>
<td>1</td>
</tr>
<tr>
<td>ENG 100</td>
<td>Engineering Orientation</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Total Orientation Hours:</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

Foundational Mathematics and Science
These courses stress the basic mathematical and scientific principles upon which the engineering discipline is based.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 102</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 103</td>
<td>General Chemistry Lab I</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 104</td>
<td>General Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 105</td>
<td>General Chemistry Lab II</td>
<td>1</td>
</tr>
<tr>
<td>MATH 221</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 225</td>
<td>Introductory Matrix Theory</td>
<td>2</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 241</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 285</td>
<td>Intro Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 211</td>
<td>University Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 212</td>
<td>University Physics: Elec &amp; Mag</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 213</td>
<td>Univ Physics: Thermal Physics</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total Foundational Mathematics and Science Hours:</strong></td>
<td><strong>34</strong></td>
</tr>
</tbody>
</table>

Agricultural and Biological Engineering Technical Core
These courses stress fundamental concepts and basic laboratory techniques that comprise the common intellectual understanding of agricultural and biological engineering and the background for the technical courses and electives in each student's concentration.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 141</td>
<td>ABE Principles: Biological</td>
<td>2</td>
</tr>
<tr>
<td>ABE 223</td>
<td>ABE Principles: Machine Syst</td>
<td>2</td>
</tr>
<tr>
<td>ABE 224</td>
<td>ABE Principles: Soil &amp; Water</td>
<td>2</td>
</tr>
<tr>
<td>ABE 225</td>
<td>ABE Principles: Bioenvironment</td>
<td>2</td>
</tr>
<tr>
<td>ABE 226</td>
<td>ABE Principles: Bioprocessing</td>
<td>2</td>
</tr>
<tr>
<td>ABE 430</td>
<td>Project Management</td>
<td>2</td>
</tr>
<tr>
<td>ABE 469</td>
<td>Industry-Linked Design Project</td>
<td>4</td>
</tr>
<tr>
<td>CS 101</td>
<td>Intro Computing: Engrg &amp; Sci</td>
<td>3</td>
</tr>
</tbody>
</table>
Agricultural & Biological Engineering: Biological Engineering, BS

ECE 205  Electrical and Electronic Circuits  3
SE 101  Engineering Graphics & Design  3
TAM 210  Introduction to Statics  3
or TAM 211 Statics
TAM 212  Introductory Dynamics  3

Total Agricultural and Biological Engineering Technical Core Hours: 30

General Education Requirements

Code  Title  Hours
A minimum of six courses is required, as follows: 18
ECON 103  Principles of Academic Writing  3

Social and Behavioral Sciences  3

Humanities & the Arts  6
The Grainger College of Engineering Liberal Education course list, or from the campus General Education lists for Social and Behavioral Sciences or Humanities and the Arts 6
Cultural Studies: Non-Western Cultures (1 course)
Cultural Studies: U.S. Minorities Cultures (1 course)
Cultural Studies: Western/Comparative Cultures (1 course)

Non-Primary Language Requirement

Code  Title  Hours
Completion of the third semester or equivalent of a non-primary language is required. Completion of three years of a single language in high school satisfies this requirement. 0-9

University Composition

These courses teach fundamentals of expository writing.

Code  Title  Hours
Choose one:
RHET 105  Writing and Research
CMN 111  Oral & Written Comm I
& CMN 112 and Oral & Written Comm II
ESL 111  Intro to Academic Writing I
& ESL 112 and Intro to Academic Writing II
ESL 115  Principles of Academic Writing

Advanced Composition (satisfied by completing ABE 469)

Free Electives

Code  Title  Hours
Free Electives  6

Total Hours of Curriculum to Graduate  128

Electives

Biological and natural sciences electives chosen from a departmentally approved list of Biological and Natural Sciences Electives. Three of the six credit hours must be at the 300 or 400 level

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 341</td>
<td>Transport Processes in ABE</td>
<td>3</td>
</tr>
<tr>
<td>CHBE 321</td>
<td>Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 232</td>
<td>Elementary Organic Chemistry I 1</td>
<td>3</td>
</tr>
<tr>
<td>MCB 150</td>
<td>Molec &amp; Cellular Basis of Life</td>
<td>4</td>
</tr>
</tbody>
</table>

1 External transfer students take ENG 300 instead.
2 MATH 220 may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.
3 The extra hour of credit for this course may be used to help meet free elective requirements.

Information listed in this catalog is current as of 09/2019
Hort 360 Vegetable Crop Production 3
Hort 361 Small Fruit Production 2
Hort 362 Tree Fruit Production 2
Hort 363 Postharvest Handling Hort Crop 2
Hort 421 Horticultural Physiology 4
Hort 435 Urban Food Production 3
IB 103 Introduction to Plant Biology 4
IB 150 Organismal & Evolutionary Biol 4
IB 151 Organismal & Evol Biol Lab 1
IB 203 Ecology 4
IB 329 Animal Behavior 3
IB 335 Plant Systematics 4
IB 411 Bioinspiration 3
IB 420 Plant Physiology 3
IB 439 Biogeography 3
IB 444 Insect Ecology 3 or 4
IB 452 Ecosystem Ecology 3
IB 482 Insect Pest Management 3
IB 485 Environ Toxicology & Health 3
IB 486 Pesticide Toxicology 3 or 4
MCB 100 Introductory Microbiology 3
MCB 101 Intro Microbiology Laboratory 2
MCB 244 Human Anatomy & Physiology I 3
MCB 245 Human Anat & Physiol Lab I 2
MCB 250 Molecular Genetics 3
MCB 251 Exp Techniqs in Molecular Biol 2
MCB 252 Cells, Tissues & Development 3
MCB 253 Exp Techniqs in Cellular Biol 2
MCB 300 Microbiology 3
MCB 301 Experimental Microbiology 3
MCB 314 Introduction to Neurobiology 3
MCB 316 Genetics and Disease 4
MCB 450 Introductory Biochemistry 3
NRES 201 Introductory Soils 4
NRES 219 Principles of Ecosystem Mgmt 3
NRES 348 Fish and Wildlife Ecology 3
NRES 351 Introduction to Environmental Chemistry 3
NRES 419 Env and Plant Ecosystems 3
NRES 420 Restoration Ecology 4
NRES 429 Aquatic Ecosystem Conservation 3
NRES 439 Env and Sustainable Dev 3
NRES 471 Pedology 3
NRES 475 Environmental Microbiology 3
NRES 487 Soil Chemistry 3
NRES 488 Soil Fertility and Fertilizers 3
PLPA 204 Introductory Plant Pathology 3
PLPA 401 Plant Pathogenic Fungi 4
PLPA 402 Phytoparasitic Nematodes 2
PLPA 402 Phytoparasitic Nematodes 2
PLPA 404 Plant Virology 2
PLPA 405 Plant Disease Diagnosis & Mgmt 3
PLPA 406 Phytobacteriology 2
PLPA 407 Diseases of Field Crops 3

Technical electives chosen in consultation with an advisor. At least 8 hours must be Agricultural and Biological Engineering Technical Electives

ABE 361 Off-Road Machine Design 3
ABE 425 Engrg Measurement Systems 4
ABE 436 Renewable Energy Systems 3 or 4
ABE 446 Biological Nanoengineering 3 or 4
ABE 454 Environmental Soil Physics 3
ABE 455 Erosion and Sediment Control 2
ABE 456 Land & Water Resources Engrg 3 or 4
ABE 457 NPS Pollution Processes 2
ABE 458 NPS Pollution Modeling 2
ABE 459 Drainage and Water Management 3 or 4
ABE 463 Electrohydraulic Systems 3
ABE 466 Engineering Off-Road Vehicles 3
ABE 474 Indoor Environmental Control 3 or 4
ABE 476 Indoor Air Quality Engineering 4
ABE 482 Package Engineering 3
ABE 483 Engrg Properties of Food Matls 3
ABE 488 Bioprocessing Biomass for Fuel 3
BIOE 301 Introductory Biomechanics 3
BIOE 416 Biosensors 3
BIOE 461 Cellular Biomechanics 4
BIOE 467 Biophotonics 3
BIOE 473 Biomaterials Laboratory 3
BIOE 474 Metabolic Engineering 3 or 4
BIOE 476 Tissue Engineering 3
CHBE 221 Principles of CHE 3
CHBE 422 Mass Transfer Operations 4
CHBE 424 Chemical Reaction Engineering 3
CHBE 471 Biochemical Engineering 3 or 4
CHBE 472 Techniques in Biomolecular Eng 3 or 4
CHBE 473 Biomolecular Engineering 3 or 4
CHBE 475 Tissue Engineering 3
CHBE 476 Biotransport 3
CHBE 478 Bioenergy Technology 3
CEE 300 Behavior of Materials 4
CEE 330 Environmental Engineering 3
CEE 350 Water Resources Engineering 3
CEE 360 Structural Engineering 3
CEE 380 Geotechnical Engineering 3
CEE 430 Ecological Quality Engineering 2
CEE 432 Stream Ecology 3 or 4
CEE 434 Environmental Systems I 3
CEE 437 Water Quality Engineering 3
CEE 440 Fate Cleanup Environ Pollutant 4
CEE 442 Environmental Engineering Principles, Physical 4
CEE 443 Env Eng Principles, Chemical 4
CEE 444 Env Eng Principles, Biological 4
CEE 445 Air Quality Modeling 4
CEE 446 Air Quality Engineering 4
The schedule that follows is illustrative, showing the typical sequence in which courses would be taken by a student with no college course credit already earned and who intends to graduate in four years. Each individual's case may vary, but the position of required named courses is generally indicative of the order in which they should be taken.

Suggested Sequence

First Year

First Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 100</td>
<td>Intro Agric Biological Engrg</td>
<td>1</td>
</tr>
<tr>
<td>ENG 100</td>
<td>Engineering Orientation</td>
<td>0</td>
</tr>
<tr>
<td>CHEM 102</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 103</td>
<td>General Chemistry Lab I</td>
<td>1</td>
</tr>
<tr>
<td>SE 101</td>
<td>Engineering Graphics Design</td>
<td>3-4</td>
</tr>
<tr>
<td>MATH 221</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>Liberal education elective</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Semester Hours</td>
<td></td>
<td>15-16</td>
</tr>
</tbody>
</table>

Second Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 141</td>
<td>ABE Principles: Biological</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 104</td>
<td>General Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 105</td>
<td>General Chemistry Lab II</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 211</td>
<td>University Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>RHET 105</td>
<td>Writing and Research</td>
<td>4-3</td>
</tr>
<tr>
<td>Semester Hours</td>
<td></td>
<td>17-16</td>
</tr>
</tbody>
</table>

Second Year

First Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 223</td>
<td>ABE Principles: Machine Syst</td>
<td>2</td>
</tr>
<tr>
<td>ABE 224</td>
<td>ABE Principles: Soil Water</td>
<td>2</td>
</tr>
<tr>
<td>CS 101</td>
<td>Intro Computing: Engrg Sci</td>
<td>3</td>
</tr>
<tr>
<td>MATH 241</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 212</td>
<td>University Physics: Elec Mag</td>
<td>4</td>
</tr>
<tr>
<td>TAM 210</td>
<td>Introduction to Statics or 211</td>
<td>2-3</td>
</tr>
<tr>
<td>Semester Hours</td>
<td></td>
<td>17-18</td>
</tr>
</tbody>
</table>

Second Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 225</td>
<td>ABE Principles: Bioenvironment</td>
<td>2</td>
</tr>
<tr>
<td>ABE 226</td>
<td>ABE Principles: Bioprocessing</td>
<td>2</td>
</tr>
<tr>
<td>MATH 225</td>
<td>Introductory Matrix Theory</td>
<td>2</td>
</tr>
<tr>
<td>MATH 285</td>
<td>Intro Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 232</td>
<td>Elementary Organic Chemistry</td>
<td>3-4</td>
</tr>
<tr>
<td>PHYS 213</td>
<td>Univ Physics: Thermal Physics</td>
<td>2</td>
</tr>
<tr>
<td>TAM 212</td>
<td>Introductory Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>Semester Hours</td>
<td></td>
<td>17-18</td>
</tr>
</tbody>
</table>

Third Year

First Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 341</td>
<td>Transport Processes in ABE</td>
<td>3</td>
</tr>
<tr>
<td>ECE 205</td>
<td>Electrical and Electronic Circuits</td>
<td>3</td>
</tr>
<tr>
<td>MCB 150</td>
<td>Molec Cellular Basis of Life</td>
<td>4</td>
</tr>
<tr>
<td>Agricultural and biological engineering technical elective</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Information listed in this catalog is current as of 09/2019
Liberal education elective\(^{3,4}\) 3  

Semester Hours 16

Second Semester  
ECON 103, Macroeconomic Principles 3  
102, or ACE 100\(^3\)  
CHBE 321 Thermodynamics 4  
Agricultural and biological engineering technical elective\(^7\) 3  
Biological and natural sciences elective\(^6\) 3  
Liberal education elective\(^{3,4}\) 3  

Semester Hours 16

Fourth Year  
First Semester  
ABE 430 Project Management 2  
Agricultural and biological engineering technical elective\(^7\) 3  
Other technical elective\(^7\) 3  
Liberal education elective\(^{3,4}\) 3  
Free elective 3  

Semester Hours 14

Second Semester  
ABE 469\(^4\) Industry-Linked Design Project 4  
Biological and natural sciences elective\(^5\) 3  
Other technical elective\(^7\) 3  
Liberal education elective\(^{3,4}\) 3  
Free elective 3-1  

Semester Hours 16-14  

Total Hours: 128

1 RHET 105 may be taken in the first or second semester of the first year as authorized. The alternative is SE 101. Students may take CMN 111 and CMN 112 in place of RHET 105.

2 MATH 220—Calculus may be substituted with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.

3 Liberal education electives (https://wiki.illinois.edu/wiki/display/ugadvise/Degree+Requirements/#DegreeRequirements-LiberalEducationElectives) must include 6 hours of social & behavioral sciences and 6 hours of humanities & the arts course work from the campus General Education lists. ECON 103 (or ECON 102 or ACE 100 by permission) must be one of the social & behavioral sciences courses, recommended to be taken early. The remaining 6 hours may be selected from a list maintained by the college, or additional course work from the campus General Education lists for social & behavioral sciences or humanities & the arts. Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course, (ii) one non-western culture(s) course, and (iii) one U.S. Minority Culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements.

4 ABE 469 satisfies the General Education Advanced Composition requirement.

5 The extra hour of credit for this course may be used to help meet free elective requirements.

6 Students must complete 6 hours from the approved list of Biological and Natural Sciences Electives (https://abe.illinois.edu/undergraduate/biological-natural-sciences-electives). Students in the Biological Engineering Concentration must complete at least one course with a laboratory component.

7 Students must complete 15 hours of Technical Electives (https://abe.illinois.edu/undergraduate/technical-electives) chosen in consultation with an advisor. At least 8 hours must be Agricultural and Biological Engineering Technical Electives. Students in the Biological Engineering Concentration must complete at least one course with a laboratory component.

8 May be taken for 4 credit hours; the extra hour may be used to help meet free elective requirements.