

AGRICULTURAL & BIOLOGICAL ENGINEERING: BIOLOGICAL ENGINEERING, BS

for the degree of Bachelor of Science in Agricultural & Biological Engineering, Biological Engineering Concentration

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

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Graduation Requirements

Minimum Overall GPA: 2.0

Minimum hours required for graduation: 128 hours

General education: Students must complete the Campus General Education requirements including the campus general education language requirement. One of the SBS courses must be an introductory economics course (ECON 102 or ECON 103 or ACE 100). ABE 469 will satisfy a technical core course and the Campus General Education Advanced Composition requirement.

Orientation and Professional Development

Code	Title	Hours
ABE 100	Intro Agric & Biological Engrg	1
ENG 100	Grainger Engineering Orientation Seminar (External transfer students take ENG 300.)	1
Total Hours		2

Foundational Mathematics and Science

Code	Title	Hours
CHEM 102	General Chemistry I	3
CHEM 103	General Chemistry Lab I	1
CHEM 104	General Chemistry II	3
CHEM 105	General Chemistry Lab II	1
MATH 221	Calculus I (MATH 220 may be substituted. MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree.)	4
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 257	Linear Algebra with Computational Applications	3
MATH 285	Intro Differential Equations	3
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
Total Hours		33

Agricultural and Biological Engineering Technical Core

Code	Title	Hours
For Both Concentrations:		
ABE 141	ABE Principles: Biological	2
ABE 223	ABE Principles: Machine Syst	2
ABE 224	ABE Principles: Soil & Water	2
ABE 225	ABE Principles: Bioenvironment	2
ABE 226	ABE Principles: Bioprocessing	2
ABE 430	Project Management	2
ABE 469	Capstone Design Experience (satisfies the general education advanced composition requirement)	4
CS 101	Intro Computing: Engrg & Sci	3
ECE 205	Electrical and Electronic Circuits	3
SE 101	Engineering Graphics & Design	3
TAM 211	Statics	3
TAM 212	Introductory Dynamics	3
Total Hours		31

Concentration

Code	Title	Hours
Student chooses 1 of 2 Concentrations listed below.		
Agricultural Engineering		35-36
Biological Engineering		35

Free Electives

Code	Title	Hours
Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree. (https://go.grainger.illinois.edu/FreeElectives/)		
Total Hours of Curriculum to Graduate		128

Biological Engineering Concentration Requirements

Code	Title	Hours
Required courses for ABE Biological Engineering Concentration Core		
		14

ABE 340	Thermodynamics for Agricultural and Biological Engineering	4
ABE 341	Transport Processes in ABE	3
CHEM 232	Elementary Organic Chemistry I (may be taken for 4 credit hours; the extra hour may be used to help meet free elective requirements)	3
MCB 150	Molec & Cellular Basis of Life	4

Electives		21
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From Departmentally Approved List of Electives, to include: 6 hours of Biological and Natural Sciences Electives and 15 hours of Technical Electives.

Biological and Natural Science Electives. Three of the six credit hours must be at the 300 or 400 level. Must include one course with a lab component.		6
ANSC 100	Intro to Animal Sciences	4
ANSC 221	Cells, Metabolism and Genetics	3
ANSC 350	Cellular Metabolism in Animals	3
ANSC 363	Behavior of Domestic Animals	4
ANSC 400	Dairy Herd Management	3
ANSC 401	Beef Production	3
ANSC 402	Sheep and Goat Production	3
ANSC 403	Pork Production	3
ANSC 404	Poultry Science	3
ANSC 406	Zoo Animal Conservation Sci	3
ANSC 450	Comparative Immunobiology	4
ATMS 201	General Physical Meteorology	3
ATMS 307	Climate Processes	3
CHEM 233	Elementary Organic Chem Lab I	2
CHEM 312	Inorganic Chemistry	3
CHEM 332	Elementary Organic Chem II	4
CHEM 360	Chemistry of the Environment	3
CHEM 460	Green Chemistry	3 or 4
CPSC 112	Introduction to Crop Sciences	4
CPSC 261	Biotechnology in Agriculture	3
CPSC 265	Genetic Engineering Lab	3

CPSC 270	Applied Entomology	3
CPSC 352	Plant Genetics	4
CPSC 414	Forage Crops & Pasture Ecology	3
CPSC 415	Bioenergy Crops	3
CPSC 418	Crop Growth and Management	3
CPSC 431	Plants and Global Change	3
CPSC 437	Principles of Agroecology	3
CPSC 473	Mgmt of Field Crop Insects	3
FSHN 101	The Science of Food and How it Relates to You	3
FSHN 414	Food Chemistry	3
FSHN 416	Food Chemistry Laboratory	3
FSHN 471	Food & Industrial Microbiology	3
FSHN 481	Food Processing Unit Operations I	2
FSHN 482	Food Processing Unit Operations I Lab	1
FSHN 483	Food Processing Unit Operations II	2
FSHN 484	Food Processing Unit Operations II Lab	1
GEOL 107	Physical Geology	4
GEOL 380	Environmental Geology	4
GGIS 379	Introduction to Geographic Information Systems	4
HORT 100	Introduction to Horticulture	3
HORT 341	Greenhouse Mgmt and Production	4
HORT 344	Planting for Biodiversity and Aesthetics	3
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		
IB 486		
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	CHBE 473	Biomolecular Engineering	3 or 4
MCB 301	Experimental Microbiology	3	CHBE 475	Tissue Engineering	3
MCB 314	Introduction to Neurobiology	3	CHBE 476	Biotransport	3
MCB 316	Genetics and Disease	4	CHBE 478	Bioenergy Technology	3
MCB 450	Introductory Biochemistry	3	CEE 300	Behavior of Materials	4
NRES 201	Introductory Soils	4	CEE 330	Environmental Engineering	3
NRES 219	Applied Ecology	3	CEE 350	Water Resources Engineering	3
NRES 348	Fish and Wildlife Ecology	3	CEE 360	Structural Engineering	3
NRES 351	Introduction to Environmental Chemistry	3	CEE 380	Geotechnical Engineering	3
NRES 419	Env and Plant Ecosystems	3	CEE 430	Ecological Quality Engineering	2
NRES 420	Restoration Ecology	4	CEE 432	Stream Ecology	3 or 4
NRES 429	Aquatic Ecosystem Conservation	3	CEE 434	Environmental Systems I	3
NRES 439	Env and Sustainable Dev	3	CEE 437	Water Quality Engineering	3
NRES 471	Pedology	3	CEE 440	Fate Cleanup Environ Pollutant	4
NRES 475	Environmental Microbiology	3	CEE 442	Environmental Engineering Principles, Physical	4
NRES 487	Soil Chemistry	3	CEE 443	Env Eng Principles, Chemical	4
NRES 488	Soil Fertility and Fertilizers	3	CEE 444	Env Eng Principles, Biological	4
PLPA 405	Plant Disease Diagnosis & Mgmt	3	CEE 446		
Technical electives chosen in consultation with an advisor. At least 8 hours must be Agricultural and Biological Engineering Technical Electives. Must include one course with a lab component.		15	CEE 447	Atmospheric Chemistry	4
ABE 361	Functional Analysis and Design of Agricultural Machine Systems	3	CEE 449	Environmental Engineering Lab	3
ABE 425	Engr Measurement Systems	4	CEE 450	Surface Hydrology	3
ABE 426	Principles of Mobile Robotics	4	CEE 451	Environmental Fluid Mechanics	3
ABE 436	Renewable Energy Systems	3 or 4	CEE 452	Hydraulic Analysis and Design	3
ABE 446	Biological Nanoengineering	3 or 4	CEE 453	Urban Hydrology and Hydraulics	4
ABE 450	International Water Project I	3	CEE 457	Groundwater	3
ABE 451	International Water Project II	3	CEE 458	Water Resources Field Methods	4
ABE 452	Engineering for Disaster Resilience	3 or 4	CEE 461	Reinforced Concrete I	3
ABE 454	Environmental Soil Physics	3	CEE 463	Reinforced Concrete II	3 or 4
ABE 455	Erosion and Sediment Control	2	CEE 465	Design of Structural Systems	3
ABE 456	Land & Water Resources Engrg	3 or 4	CEE 470	Structural Analysis	4
ABE 457	NPS Pollution Processes	2	CEE 483	Soil Mechanics and Behavior	4
ABE 458	NPS Pollution Modeling	2	CEE 484	Applied Soil Mechanics	3 or 4
ABE 459	Drainage and Water Management	3 or 4	CS 466	Introduction to Bioinformatics	3 or 4
ABE 463		3	ECE 206	Electrical and Electronic Circuits Lab	1
ABE 466	Engineering Off-Road Vehicles	3	ECE 333	Green Electric Energy	3
ABE 474		3 or 4	ECE 468	Optical Remote Sensing	3
ABE 476	Indoor Air Quality Engineering	4	ECE 470	Introduction to Robotics	4
ABE 482	Package Engineering	3	ECE 481	Nanotechnology	4
ABE 483	Engineering Properties of Food Materials	3	ENG 471	Seminar Energy & Sustain Engrg	1
ABE 488	Bioprocessing Biomass for Fuel	4	SE 320	Control Systems	4
BIOE 416	Biosensors	3	SE 423	Mechatronics	3
BIOE 461	Cellular Biomechanics	4	IE 431	Design for Six Sigma	3
BIOE 467	Biophotonics	3	ME 320	Heat Transfer	4
BIOE 476	Tissue Engineering	3	ME 330	Engineering Materials	4
CHBE 221	Principles of CHE	3	ME 340	Dynamics of Mechanical Systems	3.5
CHBE 422	Mass Transfer Operations	4	ME 370	Mechanical Design I	3
CHBE 424	Chemical Reaction Engineering	3	ME 371	Mechanical Design II	3
CHBE 471	Biochemical Engineering	3 or 4	ME 400	Energy Conversion Systems	3 or 4
CHBE 472	Techniques in Biomolecular Eng	3 or 4	ME 402	Design of Thermal Systems	3 or 4
			ME 403	Internal Combustion Engines	3 or 4
			ME 461	Computer Cntrl of Mech Systems	3 or 4

ME 483	Mechanobiology	4
MSE 280	Engineering Materials	3
MSE 401	Thermodynamics of Materials	3
MSE 470	Design and Use of Biomaterials	3
MSE 473	Biomolecular Materials Science	3
MSE 474	Biomaterials and Nanomedicine	3
MSE 489	Matl Select for Sustainability	3 or 4
NPRE 201	Energy Systems	2 or 3
NPRE 470	Fuel Cells & Hydrogen Sources	3
NPRE 475	Wind Power Systems	3 or 4

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Sample Sequence

This sample sequence is intended to be used only as a guide for degree completion. All students should work individually with their academic advisors to decide the actual course selection and sequence that works best for them based on their academic preparation and goals. Enrichment programming such as study abroad, minors, internships, and so on may impact the structure of this four-year plan. Course availability is not guaranteed during the semester indicated in the sample sequence. The curriculum sequence can also be viewed via dynamic and static curricular maps (<https://grainger.illinois.edu/academics/undergraduate/majors-and-minors/abe-bio-engr-map/>), which include prerequisite sequencing.

Students must fulfill their Language Other Than English requirement by successfully completing a third level of a language other than English. See the corresponding section on the Degree and General Education Requirements (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>). One of the SBS courses must be an introductory economics course (ECON 102 or ECON 103 or ACE 100). ABE 469 will satisfy a technical core course and the Campus General Education Advanced Composition requirement.

Free Electives: Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives (<https://go.grainger.illinois.edu/FreeElectives/>), so that there are at least 128 credit hours earned toward the degree.

Suggested Sequence

First Year

First Semester	Hours	Second Semester	Hours
ABE 100		1 ABE 141	2
ENG 100		1 MATH 231	3
MATH 221 (MATH 220 may be substituted)		4 CHEM 104	3
CHEM 102		3 CHEM 105	1
CHEM 103		1 PHYS 211	4
Composition I course or SE 101		4-3 SE 101 or Composition I course	3-4
		14	16

Second Year

First Semester	Hours	Second Semester	Hours
ABE 223		2 ABE 225	2

ABE 224		2 ABE 226	2
CS 101		3 MATH 285	3
MATH 241		4 PHYS 212	4
ECON 102 or ECON 103 or ACE 100 (Counts as General Education elective)		3 TAM 212	3
TAM 211		3 General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
		17	17

Third Year

First Semester	Hours	Second Semester	Hours
MATH 257		3 CHEM 232 (If taken for 4 credit hours, the 1 extra credit hour counts towards free electives)	3
ABE 340		4 ABE 341	3
ECE 205		3 Agricultural and Biological Engineering Technical elective course	3
MCB 150		4 Biological and Natural Sciences elective course	3
Agricultural and Biological Engineering Technical elective course		3 Language Other Than English (3rd level) course	4
		17	16

Fourth Year

First Semester	Hours	Second Semester	Hours
ABE 430		2 ABE 469	4
Agricultural and Biological Engineering Technical elective course		3 Technical elective course	3
Biological and Natural Sciences elective course		3 Technical elective course	3

General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3 General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
Free elective course	4 Free elective course	3
	15	16

Total Hours 128

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Agricultural & Biological Engineering

Agricultural & Biological Engineering Website (<https://abe.illinois.edu/>)
 1304 W. Pennsylvania Ave.
 Urbana, IL 61801
 217-333-3570
 Email: abe@illinois.edu

College of Agricultural, Consumer & Environmental Sciences

College of Agricultural, Consumer & Environmental Sciences Website (<https://aces.illinois.edu/>)

The Grainger College of Engineering

The Grainger College of Engineering Website (<https://grainger.illinois.edu/>)

ACES Office of Academic Programs

128 Mumford Hall
 1301 West Gregory Drive
 Urbana, IL 61801

Advising

Phone: 217-333-3570
 Email: tsm-etm-abe-advising@rt.aces.illinois.edu
 ABE Advising Website (<https://abe.illinois.edu/academics/advising/>)

Admissions

ACES Undergraduate Admissions (<https://aces.illinois.edu/admissions/>)
visitACES@illinois.edu
 217-333-3380
 University of Illinois Undergrad Admissions (<https://www.admissions.illinois.edu/>)