

AGRICULTURAL ENGINEERING

For the undergraduate curriculum in agricultural engineering leading to the degree bachelor of science. The Agricultural Engineering program is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org/>.

Goal: To educate students in the analysis and design of machinery, animal housing, and environmental systems for the production, processing, storage, handling, distribution, and use of food, feed, fiber and other biomaterials, and the management of related natural resources, by integrating basic physical and biological sciences with engineering design principles.

Student Learning Outcomes: Graduates of the Agricultural Engineering curriculum should have, at the time of graduation:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Educational Objectives: Three to five years after graduation, our graduates will be using the knowledge, skills, and abilities from their agricultural engineering degree to improve the human condition through successful careers in a wide variety of fields. They will be effective leaders, collaborators, and innovators who address environmental, social, technical, and business challenges. They will be engaged in life-long learning and professional development through self-study, continuing education, or graduate/professional school.

Graduates find employment in diverse ag- and bio-related industries and government agencies dealing with agricultural machines and buildings,

animal and environmental control, grain processing and handling, soil and water resources, food, biorenewables, and biotechnology. Their work involves engineering design, development, testing, research, manufacturing, consulting, sales, and service. Students are highly encouraged to participate in either cooperative education or internship programs.

The department also offers a bachelor of science curriculum in biological systems engineering. Additionally, the department offers bachelor of science curricula in agricultural systems technology and in industrial technology.

Well-qualified juniors and seniors in agricultural engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue a bachelor of science degree in agricultural engineering and a master of science degree in agricultural engineering. A concurrent bachelor of science and master of business administration program is also offered by the department. Refer to Graduate Study for more information.

Curriculum in Agricultural Engineering

Administered by the Department of Agricultural and Biosystems Engineering.

Leading to the degree bachelor of science.

Total credits required:

126.0 cr Land and Water Resources Engineering Option

128.0 cr Power and Machinery Engineering Option

128.0 cr Animal Production Systems Engineering Option.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. International Perspectives: 3 cr.¹

U.S. Diversity: 3 cr.¹

Communication Proficiency/Library requirement :

ENGL 150	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 160	Introduction to College Level Research	1
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
MKT 450	Advanced Professional Selling	
SP CM 212	Fundamentals of Public Speaking	
SP CM 312	Business and Professional Speaking	

Social Sciences and Humanities: 12 cr.^{1,2}

3 credits from international perspectives-university approved list 3

3 credits from U.S. diversity-university approved list 3

6 credits from Social Sciences and Humanities courses-department approved list 6

Total Credits 12**Basic Program: 24 cr.**

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section. Within the Agricultural Engineering Basic Program, students are required to complete CHEM 167 and CHEM 167L or the sequence of CHEM 177, CHEM 177L, and CHEM 178. This is a departmental requirement within the College of Engineering Basic Program requirements. CHEM 178 credits can then be applied to the Math/Science Elective within the options of Power and Machinery Engineering and Animal Production Systems Engineering of the Agricultural Engineering major requirements.

A B E 160 Systematic Problem Solving and Computer Programming³ 3CHEM 167 General Chemistry for Engineering Students 4
or CHEM 177and
CHEM 178 General Chemistry II

ENGL 150 Critical Thinking and Communication (Must have a C or better in this course) 3

ENGR 101 Engineering Orientation R

LIB 160 Introduction to College Level Research 1

MATH 165 Calculus I 4

MATH 166 Calculus II 4

PHYS 231 Introduction to Classical Physics I 4

PHYS 231L Introduction to Classical Physics I Laboratory 1

Total Credits 24**Math and Physical Science: 7 cr.**CHEM 167L Laboratory in General Chemistry for Engineering 1
or CHEM 177L Laboratory in General Chemistry I

MATH 266 Elementary Differential Equations 3

STAT 305 Engineering Statistics 3

Total Credits 7**Ag Engineering Core: 35 cr.**

(A minimum GPA of 2.00 required for this set of courses, including any transfer courses please note that transfer course grades will not be calculated into the Core GPA).

A B E 216 Fundamentals of Agricultural and Biosystems Engineering 3

A B E 218 Project Management & Design in Agricultural and Biosystems Engineering 2

A B E 316 Applied Numerical Methods for Agricultural and Biosystems Engineering 3

A B E 363 Agri-Industrial Applications of Electric Power and Electronics 4

A B E 378 Mechanics of Fluids 3

A B E 404 Instrumentation for Agricultural and Biosystems Engineering 3

A B E 415 Agricultural & Biosystems Engineering Design I 2

A B E 416 Agricultural & Biosystems Engineering Design II 2

C E 274 Engineering Statics 3

E M 324 Mechanics of Materials 3

E M 327 Mechanics of Materials Laboratory 1

or A B E 378L Mechanics of Fluids Laboratory

I E 305 Engineering Economic Analysis 3

M E 231 Engineering Thermodynamics I 3

Total Credits 35**Other Remaining Courses: 11 cr.**

A B E 110 Experiencing Agricultural and Biosystems Engineering 1

A B E 170 Engineering Graphics and Introductory Design 3

A B E 201 Preparing for Workplace Seminar 1

ENGL 250 Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course) 3

Communication Elective: One of the following (Must have a C or better in this course) 3

AGEDS 311 Presentation and Sales Strategies for Agricultural Audiences

ENGL 309 Proposal and Report Writing

ENGL 314 Technical Communication

MKT 450 Advanced Professional Selling

SP CM 212 Fundamentals of Public Speaking

SP CM 312 Business and Professional Speaking

Total Credits 11

Complete remaining courses from one of the following options:

Land and Water Resources Engineering Option: 37 cr.

A B E 431 Design and Evaluation of Soil and Water Conservation Systems 3

AGRON 181 Introduction to Crop Science 3

AGRON 182 Introduction to Soil Science 3

BIOL 251 or BIOL 211	Biological Processes in the Environment	3
C E 326	Principles of Environmental Engineering	3
C E 372	Engineering Hydrology and Hydraulics	3
GEOL 201	Geology for Engineers and Environmental Scientists	3
MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1
A B E 273	CAD for Process Facilities and Land Use Planning	1
GIS Elective (One of the following):		3
C R P 251	Fundamentals of Geographic Information Systems	
C R P 451	Introduction to Geographic Information Systems	
ENSCI 270	Geospatial Technologies	
GEOL 452	Intro GIS for Geoscientists	
NREM 345	Natural Resource Photogrammetry and Geographic Information Systems	
NREM 446	Integrating GPS and GIS for Natural Resource Management	
Subsurface Systems Elective (One of the following):		3
C E 360	Geotechnical Engineering	
C E 473	Groundwater Hydrology	
Water Quality Elective (One of the following):		3
A B E 432	Nonpoint Source Pollution and Control	
A B E 437	Watershed Modeling and Policy	
A B E Breadth (One of the following):		3
A B E 340	Functional Analysis of Soil, Crop, and Machine Systems	
A B E 380	Principles of Biological Systems Engineering	
A B E 424 (3 different 1cr modules)		
A B E 424A	Air Pollution: Air quality and effects of pollutants	
A B E 424B	Air Pollution: Climate change and causes	
A B E 424C	Air Pollution: Transportation Air Quality	
A B E 424D	Air Pollution: Off-gas treatment technology	
A B E 424E	Air Pollution: Agricultural sources of pollution	
A B E 469	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	
A B E 472	Controlled Environments for Animals and Plants (offered Spring even years)	
A B E 478	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	
A B E 480	Engineering Analysis of Biological Systems	
Total Credits		37

Power and Machinery Engineering Option: 39 cr.

A B E 340	Functional Analysis of Soil, Crop, and Machine Systems	3
A B E 342	Agricultural Tractor Power	3
A B E 410	Electronic Systems Integration for Agricultural Machinery	3
A B E 413	Fluid Power Engineering	3
AGRON 182	Introduction to Soil Science	3
BIOL 251 or BIOL 211	Biological Processes in the Environment	3
MAT E 273	Principles of Materials Science and Engineering	3
M E 324	Manufacturing Engineering	3
M E 324L	Manufacturing Engineering Laboratory	1
M E 325	Mechanical Component Design	3
M E 345	Engineering Dynamics	3
Computer Graphics (Two of the following):		2
A B E 271	Engineering Applications of Parametric Solid Modeling	
A B E 272	Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric	
A B E 273	CAD for Process Facilities and Land Use Planning	
A B E Elective (One of the following):		3
A B E 431	Design and Evaluation of Soil and Water Conservation Systems	
A B E 469	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	
A B E 472	Controlled Environments for Animals and Plants (offered Spring even years)	
A B E 478	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	
A B E 480	Engineering Analysis of Biological Systems	
Math/Science Elective		3
AGRON 181	Introduction to Crop Science	
CHEM 178	General Chemistry II (In combination with CHEM 177)	
MATH 207	Matrices and Linear Algebra	
MATH 265	Calculus III	
PHYS 232	Introduction to Classical Physics II	
PHYS 232L	Introduction to Classical Physics II Laboratory	
Total Credits		39
Animal Production Systems Engineering Option: 39 cr.		
A B E 327L	Animal Production Systems Design Lab	1
A B E 469	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	3

A B E 472	Controlled Environments for Animals and Plants (offered Spring even years)	3
A B E 478	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	3
BIOL 251	Biological Processes in the Environment	3
	or BIOL 211	
C E 332	Structural Analysis I	3
C E 333	Structural Steel Design I	3
C E 334	Reinforced Concrete Design I	3
TSM 327	Livestock and Poultry Production: Facilities, Technology, and Management	3
Animal Science/Horticulture Elective (One of the following):		3
AN S 223	Poultry Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
HORT 221	Principles of Horticulture Science	
Computer Graphics (One of the following):		1
A B E 271	Engineering Applications of Parametric Solid Modeling	
A B E 272	Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric	
A B E 273	CAD for Process Facilities and Land Use Planning (Preferred)	
A B E elective (One of the following): ²		3
A B E 431	Design and Evaluation of Soil and Water Conservation Systems	
A B E 340	Functional Analysis of Soil, Crop, and Machine Systems	
A B E 480	Engineering Analysis of Biological Systems	
Animal Production Systems Engineering Elective		4
C E 360	Geotechnical Engineering	
M E 436	Heat Transfer	
Math/Science Elective		3
AGRON 181	Introduction to Crop Science	
AGRON 182	Introduction to Soil Science	
CHEM 178	General Chemistry II (In combination with CHEM 177)	
GEOL 201	Geology for Engineers and Environmental Scientists	
HORT 332	Greenhouse and Nursery Operations and Management	
MATH 207	Matrices and Linear Algebra	

MATH 265	Calculus III
PHYS 232	Introduction to Classical Physics II
PHYS 232L	Introduction to Classical Physics II Laboratory

Total Credits **39**

Co-op/Internships (Optional)

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program.
U.S. Diversity, International Perspectives and Social Science/ Humanities courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (<http://www.abe.iastate.edu/undergraduate-students/agricultural-engineering/ae-curricula/>)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

TRANSFER CREDIT REQUIREMENTS

Students graduating with a degree in A E or BSE are required to have a minimum of 18 credits of 300-level and 400-level ABE courses taken at Iowa State University (excluding 490, 415, and 416), and must complete the two-semester ABE Capstone sequence (ABE 415 & 416) at Iowa State University. The Department of Agricultural & Biosystems Engineering requires a grade of C or better for any transfer credit course that is applied to the degree program.

See also: A 4-year plan of study grid showing course template by semester. (<http://catalog.iastate.edu/previouscatalogs/2023-2024/collegeofengineering/agriculturalengineering/#fouryearplanstext>)

Agricultural Engineering, B.S. - power & machinery option

First Year

Fall	Credits Spring	Credits
ENGR 101	R A B E 110	1
A B E 170	3 A B E 160	3
CHEM 167	4 MATH 166	4
CHEM 167L	1 PHYS 231	4
MATH 165	4 PHYS 231L	1
ENGL 150	3 ENGL 250	3
LIB 160	1	
16		16

Second Year

Fall	Credits Spring	Credits
A B E 216	3 A B E 218	2
C E 274	3 A B E 201	1

MAT E 273	3 E M 324	3
AGRON 182	3 MATH 266	3
Math/Science Elective	3 STAT 305	3
	International Perspectives Elective	3
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	15	15

MATH 266	3 E M 324	3
TSM 327	3 M E 231	3
A B E 327L	1 STAT 305	3
US Diversity Elective	3 BIOL 211 or 251	3
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	16	15

Third Year

Fall	Credits Spring	Credits
A B E 340	3 A B E 316	3
A B E 363	4 A B E 342	3
M E 231	3 A B E 378	3
M E 345	3 E M 327 or A B E 378L	1
Communication Elective	3 M E 324L	1
Computer Graphics Elective	2 BIOL 251 or 211	3
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	18	14

Third Year

Fall	Credits Spring	Credits
A B E 316	3 A B E 478	3
A B E 363	4 C E 333	3
A B E 378	3 I E 305	3
C E 332	3 Computer Graphics Elective	1
E M 327 or A B E 378L	1 Communication Elective	3
Math/Science Elective	3 International Perspective Elective	3
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	17	16

Fourth Year

Fall	Credits Spring	Credits
A B E 415	2 A B E 416	2
A B E 404	3 A B E 410	3
A B E 413	3 A B E Elective	3
M E 324	3 I E 305	3
M E 325	3 Social Science or Humanities Elective	3
US Diversity Elective	3 Social Science or Humanities Elective	3
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	17	17

Fourth Year

Fall	Credits Spring	Credits
A B E 415	2 A B E 416	2
A B E 404	3 A B E 469	3
A B E Elective	3 A B E 472	3
AN S/HORT Elective	3 C E 334	3
Animal Production Systems Engineering Elective	3 Social Science or Humanities Elective	3
Social Science or Humanities Elective	3	
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	17	14

Agricultural Engineering, B.S. - animal production systems engineering option

Agricultural Engineering, B.S. - land and water resources engineering option

First Year

Fall	Credits Spring	Credits
ENGR 101	R A B E 110	1
A B E 170	3 A B E 160	3
CHEM 167	4 MATH 166	4
CHEM 167L	1 PHYS 231	4
MATH 165	4 PHYS 231L	1
ENGL 150	3 ENGL 250	3
LIB 160	1	
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	16	16

First Year

Fall	Credits Spring	Credits
ENGR 101	R A B E 110	1
A B E 170	3 A B E 160	3
CHEM 167	4 MATH 166	4
CHEM 167L	1 PHYS 231	4
MATH 165	4 PHYS 231L	1
ENGL 150	3 ENGL 250	3
LIB 160	1	
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	16	16

Second Year

Fall	Credits Spring	Credits
A B E 216	3 A B E 218	2
C E 274	3 A B E 201	1

Second Year

Fall	Credits Spring	Credits
A B E 216	3 A B E 218	2
C E 274	3 A B E 201	1

MATH 266	3	E M 324	3
AGRON 181	3	M E 231	3
AGRON 182	3	STAT 305	3
		BIOL 251 or 211	3
	15		15

Third Year

Fall	Credits	Spring	Credits
A B E 316	3	A B E 273	1
A B E 363	3	C E 326	3
A B E 378	3	C E 372	3
E M 327 or A B E 378L	2	MICRO 201	2
GIS Elective	1	MICRO 201L	1
Communication Elective	3	ABE Breadth Elective	3
		US Diversity Elective	3
	17		16

Fourth Year

Fall	Credits	Spring	Credits
A B E 415	2	A B E 416	2
A B E 404	3	I E 305	3
A B E 431	3	Subsurface Systems Elective	3
GEOL 201	3	Water Quality Elective	3
Social Science or Humanities Elective	3	Social Science or Humanities Elective	3
International Perspectives Elective	3		
	17		14

The Department of Agricultural and Biosystems Engineering has concurrent Bachelor of Science /Master of Science (BS/MS) programs designed especially for departmental seniors who wish to pursue advanced studies. Concurrent BS/MS programs are: agricultural engineering (BS) with agricultural and biosystems engineering (MS) and biological systems engineering (BS) with agricultural and biosystems engineering (MS).

The concurrent BS/MS program allows seniors to:

- Become eligible for a research assistantship during their senior year
- Complete an MS degree (with thesis) within 18 months of BS graduation

For more information about our concurrent undergraduate and graduate programs in Agricultural & Biosystems Engineering, visit: <https://www.abe.iastate.edu/graduate-students/abe-concurrent-degrees/>.

Graduate Study

The department offers master of science, master of engineering, and doctor of philosophy degrees with a major in agricultural and biosystems engineering. Within the agricultural and biosystems engineering major the student may specialize in advanced machinery engineering, animal production systems engineering, biological and process engineering, occupational safety engineering, or water and environmental stewardship engineering. Details on current research programs available at <http://www.abe.iastate.edu/>. (<http://www.abe.iastate.edu/>)

For the master of science program, at least 30 credits of acceptable graduate work must be completed with a minimum of 22 credits of course work; corresponding numbers for the master of engineering program are 32 and 27. For the doctor of philosophy degree, at least 72 credits of acceptable graduate work must be completed with a minimum of 42 credits of course work. All Ph.D. students must complete a teaching/extension experience prior to graduation.

The department also offers both master of science and doctor of philosophy degrees in industrial and agricultural technology.

The department also participates in interdepartmental majors in environmental science, sustainable agriculture, human computer interaction, and toxicology (see Index).