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, https://www.abet.org (https://www.abet.org/), under the commission's General Criteria and Program Criteria for Agricultural and Similarly Named Engineering Programs.

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 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
MKT 4500	Advanced Professional Selling	

SPCM 2120	Fundamentals of Public Speaking	
SPCM 3120	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 1670 and CHEM 1670L or the sequence of CHEM 1770, CHEM 1770L, and CHEM 1780. This is a departmental requirement within the College of Engineering Basic Program requirements. CHEM 1780 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.

ABE 1600	Systematic Problem Solving and Computer Programming [3]	3
CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770		
and		
CHEM 1780	General Chemistry II	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		**24**

Math and Physical Science: 7 cr.

CHEM 1670L	Laboratory in General Chemistry for Engineering	1
or CHEM 1770L	Laboratory in General Chemistry I	
MATH 2660	Elementary Differential Equations	3
STAT 3050	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).

ABE 2160	Fundamentals of Agricultural and Biosystems Engineering	3
ABE 2180	Project Management & Design in Agricultural and Biosystems Engineering	2
ABE 3160	Applied Numerical Methods for Agricultural and Biosystems Engineering	3
ABE 3630	Agri-Industrial Applications of Electric Power and Electronics	4
ABE 3780	Mechanics of Fluids	3
ABE 4040	Instrumentation for Agricultural and Biosystems Engineering	3
ABE 4150	Agricultural & Biosystems Engineering Design I	2
ABE 4160	Agricultural & Biosystems Engineering Design II	2
CE 2740	Engineering Statics	3
EM 3240	Mechanics of Materials	3
EM 3270	Mechanics of Materials Laboratory	1
or ABE 3780L	Mechanics of Fluids Laboratory	
IE 3050	Engineering Economic Analysis	3
ME 2310	Engineering Thermodynamics I	3
Total Credits		**35**

Other Remaining Courses: 11 cr.

ABE 1100	Experiencing Agricultural and Biosystems Engineering	1
ABE 1700	Engineering Graphics and Introductory Design	3
TSM 2010	Preparing for Workplace Seminar	1
ENGL 2500	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 3110	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
MKT 4500	Advanced Professional Selling	
SPCM 2120	Fundamentals of Public Speaking	
SPCM 3120	Business and Professional Speaking	
Total Credits		**11**

Complete remaining courses from one of the following options:

Land and Water Resources Engineering Option: 37 cr.

ABE 4310	Design and Evaluation of Soil and Water Conservation Systems	3
AGRON 1810	Introduction to Crop Science	3
AGRON 1820	Introduction to Soil Science	3
BIOL 2510	Biological Processes in the Environment	3
or BIOL 2110		
CE 3260	Principles of Environmental Engineering	3
CE 3720	Engineering Hydrology and Hydraulics	3
GEOL 2010	Geology for Engineers and Environmental Scientists	3
MICRO 2010	Introduction to Microbiology	2
MICRO 2010L	Introductory Microbiology Laboratory	1
ABE 2730	CAD for Process Facilities and Land Use Planning	1
GIS Elective (One of the following):		3
CRP 2510	Fundamentals of Geographic Information Systems	
CRP 4510	Introduction to Geographic Information Systems	
ENSCI 2700	Geospatial Technologies	
GEOL 4520	Intro GIS for Geoscientists	
NREM 3450	Natural Resource Photogrammetry and Geographic Information Systems	
NREM 4460	Integrating GPS and GIS for Natural Resource Management	
Subsurface Systems Elective (One of the following):		3
CE 3600	Geotechnical Engineering	
CE 4730	Groundwater Hydrology	
Water Quality Elective (One of the following):		3
ABE 4320	Nonpoint Source Pollution and Control	
ABE 4370	Watershed Modeling and Policy	
ABE Breadth (One of the following):		3
ABE 3400	Functional Analysis of Soil, Crop, and Machine Systems	
ABE 3800	Principles of Biological Systems Engineering	
ABE 4240 (3 different 1cr modules)		
ENSCI 4240A	Air Pollution: Air Quality and Effects of Pollutants	
ENSCI 4240B	Air Pollution: Climate Change and Causes	
ENSCI 4240C	Air Pollution: Transportation Air Quality	
ENSCI 4240D	Air Pollution: Off-Gas Treatment Technology	
ENSCI 4240E	Air Pollution: Agricultural Sources of pollution	
ABE 4690	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	
ABE 4720	Controlled Environments for Animals and Plants (offered Spring even years)	
ABE 4780	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	
ABE 4800	Engineering Analysis of Biological Systems	
Total Credits		**37**

Power and Machinery Engineering Option: 39 cr.

ABE 3400	Functional Analysis of Soil, Crop, and Machine Systems	3
ABE 3420	Agricultural Tractor Power	3
ABE 4100	Electronic Systems Integration for Agricultural Machinery	3
ME 4130	Fluid Power Engineering	3
AGRON 1820	Introduction to Soil Science	3
BIOL 2510	Biological Processes in the Environment	3
or BIOL 2110		
MATE 2730	Principles of Materials Science and Engineering	3
ME 3240	Manufacturing Engineering	3
ME 3240L	Manufacturing Engineering Laboratory	1
ME 3250	Mechanical Component Design	3
ME 3450	Engineering Dynamics	3
Computer Graphics (Two of the following):		2
ABE 2710	Engineering Applications of Parametric Solid Modeling	
ABE 2720	Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric	
ABE 2730	CAD for Process Facilities and Land Use Planning	
ABE Elective (One of the following):		3
ABE 4310	Design and Evaluation of Soil and Water Conservation Systems	
ABE 4690	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	
ABE 4720	Controlled Environments for Animals and Plants (offered Spring even years)	
ABE 4780	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	
ABE 4800	Engineering Analysis of Biological Systems	
Math/Science Elective		3
AGRON 1810	Introduction to Crop Science	
CHEM 1780	General Chemistry II (In combination with CHEM 1770)	
MATH 2070	Matrices and Linear Algebra	
MATH 2650	Calculus III	
PHYS 2320	Introduction to Classical Physics II	

PHYS 2320L	Introduction to Classical Physics II Laboratory	
Total Credits		**39**

Animal Production Systems Engineering Option: 39 cr.

ABE 3270L	Animal Production Systems Design Lab	1
ABE 4690	Engineering for Grain Storage, Preservation, Handling, and Processing Systems	3
ABE 4720	Controlled Environments for Animals and Plants (offered Spring even years)	3
ABE 4780	Wood Frame and Agri-Industrial Structures (offered Spring odd years)	3
BIOL 2510	Biological Processes in the Environment	3
or BIOL 2110		
CE 3320	Structural Analysis I	3
CE 3330	Structural Steel Design I	3
CE 3340	Reinforced Concrete Design I	3
TSM 3270	Livestock and Poultry Production: Facilities, Technology, and Management	3
Animal Science/Horticulture Elective (One of the following):		3
ANS 2230	Poultry Science	
ANS 2250	Swine Science	
ANS 2260	Beef Cattle Science	
ANS 2290	Sheep Science	
ANS 2350	Dairy Cattle Science	
HORT 2210	Principles of Horticulture Science	
Computer Graphics (One of the following):		1
ABE 2710	Engineering Applications of Parametric Solid Modeling	
ABE 2720	Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric	
ABE 2730	CAD for Process Facilities and Land Use Planning (Preferred)	
ABE elective (One of the following): [2]		3
ABE 4310	Design and Evaluation of Soil and Water Conservation Systems	
ABE 3400	Functional Analysis of Soil, Crop, and Machine Systems	
ABE 4800	Engineering Analysis of Biological Systems	
Animal Production Systems Engineering Elective		4
CE 3600	Geotechnical Engineering	
ME 4360	Heat Transfer	
Math/Science Elective		3
AGRON 1810	Introduction to Crop Science	
AGRON 1820	Introduction to Soil Science	
CHEM 1780	General Chemistry II (In combination with CHEM 1770)	
GEOL 2010	Geology for Engineers and Environmental Scientists	
HORT 3320	Greenhouse and Nursery Operations and Management	
MATH 2070	Matrices and Linear Algebra	
MATH 2650	Calculus III	
PHYS 2320	Introduction to Classical Physics II	
PHYS 2320L	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 AE or BSE are required to have a minimum of 18 credits of 3000-level and 4000-level ABE courses taken at Iowa State University (excluding 4900, 4150, and 4160), and must complete the two-semester ABE Capstone sequence (ABE 4150 & 4160) 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.

Agricultural Engineering, B.S. - Power & Machinery option

First Year

Fall	Credits	Spring	Credits
ENGR 1010		R ABE 1100	1
ABE 1700		3 ABE 1600	3
CHEM 1670		4 MATH 1660	4
CHEM 1670L		1 PHYS 2310	4
MATH 1650		4 PHYS 2310L	1
ENGL 1500		3 ENGL 2500	3

LIB 1600	1		
	16		**16**

Second Year

Fall	Credits	Spring	Credits
ABE 2160	3	ABE 2180	2
CE 2740	3	TSM 2010	1
MATE 2730	3	EM 3240	3
AGRON 1820	3	MATH 2660	3
Math/Science Elective	3	STAT 3050	3
		International Perspectives Elective	3
	15		**15**

Third Year

Fall	Credits	Spring	Credits
ABE 3400	3	ABE 3160	3
ABE 3630	4	ABE 3420	3
ME 2310	3	ABE 3780	3
ME 3450	3	EM 3270 or ABE 3780L	1
Communication Elective	3	ME 3240L	1
Computer Graphics Elective	2	BIOL 2510 or 2110	3
	18		**14**

Fourth Year

Fall	Credits	Spring	Credits
ABE 4150	2	ABE 4160	2
ABE 4040	3	ABE 4100	3
ME 4130	3	ABE Elective	3
ME 3240	3	IE 3050	3
ME 3250	3	Social Science or Humanities Elective	3
US Diversity Elective	3	Social Science or Humanities Elective	3
	17		**17**

Agricultural Engineering, B.S. - Animal Production Systems Engineering option

First Year

Fall	Credits	Spring	Credits
ENGR 1010	R	ABE 1100	1
ABE 1700	3	ABE 1600	3
CHEM 1670	4	MATH 1660	4
CHEM 1670L	1	PHYS 2310	4
MATH 1650	4	PHYS 2310L	1
ENGL 1500	3	ENGL 2500	3
LIB 1600	1		
	16		**16**

Second Year

Fall	Credits	Spring	Credits
ABE 2160	3	ABE 2180	2
CE 2740	3	TSM 2010	1
MATH 2660	3	EM 3240	3
TSM 3270	3	ME 2310	3
ABE 3270L	1	STAT 3050	3
US Diversity Elective	3	BIOL 2110 or 2510	3
	16		**15**

Third Year

Fall	Credits	Spring	Credits
ABE 3160	3	ABE 4780	3
ABE 3630	4	CE 3330	3
ABE 3780	3	IE 3050	3
CE 3320	3	Computer Graphics Elective	1
EM 3270 or ABE 3780L	1	Communication Elective	3
Math/Science Elective	3	International Perspective Elective	3
	17		**16**

Fourth Year

Fall	Credits	Spring	Credits
ABE 4150	2	ABE 4160	2
ABE 4040	3	ABE 4690	3
ABE Elective	3	ABE 4720	3
ANS/HORT Elective	3	CE 3340	3
Animal Production Systems Engineering Elective	3	Social Science or Humanities Elective	3
Social Science or Humanities Elective	3		
	17		**14**

Agricultural Engineering, B.S. - Land and Water Resources Engineering option

First Year

Fall	Credits	Spring	Credits
ENGR 1010	R	ABE 1100	1
ABE 1700	3	ABE 1600	3
CHEM 1670	4	MATH 1660	4
CHEM 1670L	1	PHYS 2310	4
MATH 1650	4	PHYS 2310L	1
ENGL 1500	3	ENGL 2500	3

LIB 1600	1		
	16		**16**

Second Year

Fall	Credits	Spring	Credits
ABE 2160	3	ABE 2180	2
CE 2740	3	TSM 2010	1
MATH 2660	3	EM 3240	3
AGRON 1810	3	ME 2310	3
AGRON 1820	3	STAT 3050	3
		BIOL 2510 or 2110	3
	15		**15**

Third Year

Fall	Credits	Spring	Credits
ABE 3160	3	ABE 2730	1
ABE 3630	4	CE 3260	3
ABE 3780	3	CE 3720	3
EM 3270 or ABE 3780L	1	MICRO 2010	2
GIS Elective	3	MICRO 2010L	1
Communication Elective	3	ABE Breadth Elective	3
		US Diversity Elective	3
	17		**16**

Fourth Year

Fall	Credits	Spring	Credits
ABE 4150	2	ABE 4160	2
ABE 4040	3	IE 3050	3
ABE 4310	3	Subsurface Systems Elective	3
GEOL 2010	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 (B.S./M.S.) programs designed especially for departmental seniors who wish to pursue advanced studies. Concurrent BS/MS programs are agricultural engineering (B.S.) with agricultural and biosystems engineering (M.S.) and biological systems engineering (B.S.) with agricultural and biosystems engineering (M.S.).

The concurrent B.S./M.S. program allows seniors to:

- Become eligible for a research assistantship during their senior year.
- Complete an M.S. degree (with thesis) within 18 months of B.S. 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).