

Agricultural & Biosystems Engineering - Biosystems Option

Agricultural and Biosystems Engineering Major

The Agricultural and Biosystems Engineering (ABEN) program prepares men and women for careers requiring application of physical, biological, and engineering sciences to develop solutions relating to: the design and production of machine systems; the production and handling of biological materials; processing of food, feed, fiber, and fuel; and the preservation of natural resources and environmental quality. A major in Agricultural and Biosystems Engineering can serve a broad range of career interests and can provide excellent career opportunities for men and women from diverse backgrounds.

The program educational objectives of this major are to educate and produce graduates who will become engineers who:

1. have the ability to use their technical knowledge and design and problem solving skills throughout their careers,
2. have the interpersonal and collaborative skills and the capacity necessary for productive careers, and
3. can use their disciplinary knowledge and educational depth and breadth to deal with changing career opportunities in agricultural and related industries.

These objectives support the department mission of developing and extending knowledge through engineering and technology that advances the productivity of agricultural production, the processing and utilization of biological materials, and the management of environmental resources.

Agricultural and biosystems engineering integrates engineering topics, engineering design, and biological sciences in a single program with two concentrations: agricultural engineering and biosystems engineering. While there is considerable overlap between the agricultural engineering (AGEN) and the biosystems engineering (BSEN) concentrations, the BSEN concentration includes a heavier emphasis on fundamental biological and chemical sciences. The AGEN concentration includes a heavier emphasis in the physical sciences. A wide range of electives in related disciplines can be used to complement the disciplinary course work and to prepare for specific career interests. Although not required by the curriculum, students are encouraged to take advantage of Cooperative Education experiences or the opportunity of paid internships where they gain hands-on experience in engineering.

Biosystems Engineering Option

Graduates in biosystems engineering integrate engineering, biology, and chemistry in a variety of applications. Graduates may work in careers with the following goals: develop innovative green products and industries; convert bio-based resources to food, fuel, and other renewable products; design new generations of devices or systems for biological systems; and control biological systems for natural resource protection, waste remediation, and ecosystem restoration. Graduates may work with industries to create new and improved processes through the innovative use of microorganisms, plant and animal cells, and enzymes or they may develop sensors, control systems and computer models to monitor and

control biological processes occurring in industry or the environment. Graduates with a biosystems engineering concentration may also pursue a professional or graduate degree in engineering, medicine, veterinary medicine, management, or law.

The faculty assist with career planning and job placement of graduates. Students interested in careers involving production, delivery, management, and technical support of systems for food, agricultural, or closely related industries rather than engineering or design should consider the Agricultural Systems Management major (<http://bulletin.ndsu.edu/past-bulletin-archive/2014-15/undergraduate/colleges/agriculture-food-systems-natural-resources/agriculture-biosystems-engineering/agricultural-systems-management>) offered by the College of Agriculture, Food Systems, and Natural Resources (<http://www.ag.ndsu.edu/academics>).

Major Requirements

Major: Agricultural & Biosystems Engineering Option: Biosystems Engineering

Degree Type: B.S.A.B.En

Required Degree Credits to Graduate: 133

General Education Requirements

First Year Experience (F):

ABEN 189	Skills for Academic Success (Students transferring in 24 or more credits do not need to take ABEN 189.)	1
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Communication (C):

ENGL 110	College Composition I	3
ENGL 120	College Composition II	3
One course in Upper Level Writing. Select one of the following:		3
ENGL 321	Writing in the Technical Professions	
ENGL 324	Writing in the Sciences	
ENGL 459	Researching and Writing Grants and Proposal	
COMM 110	Fundamentals of Public Speaking	3

Quantitative Reasoning (R):

MATH 165	Calculus I	4
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Science & Technology (S):

CHEM 121 & 121L	General Chemistry I and General Chemistry I Laboratory	4
CHEM 122L	General Chemistry II Laboratory	1
PHYS 252 & 252L	University Physics II and University Physics II Laboratory	5

Humanities & Fine Arts (A): Select from current general education list 6

Social & Behavioral Sciences (B): Select from current general education list 6

Wellness (W): Select from current general education list 2

Cultural Diversity (D): Select from current general education list

Global Perspectives (G): Select from current general education list

Total Credits 41

Major Requirements - Biosystems Option

General Education Requirements		40
ABEN Core Requirements:		
ABEN 110	Introduction to Agricultural and Biosystems Engineering	2
ABEN 255	Computer Aided Analysis & Design	3
ABEN 263	Biological Materials Processing	3
ABEN 444	Transport Processes	3
ABEN 482	Instrumentation & Measurements	3
ABEN 486	Design Project I	2
ABEN 487	Design Project II	2
ABEN 491	Seminar	1
ABEN 496	Field Experience	1
ABEN 300-400 Electives: Select 9 credits from the following:		9
ABEN 358	Electric Energy Application in Agriculture	
ABEN 377	Numerical Modeling in Agricultural and Biosystems Engineering	
ABEN 450	Bioprocess Engineering	
ABEN 452	Bioenvironmental Systems Design	
ABEN 456	Biobased Energy	
ABEN 458	Process Engineering for Food, Biofuels and Bioproducts	
ABEN 464	Resource Conservation and Irrigation Engineering	
ABEN 473	Agricultural Power	
ABEN 478	Machinery Analysis & Design	
ABEN/ME 479	Fluid Power Systems Design	
ABEN 484	Drainage and Wetland Engineering	
MATH Courses:		
MATH 128	Introduction to Linear Algebra	1
MATH 166	Calculus II	4
MATH 259	Multivariate Calculus	3
MATH 266	Introduction to Differential Equations	3
ME Courses:		
ME 221	Engineering Mechanics I	3
ME 222	Engineering Mechanics II	3
ME 350	Thermodynamics and Heat Transfer	3
Additional Courses:		
BIOL 150	General Biology I	3
CHEM 122	General Chemistry II	3
CHEM 240	Survey of Organic Chemistry	3
CE 309	Fluid Mechanics	3
ENGR 402	Engineering Ethics and Social Responsibility	1
IME 440	Engineering Economy	2
IME 460	Evaluation of Engineering Data	3
or STAT 330	Introductory Statistics	
Program Electives	The following program electives may be selected from courses listed in the Program Electives Tab in the 2014-15 Bulletin (http://bulletin.ndsu.edu/undergraduate/colleges/engineering/agricultural-biosystems-engineering/biosystems_option/#programelectivestext)	

Engineering Electives	Select a minimum of 9 credits from the following department website: www.ndsu.edu/aben/academics	9
Chemistry/Biological Science Electives	Select a minimum of 6 credits from the following department website: www.ndsu.edu/aben/academics	6
Technical Electives	Select elective courses from the following department website www.ndsu.edu/aben/academics/aben/ . May choose from the ABEN section, Chemistry/Biological Sciences electives, or Engineering electives.	7
Computer Elective	Select a minimum of 3 credits from the following department website: www.ndsu.edu/aben/academics	3
Total Credits		133

Degree Requirements and Notes

A student must complete at least 60 semester credits of professional level course work in his/her program while in residence and enrolled in the college. Students transferring into the college from programs with professional accreditation are exempt from this residency requirement but are subject to the residency requirement of NDSU.

Program Electives for ABEN:

Biosystems Option - Program Electives

Engineering Electives: Select 9 credits from the following:		9
CE 310	Fluid Mechanics Laboratory	
CE 370	Introduction to Environmental Engineering	
CE 371	Environmental Engineering Laboratory	
ECE 301	Electrical Engineering I	
ME 223	Mechanics of Materials	
ME 331	Materials Science and Engineering	
Chemistry/Biological Science Electives: Select 6 credits from the following:		6
ANSC 357	Animal Genetics	
ANSC 463	Physiology of Reproduction	
BIOC 460	Foundations of Biochemistry and Molecular Biology I	
BIOC 461	Foundations of Biochemistry and Molecular Biology II	
BIOL 150L	General Biology I Laboratory	
BIOL 151	General Biology II	
BIOL 151L	General Biology II Laboratory	
BIOL 220	Human Anatomy and Physiology I	
BIOL 315	Genetics	
BIOL 315L	Genetics Laboratory	
BIOL 364	General Ecology	
BOT 314	Plant Systematics	
BOT 380	Plant Physiology	
BOT 460	Plant Ecology	
CHEM 260	Elements of Biochemistry	
CHEM 341	Organic Chemistry I	
CHEM 341L	Organic Chemistry I Laboratory	
CHEM 342	Organic Chemistry II	
CHEM 342L	Organic Chemistry II Laboratory	

MICR 202	Introductory Microbiology	
MICR 202L	Introductory Microbiology Lab	
MICR 350	General Microbiology	
MICR 350L	General Microbiology Lab	
MICR 352	General Microbiology II	
MICR 352L	General Microbiology Lab II	
MICR 452	Microbial Ecology	
ZOO 370	Cell Biology	
Technical Electives: Select 7 credits from the following or from additional courses:		7
BIOC 473	Methods of Biochemical Research	
BIOC 474	Methods of Recombinant DNA Technology	
CFS 210	Introduction to Food Science and Technology	
CFS 370	Food Processing I	
CFS 450	Cereal Technology	
Computer Elective: Select 3 credits from the following:		3
CE 212	Civil Engineering Graphic Communications	
CSCI 122	Visual BASIC	
CSCI 160	Computer Science I	
ECE 173	Introduction to Computing	
GEOG 455	Introduction to Geographic Information Systems	
IME 380	CAD/CAM for Manufacturing	
ME 212	Fundamentals of Visual Communication for Engineers	
ME 213	Modeling of Engineering Systems	
Total Credits		25