

Agricultural & Biosystems Engineering

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 compliment 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.

Agricultural Engineering Option

Career opportunities for graduates in agricultural engineering are many and diverse. Graduates may work for companies and agencies that design, develop, test, and manufacture power and machine systems; handle, store, and process agricultural commodities; design environmental controls and housing systems for plant and animal production; design equipment and systems for processing, manufacturing, distribution and quality protection of food products; design systems for management of air, land and water resources; design and manage crop irrigation systems; and develop electrical and electronic applications for agricultural problems. Graduates with an agricultural engineering concentration may also pursue graduate degrees in engineering, business, or law. By selecting appropriate elective courses, students may emphasize areas such as agricultural systems, environmental systems, biomaterials and processing systems, or an emphasis area designed by the student in consultation with an adviser.

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/2017-18/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: Agricultural

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

Minimum Degree Credits to Graduate: 134

General Education Requirements for Baccalaureate Degree

- A list of approved general education courses is available here (<http://bulletin.ndsu.edu/past-bulletin-archive/2017-18/academic-policies/undergraduate-policies/general-education/#genedcoursestext>).
- General education courses may be used to satisfy requirements for both general education and the major, minor, and program emphases, where applicable. Students should carefully review the major, minor, and program emphases requirements for minimum grade restrictions, should they apply.

Code	Title	Credits
Communication (C)		12
ENGL 110	College Composition I	

ENGL 120	College Composition II	
COMM 110	Fundamentals of Public Speaking	
Upper Division Writing [†]		
Quantitative Reasoning (R) [†]		3
Science and Technology (S) [†]		10
Humanities and Fine Arts (A) [†]		6
Social and Behavioral Sciences (B) [†]		6
Wellness (W) [†]		2
Cultural Diversity (D) ^{*†}		
Global Perspectives (G) ^{*†}		
Total Credits		39

* May be satisfied by completing courses in another General Education category.

† May be satisfied with courses required in the major. Review major requirements to determine if a specific upper division writing course is required.

Major Requirements - Agricultural Option

Code	Title	Credits
ABEN Core Courses:		
ABEN 110	Introduction to Agricultural and Biosystems Engineering	3
ABEN 189	Skills for Academic Success ¹	1
ABEN 255	Computer Aided Analysis & Design	3
ABEN 263	Biological Materials Processing	3
ABEN 377	Numerical Modeling in Agricultural and Biosystems Engineering	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 383	Structural Design for Biosystems	
ABEN 444	Transport Processes	
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 479	Fluid Power Systems Design	
ABEN 484	Drainage and Wetland Engineering	
MATH 128	Introduction to Linear Algebra	1
MATH 165	Calculus I (May satisfy general education category R)	4
MATH 166	Calculus II	4
MATH 259	Multivariate Calculus	3
MATH 266	Introduction to Differential Equations	3
ME 212	Fundamentals of Visual Communication for Engineers	3
ME 221	Engineering Mechanics I	3
ME 222	Engineering Mechanics II	3
ME 223	Mechanics of Materials	3
ME 350	Thermodynamics and Heat Transfer	3
CE 309	Fluid Mechanics	3

or ME 352	Fluid Dynamics	
CHEM 121	General Chemistry I (May satisfy general education category S)	3
CHEM 122	General Chemistry II (May satisfy general education category S)	3
ECE 301	Electrical Engineering I	3
Select one from the following:		3
ENGL 321	Writing in the Technical Professions	
ENGL 324	Writing in the Sciences	
ENGL 459	Researching and Writing Grants and Proposal	
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	
PHYS 252 & 252L	University Physics II and University Physics II Laboratory (May satisfy general education category S)	5
Program Electives: Select the following program electives in each category from courses listed in the Program Electives Tab. The minimum credit in each category will apply.		23
Computer Electives	Select a minimum of 3 credits from the Program Electives Tab.	
Business or Communication Elective	Select a minimum of 3 credits from the following prefix options: BUSN, COMM, ACCT, AGECE, ECON, MGT, MIS, MRKT ²	
Chemistry/Biological Science Electives	Select a minimum of 9 credits from the Program Electives Tab.	
Technical Electives	Select a minimum of 8 credits from the Program Electives Tab.	
Total Credits		110

¹ AGRI189 is only required for first-time, first-year students--A first-time, first-year student is defined as a student who has not yet completed a college course as a college student. Students that are not first-time, first-year students that either transfer into the university or change their major are not required to take AGRI 189.

² The course used for this business or communication elective cannot double-count as General Education.

SUGGESTED EMPHASIS AREA for the Agricultural Engineering Option: Consult with adviser when making selections.

- **Agricultural Systems** - Select electives with emphasis on machine, power, structural, and electrical/electronic systems to solve problems involving engineering aspects of food, feed, and fiber production.
- **Environmental Systems** - Select electives with emphasis on areas that contribute to solving problems in environmental engineering, natural resources management, hydrology, irrigation, watershed management, and waste management.
- **Biomaterial Systems** - Select electives with emphasis on combining engineering, biological, and physical sciences in the application of engineering principles to handling and processing of biomaterials for food and non-food products.

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 the Agricultural and Biosystems Engineering - Agricultural Option

Computer Electives: Select one course 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 105	Fundamentals of Geographic Information Systems	
GEOG 455	Introduction to Geographic Information Systems	
IME 380	CAD/CAM for Manufacturing	
ME 213	Modeling of Engineering Systems	
Business or Communication Electives: Choose one of the following courses or a course from the following prefix options:		3
BUSN, COMM, ACCT, AGECE, ECON, MGT, MIS, MRKT (The course used for this elective cannot double-count as General Education)		
ACCT 102	Fundamentals of Accounting	

ACCT 200	Elements of Accounting I	
AGEC 242	Introduction to Agricultural Management	
AGEC 244	Agricultural Marketing	
AGEC 246	Introduction to Agricultural Finance	
COMM 212	Interpersonal Communication	
COMM 214	Persuasive Speaking	
COMM 216	Intercultural Communication	
COMM 260	Introduction to Web Design	
MGMT 301	Management for Non-Business Majors	
MRKT 301	Marketing for Non-Business Majors	
Chemistry/Biological/Environmental Sciences Electives: Select 9 credits from the following:		9
ANSC 123	Feeds and Feeding	
ANSC 220	Livestock Production	
BIOL 111	Concepts of Biology	
BIOL 111L	Concepts of Biology Lab	
BIOL 124	Environmental Science	
BIOL 124L	Environmental Science Laboratory	
BIOL 150	General Biology I	
BIOL 150L	General Biology I Laboratory	
BIOL 151	General Biology II	
BIOL 151L	General Biology II Laboratory	
CFS 210	Introduction to Food Science and Technology	
CFS 450	Cereal Technology	
CHEM 121L	General Chemistry I Laboratory	
CHEM 122L	General Chemistry II Laboratory	
CHEM 240	Survey of Organic Chemistry	
ENT 210	Insects, Humans and the Environment	
MICR 202	Introductory Microbiology	
MICR 202L	Introductory Microbiology Lab	
MICR 350	General Microbiology	
MICR 350L	General Microbiology Lab	
NRM 322	Environmental Law and Policy	
PLSC 110	World Food Crops	
PLSC 225	Principles of Crop Production	
PLSC 315	Genetics	
PLSC 320	Principles of Forage Production	
PLSC 323	Principles of Weed Science	
PLSC 335	Seed Technology & Production	
RNG 225	Natural Resource & Agro-Ecosystems	
SOIL 210	Introduction to Soil Science	
SOIL 217	Introduction to Meteorology & Climatology	
SOIL 410	Soils and Land Use	
SOIL 480	Soils and Pollution	
Technical Electives: May choose from the ABEN section, Chemistry/Biological Science electives or the Engineering electives listed below:		8
ABEN 496 - Ag Tech Expo (1 add'l cr.) may be used as a Technical Elective. ABEN 496 - Field Exp./Internship, 1 cr., may be used as an ABEN Elective or as a Technical Elective. A maximum of two credits of ABEN 496 FE/Internship may be counted towards degree requirements.		
ASM 323	Post-Harvest Technology	
ASM 373	Tractors & Power Units	
ASM 374	Power Units Laboratory	
ASM 378	Machinery Principles and Management	
ASM 429	Hydraulic Power Principles and Applications	
ASM 454	Principles and Application of Precision Agriculture	

CE 204	Surveying
CE 310	Fluid Mechanics Laboratory
CE 343	Structural Engineering and Analysis
CE 370	Introduction to Environmental Engineering
CE 371	Environmental Engineering Laboratory
CE 404	Reinforced Concrete
CE 408	Water Resources and Supply
CE 410	Water and Wastewater Engineering
CE 421	Open Channel Flow
CE 451	Advanced Surveying
CE 472	Solid Waste Management
CE 473	Air Pollution
CE 477	Applied Hydrology
CE 478	Water Quality Management
CE 479	Advanced Water and Wastewater Treatment
CE 483	Contracts and Specifications
ECE 275	Digital Design
ECE 303	Electrical Engineering II
ECE 376	Embedded Systems
GEOG 456	Advanced Geographic Information Systems
IME 330	Manufacturing Processes
IME 335	Welding Technology
IME 380	CAD/CAM for Manufacturing
IME 430	Process Engineering
IME 431	Production Engineering
IME 450	Systems Engineering and Management
IME 455	Management of People Systems
IME 456	Program and Project Management
IME 461	Quality Assurance and Control
ME 331	Materials Science and Engineering
ME 341	Mechanics of Machinery
ME 353	Thermodynamics II
ME 421	Theory of Vibrations
ME 442	Machine Design I
ME 454	Heat and Mass Transfer
ME 471	Experimental Stress Analysis
ME 473	Engineering with Polymeric Materials
ME 474	Mechanics of Composite Materials
ME 475	Automatic Controls
ME 487	Internal Combustion Engines
RNG 326	Modeling of Range and Agro-Ecosystems
STAT 461	Applied Regression Models
STAT 462	Introduction to Experimental Design

Total Credits

23

SUGGESTED EMPHASIS AREA for the Agricultural & Biosystems Engineering Option: Consult with adviser when making selections.

- Agricultural Systems - Select electives with emphasis on machine, power, structural and electrical/electronic systems to solve problems involving engineering aspects of food, feed, and fiber production.
- Environmental Systems - Select electives with emphasis on areas that contribute to solving problems in environmental engineering, natural resources management, hydrology, irrigation, watershed management, and waste management.
- Biomaterials Systems - Select electives with emphasis on combining engineering, biological, and physical sciences in the application of engineering principles to handling and processing of biomaterials for food and non-food products.

- Advance Biosciences Electives - 9 credits required. Double Count with electives above. A minimum of 3 credits must be from non-ABEN prefix courses in the Advanced Biosciences tab.

AGRICULTURAL SYSTEMS

ABEN 358	Electric Energy Application in Agriculture
ABEN 383	Structural Design for Biosystems
ABEN 444	Transport Processes
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 479	Fluid Power Systems Design
ASM 323	Post-Harvest Technology
ASM 373	Tractors & Power Units
ASM 374	Power Units Laboratory
ASM 378	Machinery Principles and Management
ASM 429	Hydraulic Power Principles and Applications
ASM 454	Principles and Application of Precision Agriculture
CE 343	Structural Engineering and Analysis
CE 404	Reinforced Concrete
ECE 275	Digital Design
ECE 303	Electrical Engineering II
ECE 376	Embedded Systems
GEOG 455	Introduction to Geographic Information Systems
GEOG 456	Advanced Geographic Information Systems
IME 330	Manufacturing Processes
IME 335	Welding Technology
IME 380	CAD/CAM for Manufacturing
IME 430	Process Engineering
IME 431	Production Engineering
IME 450	Systems Engineering and Management
IME 455	Management of People Systems
IME 456	Program and Project Management
IME 461	Quality Assurance and Control
ME 331	Materials Science and Engineering
ME 341	Mechanics of Machinery
ME 353	Thermodynamics II
ME 421	Theory of Vibrations
ME 442	Machine Design I
ME 454	Heat and Mass Transfer
ME 471	Experimental Stress Analysis
ME 473	Engineering with Polymeric Materials
ME 474	Mechanics of Composite Materials
ME 475	Automatic Controls
ME 487	Internal Combustion Engines

ENVIRONMENTAL SYSTEMS

ABEN 358	Electric Energy Application in Agriculture
ABEN 444	Transport Processes
ABEN 450	Bioprocess Engineering
ABEN 452	Bioenvironmental Systems Design
ABEN 456	Biobased Energy

ABEN 464	Resource Conservation and Irrigation Engineering
ABEN 479	Fluid Power Systems Design
ABEN 484	Drainage and Wetland Engineering
ASM 454	Principles and Application of Precision Agriculture
CE 204	Surveying
CE 370	Introduction to Environmental Engineering
CE 371	Environmental Engineering Laboratory
CE 408	Water Resources and Supply
CE 410	Water and Wastewater Engineering
CE 421	Open Channel Flow
CE 451	Advanced Surveying
CE 472	Solid Waste Management
CE 473	Air Pollution
CE 477	Applied Hydrology
CE 478	Water Quality Management
CE 479	Advanced Water and Wastewater Treatment
CE 483	Contracts and Specifications
CHEM 240	Survey of Organic Chemistry
CHEM 341	Organic Chemistry I
CHEM 341L	Organic Chemistry I Laboratory
ECE 303	Electrical Engineering II
ME 454	Heat and Mass Transfer
MICR 350	General Microbiology
RNG 326	Modeling of Range and Agro-Ecosystems
SOIL 210	Introduction to Soil Science
SOIL 410	Soils and Land Use
SOIL 480	Soils and Pollution
BIOMATERIALS SYSTEMS	
ABEN 358	Electric Energy Application in Agriculture
ABEN 444	Transport Processes
ABEN 450	Bioprocess Engineering
ABEN 452	Bioenvironmental Systems Design
ABEN 456	Biobased Energy
ABEN 458	Process Engineering for Food, Biofuels and Bioproducts
ABEN 479	Fluid Power Systems Design
ABEN 479	Fluid Power Systems Design
ABEN 484	Drainage and Wetland Engineering
BIOC 460	Foundations of Biochemistry and Molecular Biology I
BIOC 460L	Foundations of Biochemistry I Laboratory
CFS 210	Introduction to Food Science and Technology
CFS 430	Food Unit Operations
CFS 450	Cereal Technology
CFS 470	Food Processing II
CFS 471	Food Processing Laboratory
CHEM 240	Survey of Organic Chemistry
CHEM 341	Organic Chemistry I
CHEM 341L	Organic Chemistry I Laboratory
CHEM 342	Organic Chemistry II
ECE 303	Electrical Engineering II
IME 450	Systems Engineering and Management
IME 460	Evaluation of Engineering Data
IME 461	Quality Assurance and Control

ME 331	Materials Science and Engineering
ME 442	Machine Design I
ME 454	Heat and Mass Transfer
MICR 350	General Microbiology

A minimum of 3 credits must be from non-ABEN Advanced Bioscience Courses.

ABEN Courses (Eligible for Adv. Biosci.)

ABEN 444	Transport Processes	3
ABEN 450	Bioprocess Engineering	3
ABEN 452	Bioenvironmental Systems Design	3
ABEN 456	Biobased Energy	3
ABEN 458	Process Engineering for Food, Biofuels and Bioproducts	3
ABEN 464	Resource Conservation and Irrigation Engineering	4
ABEN 484	Drainage and Wetland Engineering	3

SOIL Courses

SOIL 322	Soil Fertility and Fertilizers	3
SOIL 351	Soil Ecology	3
SOIL 410	Soils and Land Use	3
SOIL 444	Soil Genesis and Survey	3
SOIL 465	Soil And Plant Analysis	3
SOIL 480	Soils and Pollution	3

PLSC Courses

PLSC 320	Principles of Forage Production	3
PLSC 335	Seed Technology & Production	2
PLSC 350	Sugarbeet Production	2
PLSC 411	Genomics	3
PLSC 431	Intermediate Genetics	3

Additional Course Options

BIOL 364	General Ecology	3
BOT 380	Plant Physiology	3
ANSC 357	Animal Genetics	3
RNG 452	Geographic Information Systems in Range Survey	3

Freshman

Fall	Credits	Spring	Credits
ABEN 110	3	ABEN 496 (Ag Tech Expo)	1
ABEN 189	1	ME 212	3
CHEM 121	3	ME 221	3
ENGL 110	4	CHEM 122	3
MATH 165	4	ENGL 120	3
CHEM/BIO Elective	3	MATH 166	4
	18		17

Sophomore

Fall	Credits	Spring	Credits
ABEN 255	3	ABEN 263	3
COMM 110	3	PHYS 252	4
ME 222	3	PHYS 252L	1
ME 223	3	MATH 266	3
MATH 259	3	CE 309	3
MATH 128	1	Computer Elective	3

Gen Ed Elective	2		
	18		17
Junior			
Fall	Credits	Spring	Credits
IME 460	3	ABEN 377	3
ME 350	3	ABEN 482	3
ENGL 321, 324, or 459	3	ECE 301	3
ENGR 402	1	ABEN Elective	3
ABEN Elective	3	Gen Ed Elective	3
CHEM/BIO Elective	3		
	16		15
Senior			
Fall	Credits	Spring	Credits
ABEN 486	2	ABEN 487	2
ABEN 491	1	Tech Elective	3
IME 440	2	CHEM/BIO Elective	3
ABEN Elective	3	Gen Ed Elective	3
Gen Ed Elective	3	Gen Ed Elective	3
Tech Elective	5	BUS/COMM Elective	3
	16		17

Total Credits: 134

Major Requirements

Major: Agricultural & Biosystems Engineering Option: Biosystems

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

Minimum Degree Credits to Graduate: 133

General Education Requirements for Baccalaureate Degree

- A list of approved general education courses is available here (<http://bulletin.ndsu.edu/past-bulletin-archive/2017-18/academic-policies/undergraduate-policies/general-education/#genedcoursestext>).
- General education courses may be used to satisfy requirements for both general education and the major, minor, and program emphases, where applicable. Students should carefully review the major, minor, and program emphases requirements for minimum grade restrictions, should they apply.

Code	Title	Credits
Communication (C)		12
ENGL 110	College Composition I	
ENGL 120	College Composition II	
COMM 110	Fundamentals of Public Speaking	
Upper Division Writing [†]		
Quantitative Reasoning (R) [†]		3
Science and Technology (S) [†]		10
Humanities and Fine Arts (A) [†]		6
Social and Behavioral Sciences (B) [†]		6
Wellness (W) [†]		2
Cultural Diversity (D) ^{**†}		
Global Perspectives (G) ^{**†}		
Total Credits		39

* May be satisfied by completing courses in another General Education category.

† May be satisfied with courses required in the major. Review major requirements to determine if a specific upper division writing course is required.

Major Requirements - Biosystems Option

Code	Title	Credits
ABEN Core Requirements:		
ABEN 110	Introduction to Agricultural and Biosystems Engineering	3
ABEN 189	Skills for Academic Success ¹	1
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 form 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 128	Introduction to Linear Algebra	1
MATH 165	Calculus I (May satisfy general education category R)	4
MATH 166	Calculus II	4
MATH 259	Multivariate Calculus	3
MATH 266	Introduction to Differential Equations	3
ME 221	Engineering Mechanics I	3
ME 222	Engineering Mechanics II	3
ME 350	Thermodynamics and Heat Transfer	3
BIOL 150	General Biology I	3
CHEM 121 & 121L	General Chemistry I and General Chemistry I Laboratory (May satisfy general education category S)	4
CHEM 122 & 122L	General Chemistry II and General Chemistry II Laboratory (May satisfy general education category S)	4
CHEM 240	Survey of Organic Chemistry	3
CE 309	Fluid Mechanics	3
Select one from the following:		3
ENGL 321	Writing in the Technical Professions	
ENGL 324	Writing in the Sciences	
ENGL 459	Researching and Writing Grants and Proposal	
ENGR 402	Engineering Ethics and Social Responsibility	1
IME 440	Engineering Economy	2
IME 460 or STAT 330	Evaluation of Engineering Data Introductory Statistics	3

PHYS 252 & 252L	University Physics II and University Physics II Laboratory (May satisfy general education category S)	5
Program Electives: Select the following program electives in each category from courses listed in the Program Electives Tab. The minimum credit in each category will apply.		24
Engineering Electives	Select a minimum of 9 credits from the Program Electives Tab.	
Chemistry/Biological Science Electives	Select a minimum of 6 credits from the Program Electives Tab.	
Technical Electives	Select a minimum of 6 elective courses from the Program Electives Tab.	
Computer Elective	Select a minimum of 3 credits from the Program Electives Tab.	
Total Credits		110

¹ AGRI189 is only required for first-time, first-year students—A first-time, first-year student is defined as a student who has not yet completed a college course as a college student. Students that are not first-time, first-year students that either transfer into the university or change their major are not required to take AGRI 189.

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.

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 380	Plant Physiology	
BOT 460	Plant Ecology	
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 6 credits from the following or from additional courses:		6

Tech electives can be add'l courses from ABEN, ENGR, or CHEM/BIO Electives. ABEN 496 - Ag Tech Expo (1 add'l cr.) may be used as a Technical Elective. ABEN 496 - Field Exp./Internship, 1 cr., may be used as an ABEN Elective or as a Technical Elective. A maximum of two credits of ABEN 496 FE/Internship may be counted towards degree requirements.

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 24

Advance Biosciences Electives - 9 credits required. Students may double count with other program electives. A minimum of 3 credits must be from non-ABEN prefix courses in the Advanced Biosciences tab.

ABEN Courses (Eligible for Adv. Biosci.)

ABEN 444	Transport Processes
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 484	Drainage and Wetland Engineering

Engineering Electives (Eligible for Adv. Biosci.)

CE 370	Introduction to Environmental Engineering
CE 371	Environmental Engineering Laboratory

CHEM/BIO Electives (Eligible for Adv. Biosci.)

ANSC 357	Animal Genetics
BIOC 260	Elements of Biochemistry
BIOC 473	Methods of Biochemical Research
BIOC 474	Methods of Recombinant DNA Technology
BIOL 364	General Ecology
BOT 380	Plant Physiology
BOT 460	Plant Ecology
CHEM 341	Organic Chemistry I
CHEM 341L	Organic Chemistry I Laboratory
CHEM 342	Organic Chemistry II
CHEM 342L	Organic Chemistry II Laboratory
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

Freshman			
Fall	Credits	Spring	Credits
ABEN 110	3	ABEN 496 (Ag Tech Expo)	1
ABEN 189	1	ME 221	3
CHEM 121	3	CHEM 122	3
CHEM 121L	1	CHEM 122L	1
ENGL 110	4	ENGL 120	3
MATH 165	4	MATH 166	4
BIOL 150	3	Computer Elective	3
	19		18
Sophomore			
Fall	Credits	Spring	Credits
ABEN 255	3	ABEN 263	3
CHEM 240	3	PHYS 252	4
COMM 110	3	PHYS 252L	1
MATH 128	1	MATH 266	3
MATH 259	3	Gen Ed Elective	3
ME 222	3	CHEM/BIO Elective	3
	16		17
Junior			
Fall	Credits	Spring	Credits
CE 309	3	ABEN 444	3
IME 440	2	ABEN 482	3
IME 460	3	ME 350	3
ENGL 321, 324, or 459	3	ABEN Elective	3
ENGR Elective	3	Gen Ed Elective	5
CHEM/BIO Elective	3		
	17		17
Senior			
Fall	Credits	Spring	Credits
ABEN 486	2	ABEN 487	2
ABEN 491	1	ABEN Elective	3
ENGR 402	1	ENGR Elective	3
ABEN Elective	3	Gen Ed Elective	3
Gen Ed Elective	3	Tech Elective	3
ENGR Elective	3		
Tech Elective	3		
	16		14

Total Credits: 134