

Biological Engineering (BS): Agricultural Engineering Concentration

To see more about what you will learn in this program, visit the Learning Outcomes website (<https://apps.oirp.ncsu.edu/pgas/>)!

The BE curriculum is jointly administered by the College of Agriculture and Life Sciences and the College of Engineering and combines the fields of engineering, biology, chemistry, and agriculture. The Biological Engineering program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>. BE graduates are qualified to become registered professional engineers by passing the appropriate examinations and upon completing the engineering experience requirements. Specific curriculum requirements are available online.

BAE faculty, in concert with program constituencies, has developed the following undergraduate program objectives. Within the first five years following graduation, NC State's Biological Engineering graduates will:

- Excel in their careers by applying their engineering knowledge, critical-thinking skills, systematic approach to problem solving, and innovation to improve biological and agricultural systems;
- Work effectively both independently and as part of professional teams and demonstrate leadership potential in project management;
- Display professionalism, ethics, equity, and inclusivity in the practice of engineering to safeguard life, health, and public welfare;
- Communicate effectively in a professional environment; and
- Be engaged in life-long learning and professional development.

Plan Requirements

First Year

Fall Semester		Hours
CH 101	Chemistry - A Molecular Science ¹	3
CH 102	General Chemistry Laboratory ¹	1
E 101	Introduction to Engineering & Problem Solving ²	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research ²	4
MA 141	Calculus I ¹	4
Select one of the following:		3
ARE 201	Introduction to Agricultural & Resource Economics	
ARE 201A	Introduction to Agricultural & Resource Economics	
EC 201	Principles of Microeconomics	
EC 205	Fundamentals of Economics	
Hours		17

Spring Semester

Select one of the following:		4
CH 201 & CH 202	Chemistry - A Quantitative Science and Quantitative Chemistry Laboratory	

CH 220 & CH 222	Introductory Organic Chemistry and Organic Chemistry I Lab	
CH 221 & CH 222	Organic Chemistry I and Organic Chemistry I Lab	
MA 241	Calculus II ¹	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory ¹	4
Hours		12

Second Year

Fall Semester		Hours
BAE 200	Computer Methods in Biological Engineering	2
CE 214 or MAE 206	Engineering Mechanics-Statics ² or Engineering Statics	3
MA 242	Calculus III	4
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
BIO 181 or BIO 183	Introductory Biology: Ecology, Evolution, and Biodiversity or Introductory Biology: Cellular and Molecular Biology	4
Hours		17

Spring Semester

BAE 202	Introduction to Biological and Agricultural Engineering Methods	4
CE 215 or MAE 208	Engineering Mechanics-Dynamics ² or Engineering Dynamics	3
MA 341	Applied Differential Equations I	3
MAE 201	Engineering Thermodynamics I	3
PB 321 or SSC 200	Introduction to Whole Plant Physiology or Soil Science	3
Hours		16

Third Year

Fall Semester		Hours
BAE 325	Introductory Geomatics	3
BAE 302	Transport Phenomena	3
BAE 305	Biological Engineering Circuits	4
CE 282 or MAE 308	Hydraulics or Fluid Mechanics	
ENG 331 or ENG 333	Communication for Engineering and Technology or Communication for Science and Research	3
Hours		13

Spring Semester

BAE 401	Sensors and Controls	3
BAE 361	Analytical Methods in Engineering Design	3
ST 370	Probability and Statistics for Engineers	3
CE 225 or MAE 214	Mechanics of Solids or Solid Mechanics	
Advanced Biology Elective (p. 2)		3
Hours		12

Fourth Year**Fall Semester**

BAE 451	Engineering Design I	2
BAE 462	Machinery Design and Applications	3
Select one of the following:		3
IDS 201	Environmental Ethics	
STS 301	Science and Civilization	
STS 304	Ethical Dimensions of Progress	
Hours		8

Spring Semester

BAE 452	Engineering Design II	2
BAE 481	Structures & Environment	3
BAE 488	Postharvest Engineering	3
BAE 322 or BAE 371	Introduction to Food Process Engineering or Fundamentals of Hydrology for Engineers	3
Hours		11
Total Hours		106

¹ A grade of C or higher is required.

² A grade of C- or higher is required.

Code	Title	Hours	Counts towards
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GEP Courses

GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		6	
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3	
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		2	
GEP Additional Breadth (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/) (Humanities/Social Sciences/Visual and Performing Arts)		3	
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		2	
GEP U.S. Diversity (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-us-diversity/) (verify requirement)			
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)			

Foreign Language Proficiency
(<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/foreign-language-proficiency/>) (verify requirement)

Total Hours	16
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Advanced Biology Elective

Code	Title	Hours	Counts towards
FS 462	Postharvest Physiology	3	
FS 562	Postharvest Physiology	3	
HS 462	Postharvest Physiology	3	
HS 562	Postharvest Physiology	3	
MB 351	General Microbiology	3	
SSC 332	Environmental Soil Microbiology	3	

Semester Sequence

This is a sample.

First Year

Fall Semester		Hours
CH 101	Chemistry - A Molecular Science ¹	3
CH 102	General Chemistry Laboratory ¹	1
E 101	Introduction to Engineering & Problem Solving ¹	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research ¹	4
MA 141	Calculus I ¹	4
Select one of the following:		3
EC 201	Principles of Microeconomics	
EC 205	Fundamentals of Economics	
BAET 201	Shop Processes and Management	

Hours	17
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Spring Semester

Chemistry Elective (p. 1)		4
MA 241	Calculus II ¹	4
PY 205	Physics for Engineers and Scientists I ¹	3
PY 206	Physics for Engineers and Scientists I Laboratory	1
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1

Hours	16
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Second Year**Fall Semester**

BAE 200	Computer Methods in Biological Engineering	2
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MAE 206 or CE 214	Engineering Statics ¹ or Engineering Mechanics-Statics	3
MA 242	Calculus III	4
PY 208	Physics for Engineers and Scientists II	3
PY 209	Physics for Engineers and Scientists II Laboratory	1
BIO 181 or BIO 183	Introductory Biology: Ecology, Evolution, and Biodiversity or Introductory Biology: Cellular and Molecular Biology	4
Hours		17

Spring Semester

BAE 202	Introduction to Biological and Agricultural Engineering Methods	4
MAE 208	Engineering Dynamics ¹	3
MA 341	Applied Differential Equations I	3
MAE 201	Engineering Thermodynamics I	3
SSC 200	Soil Science	3
Hours		16

Third Year

Fall Semester

BAE 325	Introductory Geomatics	3
BAE 302	Transport Phenomena	3
MAE 308 or CE 282	Fluid Mechanics ¹ or Hydraulics	3
BAE 305	Biological Engineering Circuits	4
ENG 331 or ENG 333	Communication for Engineering and Technology or Communication for Science and Research	3
Hours		16

Spring Semester

BAE 401	Sensors and Controls	3
BAE 361	Analytical Methods in Engineering Design	3
MAE 214 or CE 225	Solid Mechanics ¹ or Mechanics of Solids	3
ST 370	Probability and Statistics for Engineers	3
Advanced Biology Elective (p. 2)		3
Hours		15

Fourth Year

Fall Semester

BAE 451	Engineering Design I	2
BAE 462	Machinery Design and Applications	3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Ethics (p. 1)		3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
Hours		15

Spring Semester

BAE 452	Engineering Design II	2
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BAE 488	Postharvest Engineering	3
BAE 481	Structures & Environment	3
BAE Elective (p. 1)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		2
GEP Additional Breadth (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/) (Humanities/Social Sciences/Visual and Performing Arts)		3
Hours		16
Total Hours		128

¹ A grade of C- or higher is required.

Career Opportunities

BE students learn to solve a wide variety of engineering problems and will have opportunities for specialization through selection of a specific concentration. Scientific and engineering principles are applied: to conserve and manage air, energy, soil and water resources; to manage, protect and restore natural ecosystems; to understand and utilize biological, chemical and physical processes for the production and conversion of biomass to bio energy; to analyze, understand and utilize mechanical properties of biological materials; to design and develop machinery systems for all phases of agricultural and food production; to design and evaluate structures and environmental control systems for housing animals, plant growth, and biological product storage; to develop improved systems for processing and marketing food and agricultural products; and to design sensor-based instrumentation and control systems for biological and agricultural applications.

Graduates of the BE curriculum receive a Bachelor's of Engineering in Biological Engineering, qualifying them for positions in design, development, and research in industry, government and public institutions. The curriculum also prepares students for post-graduate work leading to advanced degrees. Typical positions filled by recent BE graduates include: stream and wetlands restoration project manager; product design; development and testing engineer; plant engineering and management; engineering analysis and inspection for federal and state agencies; engineering consultant and research engineer. Entry-level salary ranges for BE graduates are similar to those of Civil, Industrial, and Mechanical Engineering graduates.

The BAET curriculum provides graduates opportunities in technical analysis, application and evaluation of agricultural production systems and environmental systems. The curriculum's flexibility enables students to specialize technologically in agriculture, the environment, or business management. Careers include technical jobs in production agriculture, environmental systems, agribusiness sales and service, and agricultural extension.