

Biological Engineering (BS): Environmental 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
Hours		14

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
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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		15

Second Year

Fall Semester

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 203	Introduction to AutoCAD Civil 3D for Environmental & Ecological Engineers	2
BAE 204	Introduction to Environmental and Ecological Engineering	2
MAE 208	Engineering Dynamics ²	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
BAE 371	Fundamentals of Hydrology for Engineers	3
CE 282	Hydraulics ²	3
BAE 305	Biological Engineering Circuits	4
Hours		16

Spring Semester

BAE 401	Sensors and Controls	3
BAE 472	Irrigation and Drainage	3
CE 225 or MAE 214	Mechanics of Solids ² or Solid Mechanics	3
ST 370	Probability and Statistics for Engineers	3
Select one of the following:		3
AEC 360	Ecology	
PB 321	Introduction to Whole Plant Physiology	
PB 360	Ecology	

SSC 332	Environmental Soil Microbiology	
Hours		15
Fourth Year		
Fall Semester		
BAE 478	Agricultural Waste Management	3
BAE 451	Engineering Design I	2
Select one of the following:		3
BAE 473	Introduction to Hydrologic and Water Quality Modeling	
BAE 481	Structures & Environment	
BAE 573	Introduction to Hydrologic and Water Quality Modeling	
SSC 473	Introduction to Hydrologic and Water Quality Modeling	
SSC 573	Introduction to Hydrologic and Water Quality Modeling	
Select one of the following:		3
IDS 201	Environmental Ethics	
STS 301	Science and Civilization	
STS 304	Ethical Dimensions of Progress	
ENG 331 or ENG 333	Communication for Engineering and Technology or Communication for Science and Research	3
Hours		14
Spring Semester		
BAE 452	Engineering Design II	2
Select one of the following:		3
BAE 322	Introduction to Food Process Engineering	
BAE 361	Analytical Methods in Engineering Design	
BAE 481	Structures & Environment	
Hours		5
Total Hours		112

¹ A grade of C or higher is required.
² A grade of C- or higher is required.

Code	Title	Hours	Counts towards
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

Semester Sequence

This is a sample.

First Year		Hours
Fall Semester		
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
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Hours		15

Spring Semester		Hours
Select one of the following:		4
CH 221 & CH 222	Organic Chemistry I and Organic Chemistry I Lab	
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	Physics for Engineers and Scientists I ¹	3
PY 206	Physics for Engineers and Scientists I Laboratory	1
Select one of the following:		3
EC 201	Principles of Microeconomics	

EC 205	Fundamentals of Economics	
ARE 201	Introduction to Agricultural & Resource Economics	

Hours **15**

Second Year

Fall Semester

BAE 200	Computer Methods in Biological Engineering	2
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 203	Introduction to AutoCAD Civil 3D for Environmental & Ecological Engineers	2
BAE 204	Introduction to Environmental and Ecological Engineering	2
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
BAE 371	Fundamentals of Hydrology for Engineers	3
CE 282	Hydraulics ¹	3
BAE 305	Biological Engineering Circuits	4

Hours **16**

Spring Semester

BAE 401	Sensors and Controls	3
BAE 472	Irrigation and Drainage	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. 1)		3

Hours **15**

Fourth Year

Fall Semester

BAE 451	Engineering Design I	2
BAE 478	Agricultural Waste Management	3
Engineering Elective		3
Ethics (p. 1)		3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3

ENG 331 or ENG 333	Communication for Engineering and Technology or Communication for Science and Research	3
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Hours **17**

Spring Semester

BAE 452	Engineering Design II	2
BAE Elective (p. 1)		3
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		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
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 **17**

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.