

Biological Engineering (BS): Ecological Engineering Concentration

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

CH 221	Organic Chemistry I	3
CH 222	Organic Chemistry I Lab	1
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
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	Introductory Biology: Ecology, Evolution, and Biodiversity	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	Thermal-Fluid Sciences	3
SSC 200	Soil Science	3
Hours		16
Third Year		
Fall Semester		
BAE 302	Transport Phenomena	3
BAE 305	Biological Engineering Circuits	4
BAE 371	Fundamentals of Hydrology for Engineers	3
CE 282	Hydraulics ²	3
PB 360	Ecology	3
Hours		16
Spring Semester		
BAE 376	Watershed Assessment and Water Quality Protection	3
BAE 401	Sensors and Controls	3
CE 225 or MAE 214	Mechanics of Solids ² or Solid Mechanics	3
ST 370	Probability and Statistics for Engineers	3
Hours		12
Fourth Year		
Fall Semester		
BAE 325	Introductory Geomatics	3
BAE 451	Engineering Design I	2
BAE 473	Introduction to Hydrologic and Water Quality Modeling	3
BAE 474	Principles and Applications of Ecological Engineering	3
ENG 331 or ENG 333	Communication for Engineering and Technology or Communication for Science and Research	3

Ethics Elective (p. 2)	3
Hours	17
Spring Semester	
BAE 452 Engineering Design II	2
Engineering Elective (p. 2)	3
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
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 Elective (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		2
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
GEP Foundations of American Democracy (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-fad/) (verify requirement)		
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)		
Total Hours		16

Ethics Elective

Code	Title	Hours
IDS 201	Environmental Ethics	3
PHI 325	Bio-Medical Ethics	3
STS 302	Contemporary Science, Technology and Human Values	3
STS 304	Ethical Dimensions of Progress	3
STS 322	Technological Catastrophes	3
STS 323	World Population and Food Prospects	3
STS 325	Bio-Medical Ethics	3

Engineering Elective

Code	Title	Hours
BAE 322	Introduction to Food Process Engineering	3
BAE 361	Analytical Methods in Engineering Design	3
BAE 478	Circular Approach to Manure Management	3
BAE 481	Structures & Environment	3
BAE 574		3

BAE 578	Circular Approach to Manure Management	3
BAE 581	Open Channel Hydraulics for Natural Systems	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
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Hours		15

Spring Semester

CH 221	Organic Chemistry I	3
CH 222	Organic Chemistry I Lab	1
MA 241	Calculus II ¹	4
PY 205	Physics for Engineers and Scientists I	3
PY 206	Physics for Engineers and Scientists I Laboratory	1
EC 205	Fundamentals of Economics	3
Hours		15

Second Year

Fall Semester

BAE 200	Computer Methods in Biological Engineering	2
MAE 206 or CE 214	Engineering Statics ² 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	Introductory Biology: Ecology, Evolution, and Biodiversity	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	Thermal-Fluid Sciences	3
SSC 200	Soil Science	3
Hours		16

Third Year

Fall Semester

BAE 302	Transport Phenomena	3
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BAE 305	Biological Engineering Circuits	4
BAE 371	Fundamentals of Hydrology for Engineers	3
CE 282	Hydraulics ²	3
PB 360	Ecology	3
Hours		16
Spring Semester		
BAE 376	Watershed Assessment and Water Quality Protection	3
ST 370	Probability and Statistics for Engineers	3
MAE 214 or CE 225	Solid Mechanics ² or Mechanics of Solids	3
BAE 401	Sensors and Controls	3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
Hours		15
Fourth Year		
Fall Semester		
BAE 451	Engineering Design I	2
BAE 325	Introductory Geomatics	3
BAE 473	Introduction to Hydrologic and Water Quality Modeling	3
BAE 474	Principles and Applications of Ecological Engineering	3
ENG 331 or ENG 333	Communication for Engineering and Technology or Communication for Science and Research	3
Ethics Elective (p. 1)		3
Hours		17
Spring Semester		
BAE 452	Engineering Design II	2
Engineering Elective (p. 2)		3
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
GEP Elective (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		2
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.

² 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.

Career Titles

- Stream and wetlands restoration project manager
- Product designer
- Development and testing engineer
- Plant engineering and management
- Engineering analyst and inspector for federal and state agencies
- Engineering consultant
- Research engineer

Learn More About Careers

NCcareers.org (<https://nccareers.org/>)

Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (<https://www.bls.gov/ooh/>)

Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (<https://www.careeronestop.org/>)

View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (<https://careers.dasa.ncsu.edu/explore-careers/career-assessments/>) (NC State student email address required) This career, major and education planning system is available to current NC State students to learn about how your values, interests,

competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (<https://careers.dasa.ncsu.edu/about/hours-appointments/>) to discuss the results.

Focus 2 Apply Assessment (<https://www.focus2career.com/Portal/Register.cfm?SID=1929>) (Available to prospective students)

A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

American Society of Agricultural and Biological Engineers (<https://www.asabe.org/>)

Career Cornerstone Center-Engineering (<https://www.careercornerstone.org/eng/eng.htm>)

National Society of Professional Engineers (<https://www.nspe.org/>)