

Biological Engineering (BS): Environmental 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

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
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	Thermal-Fluid Sciences	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 Circular Approach to Manure 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****GEP Courses**GEP Humanities (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/>) 6GEP Social Sciences (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/>) 3GEP Health and Exercise Studies (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/>) 2GEP Elective (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/>) 3GEP Interdisciplinary Perspectives (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/>) 2GEP 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****Semester Sequence**

This is a sample.

First Year**Fall Semester**CH 101 Chemistry - A Molecular Science ¹ 3CH 102 General Chemistry Laboratory ¹ 1E 101 Introduction to Engineering & Problem Solving ¹ 1

E 115 Introduction to Computing Environments 1

ENG 101 Academic Writing and Research ¹ 4MA 141 Calculus I ¹ 4GEP Health and Exercise Studies (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/>) 1**Hours 15****Spring Semester**

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 4PY 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	Thermal-Fluid Sciences	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	Circular Approach to Manure 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
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 Elective (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		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.

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/>)