

# ENVIRONMENTAL ENGINEERING

## Description

The Department of Civil and Environmental Engineering offers a complete environmental engineering undergraduate program to students on the Lincoln and Omaha campuses of the University of Nebraska. Curriculum requirements are nearly identical on both campuses. The goal is to prepare students for entry into the environmental engineering profession immediately after graduation or to pursue graduate-level studies.

The general educational objectives of the University of Nebraska–Lincoln environmental engineering undergraduate program are to prepare our graduates so that, with a UNL BS ENVE degree, a few years beyond graduation, alumni will:

Be employed in environmental engineering or a closely related field and successfully pursue professional licensure; or, graduates will be pursuing an advanced degree in environmental engineering, a closely related field or professional education in engineering, medicine, business, or law.

Contribute to society and address societal and environmental needs through engagement in professional, community, or service organizations.

Agree that the environmental engineering program prepared them for success in their careers in terms of knowledge and skillsets as embodied in the program and the Complete Engineer™ Initiative.

The professional discipline of environmental engineering is defined as the application of engineering principles to improve and maintain the environment for the protection of human health, for the protection of nature's beneficial ecosystems, and for environment-related enhancement of the quality of human life. In all professional endeavors, the environmental engineer must consider ecological effects as well as the social, economic, and political needs of people.

The environmental engineer devises solutions for topics ranging from water and air pollution control and treatment, drinking water supply, wastewater management, solid waste management, public health, water resources management, sustainable design, and industrial ecology. Environmental engineers focus on minimizing the impacts of air, water, and land pollution, minimizing waste production, maximizing the use of renewable energy in environmental systems, and protecting the environment.

Instructional emphasis is placed on fundamental engineering principles derived from mathematics, chemistry, physics, biology, earth science, and engineering science. These subjects provide a sound background for the subsequent introductory courses in environmental engineering, water resources engineering, fate and transport, process design, and sustainable design. Students are introduced to design concepts in their freshman year. Design is incorporated throughout the curriculum that culminates in two senior-level courses, CIVE 385 Professional Practice and Management in Civil Engineering and CIVE 489 Senior Design Project.

Instructional laboratories that provide experiences with more than one media (water, soil, and air) in environmental engineering provide each student with an opportunity to learn, through individual participation.

## Criteria for Professional Admission to the Environmental Engineering Degree Program

Students are expected to meet minimum college entrance requirements. After being admitted to the college as pre-environmental engineering students, students wishing to pursue a degree in environmental engineering must further be admitted to the degree program. Students who have completed 43 credit hours applicable to their environmental engineering degree are considered for formal admission to the environmental engineering degree program. Transfer students must have at least 12 credit hours of coursework from the University of Nebraska–Lincoln on record before an application will be considered. Students must receive a grade of C or better in the following classes to be professionally admitted to the environmental engineering program:

CHEM 113A Fundamental Chemistry I and CHEM 113L Fundamental Chemistry I Laboratory or CHEM 109A General Chemistry I and CHEM 109L General Chemistry I Laboratory; and

MATH 106 Calculus I, MATH 107 Calculus II, and MATH 221 Differential Equations;

CSCE 101 Fundamentals of Computer Science,

PHYS 211 General Physics I, and

MECH 223 Engineering Statics and MECH 325 Mechanics of Elastic Bodies or MECH 373 Engineering Dynamics.

## Graduate Programs

The Department of Civil and Environmental Engineering offers several graduate degree programs: master of science in environmental engineering and an accelerated master of science in environmental engineering. See the *Graduate Studies Catalog* for details.

## College Requirements

### College Admission

#### College Entrance Requirements

Students must meet both the University and College of Engineering entrance requirements. The following includes both the University and College of Engineering entrance requirements.

Students must have high school credit for (one unit is equal to one high school year):

1. Mathematics – 4 units: 2 of algebra, 1 of geometry, and 1 of precalculus and trigonometry
2. English – 4 units
3. Natural sciences – 3 units that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management or computer science)
4. Foreign language – 2 units of a single foreign language
5. Social studies – 3 units
6. Students having a composite ACT score of 28 or greater (or equivalent SAT score) will be admitted to the College of Engineering even if they lack any one of the following: trigonometry, chemistry, or physics. Students without test scores who are missing a full unit of trigonometry/pre-calculus/calculus or chemistry or physics will be evaluated through College Review.

- Students having an ACT score of 19 or less in English (or equivalent SAT score) or a grade lower than B in high school English, must take ENGL 150 Writing and Inquiry or ENGL 151 Writing for Change.

A total of 16 units is required for admission.

Engineering requires that student performance meet one of the following standards: composite ACT of 24, SAT of 1180, ACT Math subscore of 24, SAT Math subscore of 580, or a 3.5 cumulative GPA.

Any domestic first-year student who does not gain admission to Engineering but does gain admission to the University of Nebraska-Lincoln (UNL) will be reviewed through College Review. College Review is conducted through the College Review Committee which considers factors beyond standardized testing. Any first-year student who is not admitted through college review is placed in Pre-Engineering (PENG) with the Exploratory and Pre-Professional Advising Center (Explore Center). Students in the Explore Center can transfer to the College of Engineering once college admission requirements are met.

Students for whom English is not their language of nurture must meet the minimum English proficiency requirements of the University.

Students who lack entrance units may complete precollege training by Independent Study through the University of Nebraska-Lincoln Office of On-line and Distance Education, in summer courses, or as a part of their first or second semester course loads while in the Explore Center or other colleges at UNL.

Students should consult their advisor, their department chair, or Engineering Student Services (ESS) if they have questions on current policies.

## Other Admission Requirements

Students who transfer to the University of Nebraska-Lincoln from other accredited colleges or universities and wish to be admitted to the College of Engineering (COE) must meet COE first-year student entrance requirements, have a minimum cumulative GPA of 2.5, and be calculus-ready. Students not meeting either of these requirements must enroll in the Explore Center or another University college until they meet COE admission requirements. Students transferring from UNO, UNL, or UNK to the College of Engineering must be in good academic standing with their institution.

The COE accepts courses for transfer for which a C or better grade was received from colleges outside of the NU system. Although the University of Nebraska-Lincoln and the College of Engineering in general accepts C- and D grades from the University of Nebraska Kearney and the University of Nebraska Omaha, not all majors in the COE accept such low grades. Students must conform to the requirements of their intended major and, in any case, are strongly encouraged to repeat courses with a grade of C- or less.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 to be readmitted to COE.

## College Degree Requirements

### Grade Rules

#### Grade Appeals

In the event of a dispute involving any college policies or grades, the student should appeal to their instructor, and appropriate department chair or school director (in that order). If a satisfactory solution is

not achieved, the student may appeal their case through the College Academic Appeals Subcommittee.

## Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted at the University of Nebraska-Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at Nebraska in the College of Engineering. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska-Lincoln. This decision should be made in consultation with the student's College of Engineering academic advising team (e.g., ESS professional advisor and the chief faculty advisor for the student's declared degree program). The chief faculty advisor has the final authority for this decision. Eligibility is based on a) enrollment in a community college during the catalog year the student wishes to utilize, b) maintaining continuous enrollment of at least 12 credit hours per semester at the previous institution for at least 2 semesters, and c) continuous enrollment at the University of Nebraska-Lincoln within 1 calendar year from the student's last term at the previous institution. Students must complete all degree requirements from a single catalog year and within the timeframe allowable for that catalog year.

## ACE REQUIREMENTS

All students must fulfill the Achievement-Centered Education (ACE) requirements. Information about the ACE program may be viewed at [ace.unl.edu](https://ace.unl.edu) (<https://ace.unl.edu/>).

The minimum requirements of the environmental engineering program include courses involving ACE outcomes 3, 4, and 10. Students should work with their advisor to select courses that satisfy ACE outcomes 1, 2, 5, 6, 7, 8 and 9.

## Learning Outcomes

Graduates of the environmental engineering program will have:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to communicate effectively with a range of audiences.
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The above student outcomes have been approved by the ABET Engineering Area Delegation for use beginning with the 2019-20 academic year, and have been adopted by the faculty of the Department of Civil and Environmental Engineering.

## Major Requirements

### Requirements for the Degree

#### Environmental Engineering Core

ENVE 101	Introduction to Environmental Engineering (This fulfills the ENGR 10 requirement)	3
ENVE 210	Fundamentals of Environmental Engineering	3
or CHME 202	Mass and Energy Balances	
ENVE 322	Biological Principles of Environmental Engineering	2
ENVE 401	Environmental Engineering Design I	3
ENVE 402	Environmental Engineering Design II	3
ENVE 410	Environmental Fate and Transport	3
ENVE 430	Sustainable Design in Environmental Engineering	3
Credit Hours Subtotal:		20

#### Civil and Environmental Engineering

CIVE 310	Fluid Mechanics	3
or MECH 310	Fluid Mechanics	
CIVE 321	Principles of Environmental Engineering	3
CIVE 321L	Environmental Engineering Laboratory	1
CIVE 351	Introduction to Water Resources Engineering	3
or BSEN 350	Natural Resources Engineering	
CIVE 419	Flow Systems Design	3
or CIVE 452	Water Resources Development	
CIVE 420	Environmental Engineering Process Design	3
CIVE 424	Solid and Hazardous Waste Management	3
or CHME 489	Air Pollution, Assessment and Control	
Credit Hours Subtotal:		19

#### General Engineering

BSEN 244	Thermodynamics of Living Systems	3
or MECH 200	Engineering Thermodynamics	
or CHME 223	Chemical Engineering Thermodynamics I	
CSCE 101	Fundamentals of Computer Science	3
ENGR 20	Sophomore Engineering Seminar <sup>1</sup>	0
MECH 223	Engineering Statics	3
MECH 325	Mechanics of Elastic Bodies	3
or MECH 373	Engineering Dynamics	
Credit Hours Subtotal:		12

#### Environmental Engineering Electives

Select six credits from the following that have not been used to fulfill another requirement: 6

CIVE 331	Introduction to Geotechnical Engineering
CIVE 371	Materials of Construction
CIVE 419	Flow Systems Design
CIVE 422	Pollution Prevention: Principles and Practices
CIVE 424	Solid and Hazardous Waste Management
CIVE 425	Design of Water Treatment Facilities
CIVE 426	Design of Wastewater Treatment and Disposal Facilities
CIVE 430	Fundamentals of Water Quality Modeling
CIVE 452	Water Resources Development
CIVE 455	Nonpoint Source Pollution Control Engineering
CIVE 456	Surface Water Hydrology
CIVE 458	Groundwater Engineering
CIVE 475	Water Quality Strategy
CIVE 481	Computational Problem Solving In Civil Engineering
CHME 489	Air Pollution, Assessment and Control

Credit Hours Subtotal: 6

#### Technical Electives

Choose a total of six credits from: 6

Any 200-, 300- or 400-level course in any engineering major (AGEN, AREN, BSEN, CHME, CNST, CONE, CSCE, ECEN, ENVE, MECH, SOFT) not used to fulfill another requirement

Any 200-, 300- or 400-level course in Biology (BIOS), Chemistry (CHEM), Community and Regional Planning (CRPL), Environmental Studies (ENVR), Geology (GEOL), Mathematics (MATH), Meteorology-Climatology (METR), Natural Resources (NRES), Statistics (STAT) (except STAT 212, STAT 218, STAT 251), Physics (PHYS) or Astronomy (ASTR) not used to fulfill another requirement

Any course in the following list: ACCT 200, AECN 109, AGRI 115, ANTH 232, ANTH 242, ARCH 107, ASTR 117, BIOS 101, BIOS 101L, BIOS 110, BIOS 110L, BIOS 115, BIOS 189H, BLAW 300, CHEM 131, CHEM 131H, CIVE 102, ENTO 115, ENVR 109, FDST 131, FDST 131H, FDST 301, FINA 300, GEOG 109, GEOG 155, GEOL 101, GEOL 103, GEOL 105, GEOL 106, GEOL 109, GEOL 110, GEOL 120, GEOL 125, LIFE 120, LIFE 120L, LIFE 121, LIFE 121L, METR 100, METR 180, MNGT 300, MRKT 300, NRES 108, NRES 109, NUTR 131, NUTR 131H, PLAS 100, PLAS 131, POLS 250, PSYC 273, SCIL 109, TMFD 206

Credit Hours Subtotal: 6

#### Science

CHEM 113A	Fundamental Chemistry I	4
& CHEM 113L	and Fundamental Chemistry I Laboratory	
or CHEM 109A	General Chemistry I	
	and General Chemistry I Laboratory	
& CHEM 109L		
CHEM 114	Fundamental Chemistry II	3
or CHEM 110A	General Chemistry II	
	and General Chemistry II Laboratory	
& CHEM 110L		
CHEM 251	Organic Chemistry I	4
& CHEM 253	and Organic Chemistry I Laboratory	

or CHEM 261 & CHEM 263A	Mechanistic Organic Chemistry I and Mechanistic Organic Chemistry I Laboratory	
GEOL 106 or GEOL 101	Environmental Geology Dynamic Earth	3
LIFE 120 & 120L or BIOS 101 & 101L	Fundamentals of Biology I and Fundamentals of Biology I laboratory General Biology and General Biology Laboratory	4
PHYS 211	General Physics I	4
Credit Hours Subtotal:		22
<b>Mathematics</b>		
MATH 106	Calculus I	5
MATH 107	Calculus II	4
MATH 208	Calculus III	4
MATH 221	Differential Equations	3
STAT 380 or MECH 321	Statistics and Applications Engineering Statistics and Data Analysis	3
Credit Hours Subtotal:		19
<b>ACE Requirements</b>		
ACE 1: Writing		3
Choose from the list of approved ACE 1 courses		
ACE 2: Communication Skills		3
Choose from the list of approved ACE 2 courses		
ACE 3: Math/Stat/Reasoning		
This requirement is satisfied by CSCE 101, MATH 106, MATH 107, MATH 208, or STAT 380		
ACE 4: Science		
This requirement is satisfied by CHEM 113A, CHEM 109A, CHEM 110A, LIFE 120, BIOS 101, GEOL 101, or PHYS 211		
ACE 5: Humanities		3
Choose from the list of approved ACE 5 courses		
ACE 6: Social Sciences		3
Choose from the list of approved ACE 6 courses		
ACE 7: Arts		3
Choose from the list of approved ACE 7 courses		
ACE 8: Ethics		3
Choose from the list of approved ACE 8 courses		
ACE 9: Global Awareness and Human Diversity		3
Choose from the list of approved ACE 9 courses		
ACE 10: Capstone Experience		
This requirement is satisfied by ENVE 402		
Credit Hours Subtotal:		21
<b>Total Credit Hours</b>		<b>125</b>

<sup>1</sup> ENGR 493 may apply for ENGR 20 (students must be in the Kiewit Scholars Program to take the course).

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The minimum requirements of the civil engineering program include courses fulfilling ACE outcomes 3, 4, and 10. Students should work with

their advisor to select courses that satisfy ACE outcomes 1, 2, 5, 6, 7, 8 and 9.

## Requirements for Minor Offered by Department

This minor is for engineering majors ONLY.

### Required Courses

CIVE 321 / BSEN 321	Principles of Environmental Engineering	3
CIVE 351 or BSEN 350 / AGEN 350	Introduction to Water Resources Engineering Natural Resources Engineering	3
CIVE 420	Environmental Engineering Process Design	3

### Electives I

Select one or two of the following: 3-6

CIVE 419	Flow Systems Design
CIVE 424	Solid and Hazardous Waste Management
CHME 489	Air Pollution, Assessment and Control

### Electives II

Select one or two of the following: 3-6

ENVE 210	Fundamentals of Environmental Engineering
ENVE 322	Biological Principles of Environmental Engineering
ENVE 410	Environmental Fate and Transport
ENVE 430	Sustainable Design in Environmental Engineering
CIVE 321L	Environmental Engineering Laboratory
CIVE 422 / BSEN 422	Pollution Prevention: Principles and Practices
CIVE 425	Design of Water Treatment Facilities
CIVE 426	Design of Wastewater Treatment and Disposal Facilities
CIVE 430	Fundamentals of Water Quality Modeling
CIVE 452	Water Resources Development
CIVE 455 / BSEN 455	Nonpoint Source Pollution Control Engineering
CIVE 458 / BSEN 458	Groundwater Engineering
CIVE 475	Water Quality Strategy
CHME 323	Chemical Engineering Thermodynamics and Kinetics
BSEN 244	Thermodynamics of Living Systems
BSEN 441 / AGEN 441	Animal Waste Management
BSEN 468 / BIOS 458 / NRES 468	Wetlands

Credit Hours Subtotal: 18

**Total Credit Hours 18**

## Grade Rules

### C- and D Grades

All courses must be completed with a grade of D- or higher.

### Pass/No Pass Limits

No course taken Pass/No Pass will be counted toward the minor.

## Bachelor of Science in Environmental Engineering with the Master of Science in Environmental Engineering

In an accelerated program, a student may count up to 12 credit hours of approved graduate courses toward both the current undergraduate degree and the later graduate degree. Students must apply for graduate admission and be accepted prior to enrollment. For more information, visit <https://graduate.unl.edu/academics/programs/accelerated-masters/accelerated-masters-faq> (<https://graduate.unl.edu/academics/programs/accelerated-masters/accelerated-masters-faq/>).

The following courses are approved for this program:

CIVE 824	Solid and Hazardous Waste Management (replaces CIVE 424 or CHME 489) <sup>1</sup>	3
CHME 889	Air Pollution, Assessment and Control (replaces CIVE 424 or CHME 489) <sup>1</sup>	3
CIVE 819	Flow Systems Design (replaces CIVE 419 or CIVE 452) <sup>2</sup>	3
CIVE 852	Water Resources Development (replaces CIVE 419 or CIVE 452) <sup>2</sup>	3
CIVE 825	Design of Water Treatment Facilities (replaces CIVE 425)	3
ENVE 851	Soils, Water, and Environmental Chemistry (replaces CIVE 491)	4

<sup>1</sup> If both CIVE 824 and CHME 889 are taken, the second course completed can count toward the required 6 hours of "Environmental Engineering Elective" list or the 6 hours of "Additional Technical Electives."

<sup>2</sup> If both CIVE 819 and CIVE 852 are taken, the second course completed can count toward the required 6 hours of "Environmental Engineering Elective" list or the 6 hours of "Additional Technical Electives."

## Grading Requirements

Grading rules as defined by the undergraduate degree/major apply. Please consult your academic advisor and/or the department graduate chair for grading policy as it relates to credit applying toward a graduate degree.

### ENVE 101 Introduction to Environmental Engineering

**Description:** Introduction to engineering design process through hands-on projects supported by instruction of underlying engineering science and fundamentals, model development, and the required tools. Be exposed to environmental engineering to know what it means to be an environmental engineer and an introduction to environmental engineering profession with focus on ethics.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**Offered:** FALL

### ENVE 210 Fundamentals of Environmental Engineering

**Prerequisites:** CHEM 109A or CHEM 113A with a C or better, and MATH 106 with a C or better

**Description:** Introduction to material and energy balances on environmental systems involving physical, chemical, and biological processes. Primary focus on single phase systems.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**Offered:** FALL

**Prerequisite for:** ENVE 410

### ENVE 322 Biological Principles of Environmental Engineering

**Prerequisites:** CIVE/BSEN 321

**Notes:** There will be two lab sessions, one focusing on microbes in water and one focusing on microbes in soil/sludge.

**Description:** Introduction to the basics of microbes in the environment, including basic microbiological concepts, microbial environment, detection/enumeration/identification of microbes, microbial interactions with environment, microbial remediation of pollutants, waterborne pathogens, and wastewater treatment and disinfection.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Graded

**Prerequisite for:** ENVE 401

### ENVE 401 Environmental Engineering Design I

**Prerequisites:** CIVE 321, ENVE 322; CIVE 351 or BSEN 350

**Notes:** The first of two courses in the capstone sequence.

**Description:** Practical application of the engineering design process in a team project focused on an authentic and comprehensive environmental engineering design project.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL/SPR

**Prerequisite for:** ENVE 402

### ENVE 402 Environmental Engineering Design II

**Prerequisites:** ENVE 401

**Notes:** The second of two courses in the capstone sequence.

**Description:** Practical application of the engineering design process in a team project focused on an authentic and comprehensive environmental engineering design project.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** FALL/SPR

**ACE:** ACE 10 Integrated Product

**Experiential Learning:** Case/Project-Based Learning

**ENVE 410 Environmental Fate and Transport**

**Prerequisites:** CIVE 310 or CHME 332; ENVE 210 or CHME 202; and CIVE 321

**Description:** Covers fate and transport principles, such as interphase chemical equilibrium, the formulation and application of the advection-diffusion equation, and their specific environmental engineering applications.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**ENVE 430 Sustainable Design in Environmental Engineering**

**Prerequisites:** CIVE 321; Co-requisite STAT 380

**Description:** Introduction to sustainability concepts and sustainable engineering design processes for environmental engineers such as life cycle assessment, multi-criteria decision analysis, and analysis of renewable energy systems.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**Offered:** FALL