

# 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

Pre-professionally admitted College of Engineering students majoring in environmental engineering must have their academic records reviewed for professional admission to the Environmental Engineering Degree Program during the fall, spring, or summer immediately following the term in which:

- At least 12 credits (one semester) have been completed after admission to the College of Engineering.
- At least 43 credits applicable to the degree have been earned.
- PHYS 211 General Physics I, MECH 223 Engineering Statics, and MECH 325 Mechanics of Elastic Bodies or MECH 373 Engineering Dynamics have been completed.

Additionally, the student can have no more than two declined professional admission requests to other engineering majors. It is likely a student may need to complete four full semesters of credits applying to the Program before these requirements are able to be completed.

Professional admission approval to the Environmental Engineering Degree Program also requires that all of the following Departmental-specific criteria must be met:

- Earn a C letter grade or better in PHYS 211, MECH 223, and MECH 325 or MECH 373.
- Earn a cumulative grade point average of 2.4 or greater.
- Earn a C letter grade or better in ALL math, science, and engineering courses required for the bachelor of science in environmental engineering degree if the cumulative grade point average is less than 2.700.

Students approved for professional admission to the Program are then allowed to take 400-level environmental engineering courses to complete their degree.

## 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.
7. 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. Although the University of Nebraska-Lincoln accepts 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:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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.
3. An ability to communicate effectively with a range of audiences.
4. 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.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- 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          | 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 |
| or CSCE 155T | Computer Science I: Informatics Focus |   |
| ENGR 10      | Freshman Engineering Seminar          | 0 |
| ENGR 20      | Sophomore Engineering Seminar         | 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 427 | Design of Wastewater Treatment and Disposal Facilities |
| CIVE 430 | Fundamentals of Water Quality Modeling                 |
| CIVE 452 | Water Resources Development                            |
| CIVE 454 | Hydraulic Engineering                                  |
| 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 not used to fulfill another requirement

Any 200-, 300- or 400-level course in Biology, Chemistry, Community and Regional Planning, Environmental Studies, Geology, Mathematics, Meteorology-Climatology, Natural Resources, Statistics (except STAT 212, STAT 218, STAT 251), Physics or Astronomy 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 110, 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, GEOL 197, LIFE 120, LIFE 121, 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, TMSD 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<br>& CHEM 110L   | General Chemistry II<br>and General Chemistry II Laboratory                       |            |
| CHEM 251<br>& CHEM 253  | Organic Chemistry I<br>and Organic Chemistry I Laboratory                         | 4          |
| or CHEM 261<br>& CHEM 263A  | Mechanistic Organic Chemistry I<br>and Mechanistic Organic Chemistry I Laboratory |            |
| GEOL 106<br>or GEOL 101   | Environmental Geology<br>Dynamic Earth  | 3          |
| LIFE 120<br>& LIFE 120L   | Fundamentals of Biology I<br>and Fundamentals of Biology I laboratory             | 4          |
| or BIOS 101<br>& 101L   | General Biology<br>and General Biology Laboratory                                 |            |
| 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  | Statistics and Applications   | 3          |
| or MECH 321   | Engineering Statistics and Data Analysis  |            |
| 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> |

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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 /<br>BSEN 321               | Principles of Environmental Engineering                | 3   |
| CIVE 351                             | Introduction to Water Resources Engineering            | 3   |
| or BSEN 350 /<br>AGEN 350            | Natural Resources Engineering                          |     |
| CIVE 420                             | Environmental Engineering Process Design               | 3   |
| <i>Electives I</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                  |     |
| <i>Electives II</i>                  |  |     |
| 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 /<br>BSEN 422               | Pollution Prevention: Principles and Practices         |     |
| CIVE 425                             | Design of Water Treatment Facilities                   |     |
| CIVE 427                             | Design of Wastewater Treatment and Disposal Facilities |     |
| CIVE 430                             | Fundamentals of Water Quality Modeling                 |     |
| CIVE 452                             | Water Resources Development                            |     |
| CIVE 454                             | Hydraulic Engineering                                  |     |
| CIVE 455 /<br>BSEN 455               | Nonpoint Source Pollution Control Engineering          |     |
| CIVE 458 /<br>BSEN 458               | Groundwater Engineering                                |     |
| CIVE 475                             | Water Quality Strategy                                 |     |
| CHME 323                             | Chemical Engineering Thermodynamics and Kinetics       |     |
| BSEN 244                             | Thermodynamics of Living Systems                       |     |
| BSEN 441 /<br>AGEN 441               | Animal Waste Management                                |     |
| BSEN 468 /<br>BIOS 458 /<br>NRES 468 | Wetlands   |     |

|                           |           |
|---------------------------|-----------|
| Credit Hours Subtotal:    | 18        |
| <b>Total Credit Hours</b> | <b>18</b> |

## 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 |
| CIVE 827 | Design of Wastewater Treatment and Disposal Facilities (replaces CIVE 427)         | 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