CIVIL AND ENVIRONMENTAL ENGINEERING (CEE)

Degrees Offered: Ph.D., M.Eng., M.S.

This program is offered in Durham.

The Department of Civil and Environmental Engineering offers the master of engineering degree in civil engineering, the master of science degree in civil engineering, and a Ph.D. degree in civil engineering with the following areas of specialization: structural, materials, geotechnical, water resources, and environmental engineering. Interested applicants are encouraged to visit the department website for information on current research in the department and to contact faculty members in their area of interest directly. The department website has information on program requirements and frequently asked questions. Applicants with questions not answered by the department or graduate school website should write to the graduate program coordinator for specific information.

Admission Requirements

An applicant must have completed a baccalaureate science degree in engineering, mathematics, or science at an accredited college or university. If coursework or laboratory experience is deficient, an admitted student will be required to fulfill, without graduate credit, all undergraduate prerequisites for graduate courses. In some cases, the student's advisor may require additional undergraduate courses in order to achieve a well-integrated program of study.

For more information on the Civil and Environmental Engineering Graduate Program, please email CEE.Graduate@unh.edu.

https://ceps.unh.edu/cee/graduate-programs

Programs

- Civil and Environmental Engineering (Ph.D.)
- Civil and Environmental Engineering (M.Eng.)
- Civil and Environmental Engineering (M.S.)

Courses

Civil and Environmental Engineering (CEE)

CEE 804 - Transportation Engineering Highway Geometric Design
Credits: 3
This course covers the principles and practices of geometric design for rural and urban highways. Key topics include design controls, criteria, and elements such as sight distance, horizontal and vertical alignments, cross-sections, and intersection design. Students will explore the impact of traffic volumes, speed-flow-density relationships, and safety considerations on highway design. The course also addresses grade separation and interchange design, equipping students with the skills to develop efficient and safe roadway systems.
Equivalent(s): CIE 854
Grade Mode: Letter Grading

CEE 805 - Introduction to Sustainable Engineering
Credits: 3
Course begins with exploration of the precept that we live in, and must design engineering works for, a world with a finite supply of natural resources and with limited life support capacity. Tools for sustainability engineering are the major focus of the course, which include life cycle, analysis and life cycle impact analysis, the metrics and mass and energy flow analyses used in the field of industrial ecology, and environmental management systems.
Equivalent(s): CIE 851
Grade Mode: Letter Grading

CEE 806 - Environmental Life Cycle Assessment
Credits: 3
This course teaches knowledge and hands-on skills in conducting environmental life cycle assessment (LCA), which is a widely used technique by industries, academics, and governments. Students will learn to use popular LCA software (e.g., SimaPro), apply proper LCA techniques, critically analyze LCA results, and provide client-oriented suggestions during this course. Class time is primarily devoted to a combination of lectures and computer labs.
Grade Mode: Letter Grading

CEE 820 - Waste Management and Site Remediation
Credits: 3
The course has two main areas of focus: (1) solid and hazardous waste management, including the key regulations and engineering approaches, such as landfills, waste-to-energy combustion, composting, and material recovery facilities; and (2) contaminated site remediation, including the key regulations, site characterization, risk-based decision making, transport and fate of contaminants, and an introduction to remediation technologies.
Equivalent(s): CIE 842
Grade Mode: Letter Grading

CEE 821 - Environmental Sampling and Analysis
Credits: 4
Theory of analytical and sampling techniques used in environmental engineering. Topics include potentiometry, spectroscopy, chromatography, automated analysis, quality control, sampling design, and collection methods. Methods discussed in lecture are demonstrated in labs.
Grade Mode: Letter Grading

CEE 822 - Introduction to Marine Pollution and Control
Credits: 4
Introduction to the sources, effects, and control of pollutants in the marine environment. Dynamic and kinetic modeling; ocean disposal of on-shore wastes, shipboard wastes, solid wastes, dredge spoils, and radioactive wastes; and oil spills. Prior coursework in fundamental aspects of environmental engineering required.
Equivalent(s): CIE 847
Grade Mode: Letter Grading

CEE 823 - Environmental Engineering Chemistry
Credits: 4
Chemical equilibrium principles of thermodynamics, acids/bases, precipitation/dissolution, oxidation/reduction, and complexation applied to surface water, groundwater, water and wastewater treatment. Applications to legacy and emerging organic and inorganic contaminants.
Equivalent(s): CIE 849
Grade Mode: Letter Grading

CEE 824 - Environmental Engineering Microbiology
Credits: 4
Concepts of environmental engineering microbiology including microbial metabolism, growth kinetics, bioremediation applications, mass transfer kinetics and effects of environmental parameters. Coursework includes reading and discussion of the microbial literature. Laboratories cover microbiological monitoring and biological treatment experiments. Lab. Prior coursework in fundamental aspects of environmental engineering required.
Equivalent(s): CIE 856
Grade Mode: Letter Grading

CEE 829 - Sources, Control, and Stewardship of Air Pollution
Credits: 4
Sources and fate of air pollutants from natural and engineered systems. Fundamentals of pollutant chemistry, atmospheric dispersion, and engineering controls. Includes regulatory policy, environmental, and social justice issues. Prior coursework in solid and hazardous waste engineering or permission required.
Grade Mode: Letter Grading

CEE 830 - Public Health Engineering for Rural and Developing Communities
Credits: 3
The design principles are to impart to the student specific information that can be used to design public health control facilities such as small water treatment systems and on-site wastewater disposal systems. The engineering control methods taught are particularly applicable to rural areas and developing countries.
Equivalent(s): CIE 840
Grade Mode: Letter Grading

CEE 831 - Advanced Water Treatment Design
Credits: 4
The advanced design of physical, chemical, and biological treatment processes for water and wastewater systems. Emphasis on both conventional and innovative treatment processes, including technologies for emerging issues and contaminants.
Grade Mode: Letter Grading

CEE 832 - Solid Waste Facility and Remediation System Design
Credits: 4
Focuses on the design of solid waste facilities, including landfills, waste-to-energy facilities and materials recovery facilities, and the design of remediation systems including soil vapor extraction and thermal treatment. Landfill design will include the basic design principles of the liner, leachate collection system, and landfill gas management. Remediation system design will focus on cleanup technologies implemented at contaminated sites.
Equivalent(s): CIE 848
Grade Mode: Letter Grading

CEE 833 - Public Infrastructure Asset Management
Credits: 4
The course provides a thorough examination of the growing engineering field of Public Infrastructure Assess Management (IAM). The course enables the student to design an IAM system. It touches upon all types of public infrastructure with a particular focus on water infrastructure for the semester design project. Students build upon their engineering economics and project engineering skills and use simple IAM software along with GIS applications. Practice leaders from the industry provide guest lectures throughout the semester. A focus on triple bottom line or the Societal, Environmental and Economic aspects of IAM are included. The format is a modified team base design learning experience providing practice in processing of technical lecture material, personal performance evaluation (frequent quizzes) and team based performance evaluation. Student groups will present their design to the class and provide a written engineering report. Prior coursework in fundamental aspects of environmental engineering required.
Equivalent(s): CIE 839
Grade Mode: Letter Grading

CEE 835 - Properties and Production of Concrete
Credits: 3
Basic properties of hydraulic cements and mineral aggregates and their interactions in the properties of plastic and hardened concrete; modifications through admixtures; production handling and placement problems; specifications; quality control and acceptance testing; lightweight, heavyweight, and other special concretes. Prior coursework in fundamental aspects of materials engineering required.
Equivalent(s): CIE 822
Grade Mode: Letter Grading

CEE 836 - Asphalt Mixtures and Construction
Credits: 3
Specification of asphalt cements, aggregates and proportioning of mixture constituents for paving applications. Asphalt mixture design methods, production, construction, and quality control are discussed. Current and new material production and construction technologies are introduced. Prior coursework in fundamental aspects of materials engineering required.
Equivalent(s): CIE 823
Grade Mode: Letter Grading

CEE 837 - Pavement Rehabilitation, Maintenance, and Management
Credits: 3
This course covers the technical and financial strategies to extend the life of highway and airfield pavements. The course topics will include: Assessment of pavement functional and structural condition, suitability of pavement maintenance and repair techniques, use of pavement preservation processes, and application of asset management to extend the life of pavement infrastructure.
Grade Mode: Letter Grading

CEE 849 - Pavement Design and Analysis
Credits: 4
Introduction to flexible and rigid pavement design and analysis for highways and airports. Examines design inputs, materials, analysis methods, design tools, and maintenance treatments. Students will conduct a pavement design project. This course satisfies a graduate elective requirement for students enrolled in M.S. or Ph.D. program in the CEE department with Materials focus area.
Equivalent(s): CIE 821
Grade Mode: Letter Grading

CEE 851 - Open Channel Flow
Credits: 3
Energy and momentum principles in open channel flow; flow resistance; channel controls and transitions; unsteady flow concepts and dam failure studies. Modeling with HEC programs. Prior coursework in fundamental aspects of environmental engineering required.
Equivalent(s): CIE 841
Grade Mode: Letter Grading

CEE 853 - Snow Hydrology
Credits: 3
Snow is a significant component of the hydrologic cycle in high latitude and high elevation environments. It is also a part of engineering design and practice that is frequently overlooked. In this course, we will examine spatial controls on snow accumulation and the dynamics of snowmelt processes through readings in snow hydrology, field assays of snow distribution, and analytical exercises. Of particular interest will be the role of snow in water resource engineering.
Grade Mode: Letter Grading

CEE 854 - Engineering Hydrology
Credits: 3
Hydrologic cycle, probability theory related to hydrology and the design of water resources structures, water flow, flood discharge prediction, hydrograph development, hydraulic and hydrologic river routing, reservoir routing, theory of storage, reservoir operations, hydropower development, modeling of watershed hydrology with program HEC-1, HEC-HMS, multipurpose projects.
Equivalent(s): CIE 845
Grade Mode: Letter Grading

CEE 855 - Design of Pressurized Water Transmission Systems
Credits: 4
Theory developed for individual components to large complex systems. Analysis and designs of components and systems. Topics include steady and unsteady closed conduit flow, valves and meters, pump requirements, pump selection, system planning and layout, water hammer, and system operation and maintenance. Pressure system modeling with program EPANET. Coursework in fluid mechanics required.
Equivalent(s): CIE 855
Grade Mode: Letter Grading

CEE 858 - Stormwater Management Designs
Credits: 3
Historic review of stormwater management leading up to the current regulatory framework. Overview of stormwater management strategies, strategy selection and the targeting of specific contaminants, contaminant removal efficiencies, construction and site selection, and system maintenance. Hydrologic concepts including watershed and storm characteristics, design hydrology (peak flows, storm and treatment volumes), hydrograph routing, and critical review of hydrology and drainage reports. Design and sizing of treatment systems including conventional BMPs, low impact development, and manufactured devices. Rainfall runoff calculations with US SCS TR55 model. Coursework in fluid mechanics required.
Equivalent(s): CIE 858
Grade Mode: Letter Grading

CEE 859 - Stream Restoration
Credits: 4
Explores the assessment, planning, design, engineering, and monitoring of stream and watershed practices intended to protect and restore the quality and quantity of flowing and surface waters and stream corridors. Lecture material covers hydrology, geomorphology, and ecosystems, with the intent of understanding the variables associated with stream systems and their interplay. Students measure field variables and then are challenged with actual designs. Examples of stream restoration issues include in-stream flow, dam removal, induced recharge, improvements to fish habitat, and channel stabilization. Coursework in fluid mechanics required.
Equivalent(s): CIE 859
Grade Mode: Letter Grading

CEE 865 - Engineering Behavior of Soils
Credits: 4
Review of stress and strain in soil. Introduction to continuum mechanics. Development of engineering soil properties. Application of soil mechanics to shear strength and stress-strain behavior of soils. Failure states and residual strength. Application of stress paths in engineering problems. Unsaturated soil mechanics. Laboratory exercises using the direct shear test, triaxial test, and soil-water retention measurements. Coursework in foundation design required.
Equivalent(s): CIE 867
Grade Mode: Letter Grading

CEE 866 - Introduction to Geotechnical Earthquake Engineering
Credits: 3
Overview of earthquake source mechanisms; magnitude and intensity; seismicity of the U.S.A. Dynamics of simple structures; response spectra. Selection of design parameters; source, magnitude, input records. Measurement of dynamic characteristics of soils; site response, liquefaction, and ground deformation.
Prerequisite(s): CEE 878 with a minimum grade of B-.
Equivalent(s): CIE 862
Grade Mode: Letter Grading

CEE 868 - Geo-Environmental Engineering
Credits: 3
Soil composition and structure; hydrogeology; attenuation and contaminant transport; containment design including landfills, geosynthetics for liners and covers, leachate collection systems, vertical cutoff walls, and stability analyses; geo-environmental site characterization and investigation using geotechnical and geophysical methods; ground water, soil and gas monitoring, and sampling; remediation including in-situ and ex-situ techniques and treatment methods. Prior coursework in fundamental aspects of geotechnical engineering required.
Equivalent(s): CIE 866
Grade Mode: Letter Grading

CEE 878 - Foundation Design I
Credits: 4
Foundation design based on subsurface investigation and characterization using current methods of laboratory and in situ testing. Use of consolidation theory and bearing capacity theory for the design of shallow foundations, including footings and rafts. Basic design of pile foundations. Earth pressure theory applied to design of retaining walls. Slope stability theory and applications. Prior coursework in fundamental aspects of geotechnical engineering required.
Equivalent(s): CIE 860
Grade Mode: Letter Grading

CEE 879 - Foundation Design II
Credits: 3
Advanced pile and pier design under vertical and lateral loads. Slope stability by circular and noncircular arc methods. Design of flexible bulkhead walls and mechanically stabilized walls. Excavation and dewatering. Soil and site improvement.
Prerequisite(s): CEE 878 with a minimum grade of B-.
Equivalent(s): CIE 861
Grade Mode: Letter Grading

CEE 880 - Matrix Structural Analysis and Modeling
Credits: 3
Modeling and analysis of determinate and indeterminate structures by matrix computer methods. Creation of matrix elements using compatibility, equilibrium, and consecutive relationships. Plane trusses, beams, frames, and space trusses. Prior coursework in fundamental aspects of structural engineering required.
Equivalent(s): CIE 883
Grade Mode: Letter Grading

CEE 881 - Dynamics of Structures
Credits: 3
Dynamics of single- and multi-story buildings. Response due to earthquakes, blasting, traffic, and mechanical equipment. Analysis in the time domain and through the Fourier Transform. Fundamentals of structural vibration measurement.
Prerequisite(s): CEE 880 with a minimum grade of B-.
Equivalent(s): CIE 887
Grade Mode: Letter Grading

CEE 889 - Timber Design
Credits: 3
Introduction to the design of timber structures. Structural properties of wood. Determination of horizontal and vertical loads. Horizontal and vertical load-resisting systems. Design of horizontal diaphragms, shear walls, beams, and columns. Bolted, screwed, and nailed connections. Prior coursework in fundamental aspects of structural engineering required.
Equivalent(s): CIE 882
Grade Mode: Letter Grading

CEE 890 - Structural Design in Masonry
Credits: 3
Introduces the design of reinforced masonry structural members by the stress and strength method and considering deflection and other serviceability performance criteria. Includes development of wind and seismic load, curtain wall, shear wall, lintels and columns. Prior coursework in fundamental aspects of materials and structural engineering required.
Equivalent(s): CIE 876
Grade Mode: Letter Grading

CEE 891 - Reinforced Concrete Design
Credits: 0 or 4
Introduction to the design of reinforced concrete structural members by the strength method and considering deflection performance. Includes loads, approximate analysis, slabs, beams, and columns. Prior coursework in fundamental aspects of materials and structural engineering required.
Equivalent(s): CIE 874
Grade Mode: Letter Grading

CEE 892 - Pre-stressed Concrete
Credits: 3
Analysis and design of pre-stressed and post-tensioned concrete sections in flexure and shear. Strength, deflection, and losses in flexural members. Optimization of section and pre-stressing force selection.
Prerequisite(s): CEE 891 with a minimum grade of B-.
Equivalent(s): CIE 891
Grade Mode: Letter Grading

CEE 893 - Structural Design in Steel
Credits: 4
Introduction to steel member design, including horizontal and vertical members for design and analysis of buildings. Examines design inputs, material choice, analysis methods and design and construction methodologies. Prior coursework in fundamental aspects of materials and structural engineering required.
Equivalent(s): CIE 893
Grade Mode: Letter Grading

CEE 894 - LRFD Bridge Design
Credits: 3
AASHTO LRFD Bridge Design Specifications using SI units. Design objectives, loads, load case analysis and selection, load distributions, static analysis, and design for axial loads, flexure, and shear. Design of slender columns, composite beams, and plate girders. Senior-level structural design course required prior to taking this course.
Equivalent(s): CIE 892
Grade Mode: Letter Grading

CEE 895 - Independent Study
Credits: 1-4
A limited number of qualified graduate students will be permitted to pursue independent studies under faculty guidance. May be repeated.
Equivalent(s): CIE 895
Grade Mode: Letter Grading

CEE 896 - Special Topics
Credits: 1-4
Advanced or specialized topics not normally covered in regular course offerings. May be repeated, but not in duplicate areas.
Equivalent(s): CIE 896
Grade Mode: Letter Grading
Special Fee: Yes

CEE 897 - Masters Student Seminar
Credits: 1
Topics of interest to graduate students and staff; reports of research ideas, progress, and results; lectures by outside speakers. Requires one presentation from students on their research, self-assessment, and a minimum attendance level. Continuing course: instructor may assign IA grade (continuous grading) at the end of one semester. Course held simultaneously with 897/997.
Equivalent(s): CIE 900
Grade Mode: Graduate Credit/Fail grading

CEE 898 - Master's Project Paper
Credits: 3
Concluding project paper required of Master's level students who utilize the non-thesis option.
Equivalent(s): CIE 888
Grade Mode: Letter Grading

CEE 899 - Master's Thesis
Credits: 1-6
Master's Thesis.
Repeat Rule: May be repeated for a maximum of 6 credits.
Equivalent(s): CIE 899
Grade Mode: Graduate Credit/Fail grading

CEE 902 - Machine Learning for Engineering Applications
Credits: 3
This project-based course offers students the critical machine learning modeling skillsets for application to graduate level research in engineering disciplines. The course covers a wide ranges of ML topics ranging from basic regression and tree-based models to advanced methods such as computer vision, deep learning, graph models and reinforcement learning. A key aspect of the course is its research-focused approach. Students will apply machine learning techniques to their own graduate-level research projects and datasets, allowing them to advance their research projects while gaining experience with state-of-the-art ML modeling techniques. Example projects include: Image-based structural anomaly detection; Water quality prediction; Computer vision with remote sensing data; Causal inference of contamination; Graph model of transportation connectivity; Optimization of management decision making. By the end of the course, students are expected to have gained the skills needed to apply cutting-edge machine learning techniques in their research.
Grade Mode: Letter Grading

CEE 907 - Systems Thinking and Modeling
Credits: 3
This course teaches knowledge and hands-on skills in system dynamics modeling, which is one of the most commonly used tools in analyzing the mechanisms, tradeoffs, and feedbacks in environmental, social, and economic procedures and systems Students will also be trained with the ability of systems thinking during this course Class time is primarily devoted to a combination of lectures and computer labs.
Grade Mode: Letter Grading

CEE 936 - Advanced Asphalt Materials
Credits: 3
Examination of chemical composition of asphalt cements, current technologies for modification, and inclusion of recycled materials to meet desired physical properties. Advanced characterization of asphalt materials, modelling, advanced mixture design tools.
Prerequisite(s): CEE 836 with a minimum grade of B-.
Equivalent(s): CEE 923
Grade Mode: Letter Grading

CEE 949 - Advanced Pavement Design and Analysis
Credits: 3
Advanced flexible pavement design and analysis including rehabilitation/overlay design. Includes development of mechanistic-empirical methods, advanced pavement structural analysis, and advanced material characterization.
Prerequisite(s): CEE 849 with a minimum grade of B-.
Equivalent(s): CEE 921
Grade Mode: Letter Grading

CEE 951 - Statistical Hydrology
Credits: 3
Course examines statistical methods used to address water resources planning and management problems involving uncertainty objectives and hydrologic inputs. Application of statistics and probability to uncertainty in the description, measurement, and analysis of hydrologic variables and processes, including extreme events, error models, simulation, and sampling. A hydrology course and basic statistics required prior to taking this course.
Equivalent(s): CIE 951
Grade Mode: Letter Grading

CEE 959 - Advanced Stream Restoration Topics
Credits: 3
Course focuses on: stream crossing analysis and design, dam removal, and designs for aquatic species passage. Prior coursework in fundamental aspects of stream restoration required.
Equivalent(s): CIE 959
Grade Mode: Letter Grading

CEE 966 - Geotechnical Modeling
Credits: 4
Introduction to geotechnical modeling, soil constitutive modeling, introduction to numerical modeling and applications, physical modeling, centrifuge modeling, and theoretical modeling. Prior coursework in fundamental aspects of geotechnical engineering required.
Equivalent(s): CIE 962
Grade Mode: Letter Grading

CEE 967 - In Situ Geotechnical Testing
Credits: 3
In situ geotechnical testing methods for site characterization; theory and practice. Geotechnical testing methods include the piezocone, the pressuremeter, the flat plate dilatometer, the field vane, and the standard penetration test. Includes sampling techniques, geophysical exploration, and recent innovations in site and soil characterization.
Prerequisite(s): CEE 965 with a minimum grade of B-.
Equivalent(s): CIE 961
Grade Mode: Letter Grading

CEE 968 - Soil-Structure-Interaction
Credits: 3
Introduction to soil-structure-interaction, elastic and plastic analyses, serviceability calculations, relative foundation stiffness, Pile-soil-interaction, flexible retaining walls, tunnel lining, bridge abutments, dynamic soil-structure-interaction, case studies, and modeling techniques. Prior coursework in fundamental aspects of geotechnical engineering required.
Equivalent(s): CIE 963
Grade Mode: Letter Grading

CEE 995 - Problems
Credits: 2-4
The study and investigation of problems selected to meet the needs of the students.
Equivalent(s): CIE 995
Grade Mode: Letter Grading

CEE 997 - Doctoral Student Seminar
Credits: 1
Topics of interest to graduate students and staff; reports of research ideas, progress, and results; lectures by outside speakers. Requires one presentation from students on their research, self-assessment, and a minimum attendance level. Continuing course: instructor may assign IA grade (continuous grading) at the end of one semester. Course help simultaneously with 897/997.
Equivalent(s): CIE 901
Grade Mode: Graduate Credit/Fail grading

CEE 999 - Doctoral Research
Credits: 0
Doctoral Research.
Equivalent(s): CIE 999
Grade Mode: Graduate Credit/Fail grading

Faculty

Civil and Environmental Engineering Department Faculty