

# CIVIL AND ENVIRONMENTAL ENGR (CEE)

## CEE 1070. Engineering Graphics for Civil and Environmental Engineering. 1 Credit Hour.

Introduction to engineering graphics for CEE covering sketching, computer-aided design, and essential concepts for the interpretation of design drawings.

## CEE 1090. Exploring Civil and Environmental Engineering. 2 Credit Hours.

A course for introducing new CEE students to the fields of civil and environmental engineering framed within cross-cutting topic areas.

## CEE 1770. Introduction to Engineering Graphics and Visualization. 3 Credit Hours.

Engineering graphics and visualization including sketching, line drawing, and solid modeling. Development and interpretation of drawings and specification for product realization. Crosslisted with AE and ME 1770.

## CEE 1XXX. Civil and Environmental Engineering Elective. 1-21 Credit Hours.

### CEE 2040. Dynamics. 2 Credit Hours.

Kinematics and kinetics of particles and rigid bodies in one and two dimensions; principles of work/energy and impulse/momentum.

### CEE 2090. Civil and Environmental Engineering Systems. 3 Credit Hours.

Infrastructure viewed from a systems perspective; planning, analytical and evaluation approaches for civil- and environmental-engineered facilities; sustainability - engineering economy; environmental and social quality of life considerations.

### CEE 2300. Environmental Engineering Principles. 3 Credit Hours.

Introduction to chemical, biological, and physical processes in the environment. Discussion of the basic processes governing air, water, and land quality, and the behavior and impacts of contaminants associated with human and industrial activities.

### CEE 2698. Undergraduate Research Assistantship. 1-12 Credit Hours.

Independent research conducted under the guidance of a faculty member.

### CEE 2699. Undergraduate Research. 1-12 Credit Hours.

Independent research conducted under the guidance of a faculty member.

### CEE 2803. Special Topics. 3 Credit Hours.

### CEE 2812. Special Topics. 2 Credit Hours.

Special Topics in CEE.

### CEE 2901. Special Problems. 1-21 Credit Hours.

### CEE 2XXX. Civil and Environmental Engineering Elective. 1-21 Credit Hours.

### CEE 3000. Civil Engineering Systems. 3 Credit Hours.

Infrastructure viewed from a systems perspective; analytical approaches and modeling of civil-engineered facilities; sustainability; engineering economy applications.

### CEE 3010. Geomatics. 3 Credit Hours.

Spatial data collection methods including surveying, photogrammetry, remote sensing, and global positioning systems; management, manipulation, and analysis of spatial and associated attribute data.

### CEE 3020. Civil Engineering Materials. 3 Credit Hours.

Physical, mechanical, and durability properties of concrete, metals, unreinforced and reinforced plastics, timber, asphalt, and asphalt concrete.

### CEE 3040. Fluid Mechanics. 3 Credit Hours.

Elementary mechanics of fluids with emphasis on hydrostatics, control volume analysis of flowing fluids using kinematics, continuity, energy, and momentum principles; similitude, pipe flow.

### CEE 3051. Introduction to Structural Engineering. 3 Credit Hours.

Concepts in structural engineering related to the analysis and design of various types of structures such that they behave as intended throughout their lifetime.

### CEE 3052. Introduction to Structural Engineering for the Global Engineering Leadership Minor. 3 Credit Hours.

Concepts in structural engineering related to the analysis and design of various types of structures such that they behave as intended throughout their lifetime.

### CEE 3055. Structural Analysis. 3 Credit Hours.

Determination of internal forces and deflection in statically determinate trusses, beams, and frames. Introduction to analysis of statically indeterminate structures.

### CEE 3090. Data Analytics in Civil and Environmental Engineering. 3 Credit Hours.

Data analytics applications for CEE, accessing and assessing datasets, tools focused on machine learning, advantages and limitations of data driven approaches, communication data-driven assessments.

### CEE 3340. Environmental Engineering Laboratory. 3 Credit Hours.

Theory and application of environmental laboratory methods for measurement of fundamental properties and characteristics of dissolved and particulate constituents in water, air and soil systems.

### CEE 3400. Introduction to Geotechnical Engineering. 3 Credit Hours.

Introduction to soil as an engineering material, with a focus on the mechanics of soil strength and compressibility, and fluid flow through soils.

### CEE 3770. Statistics and Applications. 3 Credit Hours.

Introduction to probability, probability distributions, point estimation, confidence intervals, hypothesis testing, linear regression, and analysis of variance. Example applied to the field of civil and environmental engineering. Crosslisted with MATH 3770 and ISYE 3770. Also, credit not awarded for both CEE 3770 and MATH 3670.

### CEE 3XXX. Civil and Environmental Engineering Elective. 1-21 Credit Hours.

### CEE 4000. Global Engineering Leadership. 3 Credit Hours.

Addresses skills necessary for the global engineer-leader: creating an engineering firm and evaluating its global viability; written, oral, and cross-cultural communication; collaboration; ethics; strategic planning.

### CEE 4005. Innovation & Entrepreneurship in CEE Systems. 3 Credit Hours.

This course highlights opportunities for innovation and entrepreneurship in Civil and Environmental Engineering Systems, and the essential components of forming, pitching, and starting a business.

### CEE 4050. Infrastructure System Management. 3 Credit Hours.

Introduction to general concepts and advanced topics in infrastructure systems management applied to manage large-scale infrastructure assets.

**CEE 4090. Capstone Design. 3 Credit Hours.**

An interdisciplinary civil and environmental design experience. Problem definition, data acquisition, modeling and analysis, evaluation of design alternatives, oral and written presentation of final design.

**CEE 4100. Construction Engineering and Management. 3 Credit Hours.**

Fundamental concepts in planning, design, and construction of civil engineering projects. Introduction to project scheduling, cost estimating, controls, procurement, value engineering, quality assurance, and safety.

**CEE 4101. Construction Seminar. 1 Credit Hour.**

The seminar provides a platform for students to engage with construction industry companies and experts, to learn about different construction disciplines, their projects, and experiences.

**CEE 4110. Construction Planning, Estimating, and Scheduling. 3 Credit Hours.**

An integrated approach to planning, estimating, and scheduling of construction projects, including basic and advanced concepts, applications, and tools for developing plans, estimates, and schedules.

**CEE 4120. Construction Operations. 3 Credit Hours.**

An integrated approach to construction methods, including basic and advanced concepts, applications, and tools for planning, analysis, and assessment of construction methods and equipment.

**CEE 4130. Construction Safety and Health. 3 Credit Hours.**

Fundamentals to safety and health as they apply to civil infrastructure and building construction. Topics include planning, design, management, rules and guidelines, best practices, and inspection of safety and health.

**CEE 4140. Building Information Modeling (BIM) in Construction. 3 Credit Hours.**

Theory and Application of Building Information Modeling (BIM) in the Architecture/Engineering/Construction (A/E/C) industry with emphasis on Constructability, Scheduling, Front End Planning (FEP) and Construction monitoring.

**CEE 4150. Construction Management & Megaprojects. 3 Credit Hours.**

Covers planning and development of megaprojects. Addresses social, environmental, and economic impacts of megaprojects. Discusses cultural differences & ethical issues in managing megaprojects.

**CEE 4160. Smart and Sustainable Cities. 3 Credit Hours.**

This course examines city infrastructure systems' impact on urban sustainability. It further explores the role of "smart" technological solutions to address mounting urban sustainability challenges.

**CEE 4161. AI For Smart Cities. 3 Credit Hours.**

Study of a new system approach of problem-solving using AI for Smart Cities. including 3 key elements and 3 core methods.

**CEE 4170. Construction Law. 3 Credit Hours.**

Overview includes legal concepts, the mechanics of the judicial system, professional liability and other legal issues as they pertain to construction engineers.

**CEE 4180. Infrastructure Finance. 3 Credit Hours.**

Methods, models, and best practices including revenue, capital flow, funding and financing of infrastructure. Covers decision process, engineering economics, microeconomics, financial statement analysis, and risk.

**CEE 4200. Hydraulic Engineering. 3 Credit Hours.**

Applications of fluid mechanics to engineering and natural systems including fluid drag, open channel flow, turbomachinery, and environmental hydraulics; laboratory experiments; computational hydraulics.

**CEE 4210. Hydrology. 3 Credit Hours.**

Global circulation and the hydrologic cycle, precipitation mechanisms and analysis, evaporation and other losses, streamflow, hydrographs, river and reservoir routing, and frequency analysis.

**CEE 4211. Water Resources Systems. 3 Credit Hours.**

Components and services of water resources systems; and planning and management approaches in the face of climatic, environmental, and socio-economic change.

**CEE 4225. Introduction to Coastal Engineering. 3 Credit Hours.**

Introduction to coastal engineering processes and problems. Topics include: water wave mechanics, nearshore hydrodynamics, astronomical tides, sediment transport, beach nourishment, and coastal structures.

**CEE 4300. Environmental Engineering Systems. 3 Credit Hours.**

Environmental engineering issues associated with water, air, and land pollution, including risk assessment, groundwater contamination, global climate change, and sustainable technologies.

**CEE 4310. Water Quality Engineering. 3 Credit Hours.**

Reclamation of water and wastewater for potable and industrial uses, groundwater remediation. Principles of physical, chemical, and biological treatment processes.

**CEE 4320. Hazardous Substance Remediation. 3 Credit Hours.**

Technical aspects of hazardous waste management and treatment including legislation, exposure and risk assessment, contaminant fate and transport, waste treatment methods, and remediation technologies.

**CEE 4330. Air Pollution Engineering. 3 Credit Hours.**

Introduction to the physical and chemical processes affecting the dynamics and fate of air pollutants at the local, regional, and global scales. Particular emphasis is on tropospheric pollutant chemistry and transport.

**CEE 4340. Environmental Modeling and Health Risk Analysis. 3 Credit Hours.**

This course provides an introduction to modeling techniques used in the environmental health field, with emphasis on three different exposure pathways introduced as the air pathway, groundwater pathway, and surface water pathway.

**CEE 4350. Environmental Technology in the Developing World. 3 Credit Hours.**

Approaches, methods, and practical aspects of employing technologies for improving environmental quality in low and middle income countries. Team project-based course with field component.

**CEE 4360. Energy and Resource Recovery. 3 Credit Hours.**

This is an upper level course to introduce the technical aspects of achieving a more sustainable world by energy and resource recovery. Specifically, this course will cover both renewable energy and solid waste management.

**CEE 4370. Industrial Wastewater Process Engineering and Design. 3 Credit Hours.**

Upper level course addressing challenging, high strength industrial wastewater treatment plant design, including associated regulatory, treatability, process engineering, materials of construction, and industrial setting considerations.

**CEE 4395. Environmental Systems Design Project. 3 Credit Hours.**

Design and assessment of an environmental system, component or process, including problem definition, data acquisition, modeling and analysis, evaluation of alternatives, and presentations.

**CEE 4405. Introduction to Geotechnical Engineering. 3 Credit Hours.**

Introduction to soil as an engineering material, with a focus on the mechanics of soil strength and compressibility, and fluid flow through soils.

**CEE 4406. Applied Geotechnics. 3 Credit Hours.**

Geotechnical principles applied to civil engineering construction, including evaluation of soil and rock properties, shallow foundations, drive and bored pilings, liquefaction, and ground modification. Credit not allowed for both CEE 4406 and CEE 4410.

**CEE 4420. Subsurface Characterization. 3 Credit Hours.**

Introduction to field and laboratory methods for characterizing subsurface geological, hydrological, geotechnical, and contaminant conditions.

**CEE 4430. Environmental Geotechnics. 3 Credit Hours.**

Chemical equilibria and partitioning in subsurface systems; hazardous waste site assessment technologies and data; including soil gas data, monitoring wells, and direct-push technology.

**CEE 4450. Introduction to Petroleum Geomechanics. 3 Credit Hours.**

Introduction to the basic concepts of geomechanics and their engineering applications with a focus on the petroleum - and energy - related applications.

**CEE 4460. International Disaster Reconnaissance. 3 Credit Hours.**

Reviews consequence of and response to foreign disasters in light of technical, cultural and political factors; disasters include earthquakes, floods, hurricanes/typhoons, and man-made infrastructure failures.

**CEE 4510. Structural Steel Design. 3 Credit Hours.**

Principles of behavior of tension and compression members, beams, and connections with application to the design of elementary structures.

**CEE 4520. Reinforced Concrete Design. 3 Credit Hours.**

Principles of behavior of reinforced concrete beams, short columns, and slabs, with application to the design of elementary concrete structures, foundation, and earth- retaining structures.

**CEE 4530. Timber and Masonry Design. 3 Credit Hours.**

Stress-based design of tension, compression, and flexural members; design of building systems, unreinforced and reinforced walls using timber and masonry construction materials and techniques.

**CEE 4540. Infrastructure Rehabilitation. 3 Credit Hours.**

Rehabilitation of civil infrastructure systems including aspects of deterioration science, nondestructive assessment, renewal engineering, construction planning and management, and public policy and finance.

**CEE 4550. Structural Analysis II. 3 Credit Hours.**

Analysis of two- and three-dimensional statically indeterminate structures by classical and matrix methods of solution. Flexibility and stiffness techniques, influence lines, approximate analysis, and nonlinear analysis.

**CEE 4551. Historic Structures. 3 Credit Hours.**

Course examines some of the world's great structures from an engineering and structural art perspective while integrating architecture and history-based concepts.

**CEE 4552. Introduction to Finite Element Methods. 3 Credit Hours.**

Introduction to Finite Element Methods in Civil Engineering. Formulation of FE numerical methods for solving engineering problems applied to trusses, frames and 2D continuum problems.

**CEE 4560. Origami Engineering. 3 Credit Hours.**

This class acquaints the student with the state-of-art concepts and algorithms to design and analyze origami structures, assemblages, and tessellations.

**CEE 4600. Transportation Planning, Operations, and Design. 3 Credit Hours.**

Introduction to transportation engineering with specific emphasis on the planning, design, and operation of transportation facilities.

**CEE 4610. Multimodal Transportation Planning, Design, and Operations. 3 Credit Hours.**

Planning, design, and operation of systems of air, rail, water, and highway facilities, including those for bicycles and pedestrians.

**CEE 4620. Environmental Impact Assessment. 3 Credit Hours.**

Key policy, planning, and methodological issues in the environmental impact assessment of engineering systems including the regulatory framework and analytical techniques.

**CEE 4640. Freeway and Interchange Planning and Design. 3 Credit Hours.**

An introduction to the planning and design of freeways and interchanges. Topics include various interchange forms, HOV lanes, ramp metering, tolling, and truck by-pass ramps.

**CEE 4650. Site Development Planning and Design in Transportation. 3 Credit Hours.**

An introduction to the planning and design of site developments. Topics include site traffic analysis and driveway, parking lot, drive-thru facility, site circulation, delivery facility and residential neighborhood design.

**CEE 4660. Sustainable Transportation Abroad. 3 Credit Hours.**

Planning, design, and operations of transportation systems in countries with sustainable multimodal infrastructure; applying lessons learned to US; leadership development in context of sustainable technologies.

**CEE 4670. Introduction to Transportation and Public Health. 3 Credit Hours.**

Examines the linkage between transportation and human health in both a population and occupational sense. Explores how public and private decision making and the engineering design of transportation systems influences public health.

**CEE 4698. Undergraduate Research Assistantship. 1-12 Credit Hours.**

Independent research conducted under the guidance of a faculty member.

**CEE 4699. Undergraduate Research. 1-12 Credit Hours.**

Independent research conducted under the guidance of a faculty member.

**CEE 4791. Mechanical Behavior of Composites. 3 Credit Hours.**

Stress-strain behavior of composites, property of matrix and reinforcing materials, mechanics of fiber-reinforced composites, lamina and laminate analysis, and mechanical performance. Crosslisted with AE, CHE, ME, MSE, and PTFE 4791.

**CEE 4793. Composite Materials and Processes. 3 Credit Hours.**

Basic principles of selection and design of composite materials and their manufacturing and testing. Cost factors. Laboratory exercises on manufacturing and tests. Crosslisted with AE, CHE, ME, MSE, and PTFE 4793.

**CEE 4794. Composite Materials and Manufacturing. 4 Credit Hours.**

Basic principles of selection and design of composite materials and their manufacturing and testing. Cost factors. Laboratory exercises on manufacturing and tests. Crosslisted with AE, CHE, ME, MSE, and PTFE 4794.

**CEE 4795. Groundwater Hydrology. 3 Credit Hours.**

Dynamics of flow and solute transport in groundwater, including theory, implementation, and case studies. Crosslisted with EAS 4795.

**CEE 4801. Special Topics. 1 Credit Hour.**

**CEE 4802. Special Topics. 2 Credit Hours.**

**CEE 4803. Special Topics. 3 Credit Hours.**

**CEE 4804. Special Topics. 4 Credit Hours.**

**CEE 4805. Special Topics. 5 Credit Hours.**

**CEE 4806. Special Topics. 6 Credit Hours.**

**CEE 4900. Undergraduate Honors Research Project. 1-21 Credit Hours.**

Individual research projects conducted in conjunction with and under the direction of a CEE faculty member. Participation by invitation, and agreement with individual faculty members. Project culminates in a thesis and presentation.

**CEE 4901. Special Problems. 1-21 Credit Hours.**

**CEE 4902. Special Problems. 1-21 Credit Hours.**

**CEE 4903. Special Problems. 1-21 Credit Hours.**

**CEE 4XXX. Civil and Environmental Engineering Elective. 1-21 Credit Hours.**