Civil and Environmental Engineering

Web Site: http://www.odu.edu/cee

Ben J. Stuart, Chair

The Department of Civil and Environmental Engineering offers an undergraduate four-year program leading to the Bachelor of Science in Civil Engineering. The program is accredited by the Engineering Accreditation Commission (EAC) of ABET, http://www.abet.org. The department also offers a varied program of graduate study and research leading to the Master of Science, Master of Engineering, Doctor of Engineering, and Doctor of Philosophy degrees with majors in civil or environmental engineering. Areas of specialization include coastal, environmental, geotechnical, hydraulics and water resources, transportation, and structural engineering. For further information, please visit the web site: http://www.odu.edu/cee.

Bachelor of Science in Civil Engineering

The undergraduate degree in civil engineering prepares graduates for entry into professional practice and continued intellectual and professional development throughout their career. The program prepares its graduates to serve as master planners, designers, constructors, and operators/managers of the built environment as well as stewards of natural resources and the environment. Civil engineering graduates are also prepared to serve as both innovators and integrators in the application of existing and developing technologies in the creation and maintenance of society’s infrastructure. They also serve as evaluators and managers of risk and uncertainty and apply engineering knowledge and science to the protection of the built environment and public health.

The curriculum in civil engineering is designed to provide education in fundamental engineering sciences, certain nontechnical subjects, and all major areas of civil engineering, which will serve as a basis for entrance into civil engineering practice and/or graduate study. Technical elective courses are available that allow pursuit of several programs of study or specialization:

- geotechnical
- hydraulics and water resources
- environmental
- transportation
- structural

In addition, course work in General Education skills and ways of knowing is required to assure a well-rounded program of study.

Civil Engineering Program Objectives

The program educational objectives describe the expected accomplishments of graduates during the first few years after graduation. The educational objectives of the civil engineering program, established with participation of all constituencies, are consistent with the mission of Old Dominion University and the Department of Civil and Environmental Engineering. The objectives of the civil engineering program are to produce graduates who will:

- Successfully practice and/or pursue advanced studies in civil engineering or other fields.
- Effectively communicate the technical and social implications of civil engineering solutions.
- Appreciate and apply state-of-the-art practice in their chosen fields.
- Advance in the professional community through ethical practice, collaboration, and service.

Civil Engineering Program Outcomes

The program outcomes are statements that describe what students are expected to know and be able to do by the time of graduation. The program outcomes have been established based on the program educational objectives, in consultation with the advisory council as documented in the minutes of the Civil and Environmental Engineering Visiting Council (CEEVC) meetings.

Students who qualify for graduation will:

1. Be proficient in mathematics through differential equations, probability and statistics, calculus-based physics, general chemistry, and engineering science and have the ability to apply knowledge in these areas to civil engineering problems.
2. Have ability to design and conduct experiments and to critically analyze and interpret data in various civil engineering fields.
3. Be able to develop design criteria to meet desired needs and to design a civil engineering system, component, or a process satisfying these criteria.
4. Have ability to function on multi-disciplinary teams.
5. Be able to identify and formulate an engineering problem, to collect and analyze relevant data, and to develop a solution.
6. Understand and appreciate professional and ethical responsibilities and professional practice issues such as procurement of work, bidding versus quality-based selection processes, and interaction between design and construction professionals.
7. Be able to effectively present ideas and technical material to diverse audiences in writing, visually, and verbally.
8. Have the broad education necessary to understand the impact of engineering solutions in a societal and global context.
9. Understand and appreciate the importance of professional licensure and commitment to life-long learning.
10. Have knowledge of current issues and awareness of emerging technologies.
11. Have an ability to use modern engineering techniques, skills, and tools including computer-based tools for civil engineering analysis and design.

In addition, students will have had opportunities for work experience through internships, practicum, and cooperative education. They will also have had opportunities to participate in student organizations for exposure to community service and for developing leadership skills. The students will be able to apply knowledge in environmental, geotechnical, structural, transportation, and water resources engineering.

In addition to the curriculum detailed below, all students in the Civil Engineering program are required to take the Fundamentals of Engineering exam (http://ncees.org/exams/fe-exam/) prior to graduation. Any student passing the FE exam prior to graduation will receive a reimbursement for the exam fee paid by the CEEVC.

Civil Engineering Curriculum*

**Freshman**

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<th>Course Code</th>
<th>First Semester Hours</th>
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<td>MATH 211</td>
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<td>CHEM 123N</td>
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<td>PHYS 231N</td>
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<td>ENGN 110</td>
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<td>CEE 111</td>
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**Sophomore**

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<td>MAE 205</td>
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<tr>
<td><strong>Total</strong></td>
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*Civil and Environmental Engineering*
The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major.

**CIVIL AND ENVIRONMENTAL ENGINEERING Courses**

**CEE 111. Information Literacy and Research. 2 Credits.**
This course will introduce students to the needs, access, evaluation, use, impact and ethical/legal aspects of information, as well as to the application of information literacy and research in the fields of civil and environmental engineering. Prerequisite: ENGN 110.

**CEE 195. Topics in Civil and Environmental Engineering. 1-3 Credits.**
Special topics in civil and/or environmental engineering at the introductory level. Prerequisite: Permission of the department chair.

**CEE 204. Statics. 3 Credits.**
Introduction to engineering problems and their solutions through a study of the statics of particles and rigid bodies. Corequisite: PHYS 231N. Prerequisite: MATH 211 with a C or higher.

**CEE 219. Surveying for Engineers. 1 Credit.**
This course will provide an introduction to Land Surveying theory and practices as they relate to Civil Engineering. Upon successful completion of this course, prospective engineers will have a working knowledge of: survey computations; survey field methods; survey benchmarks and data; survey elements of land development; and survey legal issues.

**CEE 220. Mechanics of Deformable Bodies. 3 Credits.**
This course provides fundamental theories to understand the strength of materials focused on civil engineering applications. It will cover stress-strain relationship, equilibrium of deformable bodies and behavior of axially loaded members. It will also analyze for stresses, strains, and deformation of members subjected to torsions in both elastic and inelastic ranges. Other topics, such as buckling and stability of columns, Mohr circle, and energy methods will also be discussed. Prerequisites: CEE 204 with a grade of C or better.

**CEE 240. Geographic Information Systems in Civil and Environmental Engineering. 3 Credits.**
Geographic Information Systems as they apply to civil and environmental engineering. Spatial data acquisition, generation and analysis methods from terrestrial, aerial and satellite sources. Modeling of terrain, land, and hydrographic information using CAD. Use of GIS software in the creation and application of GIS spatial data bases to engineering problems. Prerequisite: MATH 212, sophomore standing or higher.

**CEE 295. Topics in Civil and Environmental Engineering. 1-3 Credits.**
Topics in civil and/or environmental engineering at the basic engineering level. Prerequisite: Permission of the department chair.

**CEE 304. Probability Statistics and Risk in Civil and Environmental Engineering. 3 Credits.**
CEE infrastructure systems definitions and methodology. CEE economics basics and use. Probability theory and applications. Statistics parameters, functions, variance, regression, and correlation analysis. Professional practice issues of ethics, licensure, procurement of work, and professional interaction. Prerequisite: junior standing in CEE.

**CEE 305. Civil and Environmental Computations. 3 Credits.**
Introduction to selected numerical methods and their specific application to solving problems in many of the areas of civil and environmental engineering. Further development of computer programming proficiency. Prerequisites: junior standing, MATH 307, CS 150.

**CEE 310. Structures I. 3 Credits.**
Analysis of statically determinate structures. Influence lines and structural design. Displacement calculations. Introduction to analysis of indeterminate structures. Prerequisites: CEE 220 and a grade of C or better in CEE 204.

**CEE 320. Civil Engineering Materials. 3 Credits.**
Properties of steel, portland cement concrete, bituminous concrete, aggregates, and timber. Prerequisites: CEE 220.

**CEE 323. Soil Mechanics. 3 Credits.**
Fundamental engineering properties of soil and their application to earth structures and foundations. Topics include seepage, compaction, strength, and deformation characteristics of soils. Corequisite: CEE 335. Prerequisite: CEE 220.
CE 330, Hydromechanics, 3 Credits.  
Fluid properties, fluid statics and fundamentals of fluid kinematics. Steady, incompressible conservation laws for mass, momentum and energy including real fluid energy losses. Turbulent, incompressible fluid flows in closed conduits and with a free surface. Introduction to thermodynamics. Prerequisites: MATH 212 and MAE 205.

CE 335, CE Soils and Hydraulics Laboratory, 1 Credit.  
Soils and hydraulics tests, including index testing, compaction, permeability, consolidation, shear tests for soils. Pipe flow, open channel flow, surface hydrology, groundwater, and hydraulic structures for hydraulics. Corequisites: CEE 323 and 340.

CE 340, Hydraulics and Water Resources, 3 Credits.  

CE 350, Environmental Pollution and Control, 3 Credits.  
Introduction to the fundamental principles of environmental engineering. Topics in water quality, water and wastewater treatment, air quality, and solid waste and landfills are discussed. Prerequisites: CHEM 121N-CHEM 122N, MATH 211, PHYS 231N.

CE 367, Cooperative Education, 1-3 Credits.  
May be repeated for credit. Available for pass/fail grading only. Student participation for credit based on the academic relevance of the work experience, criteria, and evaluative procedures as formally determined by the department and Career Development Services prior to the semester in which the work experience is to take place. (qualifies as a CAP experience) Prerequisites: approval by the department and Career Development Services in accordance with the policy for granting credit for cooperative education programs.

CE 368, Internship, 1-3 Credits.  
May be repeated for credit. Available for pass/fail grading only. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students to gain short duration career-related experience. (qualifies as a CAP experience) Prerequisites: approval by department and Career Development Services.

CE 369, Practicum, 1-3 Credits.  
May be repeated for credit. Available for pass/fail grading only. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students to gain short duration career-related experience. (qualifies as a CAP experience) Prerequisites: approval by department and Career Development Services.

CE 395, Topics, 1-3 Credits.  
Topics in civil and/or environmental engineering. Prerequisite: permission of the instructor.

CE 402, Professional Practice of Engineering, 1 Credit.  
The course will cover the practice and business aspects of engineering including concepts in management, business, public policy, and leadership. It will also cover public and private procurement of work, project management and execution, responsibility to clients, contracting, project finances, professional liability, and public safety. Prerequisite: Senior standing.

CE 403W, Civil Engineering Design Project and Professional Practice, 3 Credits.  
For graduating seniors only. Group design project of civil engineering systems requiring synthesis, data gathering, preliminary investigation, master planning, conceptual designs, layouts, support studies, cost estimates and report writing. Emphasis will be on alternatives, constraints, economics, ethics and professional practice, business and project management, public policy and leadership. (This is a writing intensive course.) Prerequisite: grade of C or better in ENGL 211C or ENGL 221C or ENGL 231C.

CE 410, Concrete Design I, 3 Credits.  
Fundamental concepts of reinforced concrete analysis and design by ultimate strength and working stress methods. Prerequisite: CEE 310.
CEE 459/559. Biofuels Engineering. 3 Credits.
Course covers the overview of renewable energy sources; fundamentals of biofuels; biomass and types of biomass (e.g., woody biomass, forest residues, agricultural residues, energy crops); composition of lignocelluloses (cellulose, hemicellulose, and lignin); biomass conversion technologies; thermochemical, supercritical water, and biochemical conversion processes; types of biofuels from biomass; liquid fuels (bioethanol, bio-oil, biocrude, and hydrocarbons); gaseous fuels (synthesis gas, hydrogen, biodiesel); solid fuels (biochar, torrefied biomass); biodiesel from vegetable oils, algae to biofuels; value-added processing of biofuel residues; economic and environmental assessments; policies and future R&D. Prerequisite: permission of the instructor.

CEE 460/560. Advanced Analytical Techniques in Environmental Engineering. 3 Credits.
The objective of this class is to introduce students to the analytical, experimental, and process engineering techniques that are utilized to support decision making in environmental engineering. Prerequisite: CEE 350.

CEE 470/570. Transportation Fundamentals. 3 Credits.
This course surveys the current practice of transportation engineering in the United States. It focuses on various ground transportation modes and covers policy, institutional, planning and operational issues. Students are introduced to planning models, capacity analysis, traffic impact analysis, and parking studies. Prerequisite: senior standing.

CEE 471/571. Transportation Operations I. 3 Credits.
This is the first course in transportation operations and traffic flow theory. Topics include traffic engineering studies, capacity analysis, intersection control, traffic flow models, shockwave analysis, signal warrant analysis, and safety analysis. Course includes applications of modeling and simulation to isolated intersections. Prerequisite: CEE 470.

CEE 482/582. Introduction to Coastal Engineering. 3 Credits.
Classical small amplitude wave theory, wave transformations in shallow water, shoaling, refraction, diffraction, reflection, breaking. Wave induced near shore currents and sediment transport processes. Alternatives to mitigate coastal erosion processes. Introduction to coastal structures. Prerequisites: CEE 330 and permission of the instructor.

CEE 495/595. Topics in Civil and Environmental Engineering. 1-3 Credits.
Special topics of interest with emphasis placed on recent developments in civil and/or environmental engineering. Prerequisite: Permission of the department chair.

CEE 497. Independent Study in Civil and Environmental Engineering. 1-3 Credits.
Individual analytical, experimental and/or design study selected by the student and supervised by the advisor. Prerequisites: approval of the advisor.