

# CIVIL AND ENVIRONMENTAL ENGINEERING (CEEN)

## CEEN 2601 Statics 3 s.h.

Principles of engineering mechanics as applied to statics with vector applications to forces and moments; centroid and center of gravity; equilibrium; friction; moments of inertia: relationship between loads, stress and strain in tension, compression, torsion and bending.

**Prereq.:** MATH 1572 or MATH 1572H; PHYS 2610 or concurrent.

## CEEN 2602 Strength of Materials 3 s.h.

Relationships between loads, shear and bending moments in beams; combined stresses in beams; indeterminate beam analysis; virtual load; connections; columns.

**Prereq.:** CEEN 2601.

## CEEN 2602L Strength of Materials Lab 1 s.h.

Experimental verification of strength of materials; testing: tension, torsion, non-destructive tests of steel; concrete compression and Poisson ration, wood tests.

**Coreq.:** CEEN 2602.

## CEEN 2610 Surveying 3 s.h.

The theory of surveying and the use of instruments. Problems in leveling, traversing, and topography. Introduction to circular and vertical curves.

**Prereq.:** MATH 1513 or equivalent.

## CEEN 2610L Surveying Laboratory 1 s.h.

Field surveying principles and techniques. Uses of transit and level are stressed. Three laboratory hours per week.

**Coreq.:** CEEN 2610.

## CEEN 2660 Computer Aided Design and Drafting 2 s.h.

This course is designed for students who wish to be involved with the civil engineering design fields and for those interested in computer aided design and drafting. Students will be introduced to both traditional and computer aided design and drafting skills. The aim of this course is to introduce students to basic information, skills, and concepts related to drafting and design. Special attention is given to: sketching, measurement, room planning, multi-view drawing, auxiliary views, working drawings, sectional views, orthographic drawings along with AutoCAD tools and commands. The course includes 1 s.h. lecture and 1 s.h. lab.

## CEEN 3710 Civil Engineering Materials 3 s.h.

A study of the principal materials used for civil engineering and construction purposes, with special attention paid to physical and mechanical properties of the materials and their importance to the engineer.

**Prereq.:** CEEN 2602.

## CEEN 3711 Technology and Society 3 s.h.

A critical exploration of how societal needs affect the creation of technologies and how technology affects society. The course is interdisciplinary in nature and presents various approaches to examining the complex interaction between humans and their tools. Topics include: (1) technology in human history; (2) society, science, and technology development; (3) technology and social change; (4) technology, knowledge, and power; (5) technology, population, and the environment. Listed also as SOC 3789.

**Prereq.:** Junior standing or consent of instructor.

## CEEN 3716 Fluid Mechanics 3 s.h.

Proportions of fluids, fluid statics, kinematics; Bernoulli equation; fluid momentum; laminar and turbulent flow through simple pipes; boundary layers; dimensional analysis and similitude.

**Prereq.:** CEEN 2602.

## CEEN 3716L Fluid Mechanics Lab 1 s.h.

Experimental verification of the principles of fluid mechanics as applied to incompressible fluid. Three hours laboratory per week.

**Prereq.:** CEEN 2602.

**Coreq.:** CEEN 3716.

## CEEN 3717 Hydraulic Design 4 s.h.

Analysis of flow in complex pipe systems; pumps; open channel flow; culverts; spillways; storm water drainage. Three hours lecture and three hours of computational laboratory per week.

**Prereq.:** CEEN 2610 and CEEN 3716.

## CEEN 3720 Transportation Engineering 3 s.h.

Introductory survey of transportation topics including transportation systems, vehicular operation and control, and transportation planning techniques; introduction to design of highways, airports, and railroads; and traffic engineering.

**Prereq.:** CEEN 2610.

## CEEN 3736 Fundamentals of Environmental Engineering 3 s.h.

Causes and effects of water, air and land pollution; measurements of environmental quality; environmental regulations; introduction to methods of pollution control.

**Prereq.:** CHEM 1515.

## CEEN 3749 Structural Analysis 1 3 s.h.

The determination of shears, moments, and stresses in statically determinate beams, frames, and trusses. Consideration of dead, live, moving, and wind loads. Elastic deflections of simple structures. Introduction to the analysis of statically indeterminate structures using numerical and energy methods.

**Prereq.:** CEEN 2602.

## CEEN 3749L Structural Analysis 1 Lab 1 s.h.

Introduction to stiffness-based analysis of determinate and indeterminate structures. Computer analysis of various structural systems, including plane and space trusses, continuous beams, plane and space frames, plates. P-delta stability analysis of frames. Three hours computational lab per week.

**Prereq.:** CEEN 2602; concurrent with CEEN 3749.

## CEEN 3751 Water Quality Analysis 3 s.h.

Introduction to physical, chemical, and biological measurements of water quality. Sample collection and laboratory analysis of natural waters, drinking water, and wastewater. Interpretation of environmental data. Two hours lecture and three hours laboratory per week. Identical to ENST 3751.

**Prereq.:** CEEN 3736 or ENST 2600; CHEM 1515.

## CEEN 3751L Water Quality Analysis Lab 0 s.h.

Laboratory experience in the analysis of natural waters, drinking water and wastewater. Emphasizes procedures for the collection and interpretation of data on current environmental problems. Three hours laboratory per week. Must be taken concurrently with CEEN 3751.

## CEEN 4800 Special Topics 3 s.h.

Special topics and new developments in Civil Engineering. Subject matter, credit hours, and special prerequisites to be announced in advance of each offering. May be repeated to a maximum of 6 s.h.

**Prereq.:** Senior standing or consent of instructor.

## CEEN 4812 Construction Management 3 s.h.

Fundamentals of construction management: contracts, bonding, estimating, organization, finance; cost and productivity of equipment, material, and labor; and project planning and scheduling.

**Prereq.:** CEEN 3717 or CEEN 4881.

## CEEN 4835 Highway Design 3 s.h.

Methods of highway route location; design methods and standards for highways, intersections, freeways, and interchanges. Includes extensive use of computer-aided design.

**Prereq.:** CEEN 3720.

## CEEN 4863 Integrated Design Project 3 s.h.

Students will be required to complete a culminating design experience that focuses attention on professional practice and is predicated on the accumulated background of curriculum components. Three hours of lecture.

**Prereq.:** CEEN 5855 and GPA of 2.0 or better.

**Coreq.:** CEEN 4863L.

**CEEN 4863L Integrated Design Project Lab 1 s.h.**

Students will be required to complete a meaningful design experience that focuses attention on professional practice and is predicated on the accumulated background of curriculum components. Three hours of laboratory a week.

**Prereq.:** CEEN 5855 and GPA of 2.0.

**Coreq.:** CEEN 4863.

**CEEN 4879 Civil Engineering Analysis 3 s.h.**

Application of mathematical and numerical methods to the systematic analysis and development of problems in the field of Civil Engineering.

**Prereq.:** CEEN 3749.

**CEEN 4881 Geotechnical Engineering 3 s.h.**

Properties of soil, classification, capillarity, seepage, permeability, stresses, consolidation, shear strength; analysis and design of foundation structures, retaining walls, piles, drilled piers, sheet pile walls, special footings, stability.

**Prereq.:** MATH 2673; CEEN 3749.

**CEEN 4881L Geotechnical Lab 1 s.h.**

Typical soil testing procedures and physical testing of soil samples.

**Prereq.:** Concurrent with: CEEN 4881.

**CEEN 5820 Pavement Material and Design 3 s.h.**

Design methods for flexible, rigid and other wheel-supporting pavements to include investigation, testing and preparation of subgrade, base course and pavement materials, design of various pavement mixtures, stresses in pavements, pavement design, and strengthening existing pavements.

**Prereq.:** CEEN 3720 and CEEN 4881.

**CEEN 5829 Civil Engineering Materials - Concrete 3 s.h.**

A course designed to broaden the student's understanding of Portland Cement Concrete as a construction material. Topics include the study of cement, hydration of cement, aggregates, admixtures for concrete, mix design handling and placing, curing and properties of Portland Cement Concrete. Testing of Concrete, quality control and special concretes are also included. A library research paper on a concrete-related topic of the student's choice is required.

**Prereq.:** CEEN 3749 or permission of instructor.

**CEEN 5832 Natural Systems Engineering 3 s.h.**

Introduction to the features, functions and values of natural aquatic systems, and engineering approaches to analysis and restoration design. Focus on wetlands and streams. Topics include regulations, wetland delineation, constructed wetland design, basic stream geomorphology, and stream restoration design.

**Prereq.:** CEEN 3736 or permission of instructor.

**CEEN 5836 Environmental Water Chemistry 3 s.h.**

Fundamental principles and calculations of major chemical reactions and equilibria that occur in aquatic environments, and water/wastewater treatment processes.

**Prereq.:** CEEN 3736.

**CEEN 5837 Environmental Engineering Design 3 s.h.**

Theory and design of unit operations and processes for treatment of drinking water and municipal wastewater.

**Prereq.:** CEEN 3736.

**CEEN 5849 Structural Analysis 2 3 s.h.**

Analysis of statically indeterminate beams, trusses, bents and multistory frames, utilizing concepts of strain energy, virtual work, slope-deflection, and moment distribution. Introduction to matrix methods of analysis using force and displacement methods.

**Prereq.:** CEEN 3749.

**CEEN 5855 Reinforced Concrete Design 3 s.h.**

An introduction to the behavior, analysis, and design of reinforced concrete members. Included are singly and doubly reinforced beams, tee-beams, slabs, short and long columns.

**Prereq.:** CEEN 3749.

**CEEN 5856 Steel Design 3 s.h.**

An introduction to the behavior and design of steel structures. Included is the design of rolled and built-up tension members, beams, columns, beam-columns, welded and bolted connections.

**Prereq.:** CEEN 3749.

**CEEN 5869 Design of Air Pollution Control Systems 3 s.h.**

Engineering analysis, procedures, and techniques for the selection, applications and operation of air pollution control methods in various operational situations.

**Prereq.:** CEEN 3736.

**CEEN 5877 Systems Engineering and Project Management 3 s.h.**

Systems approach to engineering design; non-linear models; linear programming; dynamic programming; network analysis; project management.

**Prereq.:** MATH 3705.

**CEEN 5879 Water Quality Modeling 3 s.h.**

Mathematical modeling of physical, chemical, and biological processes in natural systems; development of computer models to simulate the fate and transport of pollutants in lakes, streams, and estuaries; application of models to evaluate water resource management options.

**Prereq.:** C or better in CEEN 3736.

**CEEN 5880 Advanced Hydraulics 3 s.h.**

Application of hydraulic principles for one dimensional river modeling; understanding the fundamental processes of open channel hydraulics; application of HEC-RAS/HEC-GeoRAS models for river system modeling.

**Prereq.:** A "C" or better in CEEN 3717.

**CEEN 5882 Foundation Engineering 3 s.h.**

Analysis and design of various foundations, including abutments, piers, piles, and footings; slope stability of embankments.

**Prereq.:** CEEN 4881 and CEEN 5855.

**CEEN 5883 Bridge Engineering 3 s.h.**

Analysis and design of concrete and steel bridges; specifications and code requirements; design detailing; effects of natural and man-made hazards on bridges; implications of bridge failures.

**Prereq.:** CEEN 5855 and CEEN 5856.

**CEEN 5884 Solid and Hazardous Waste Management 3 s.h.**

Sources, characteristics, handling and disposal options for solid waste and hazardous waste; topics include regulations, health effects, waste minimization, collection systems, landfill design, treatment and processing methods, and site assessment.

**Prereq.:** CEEN 3736.

**CEEN 6910 Advanced Strength of Materials 3 s.h.**

The basic methods of structural mechanics, such as conditions of equilibrium and compatibility, stress-strain relations. General treatment of energy principles including virtual work, minimum potential energy; applications to statically determinate and indeterminate systems such as rings, curved beams, plates, and other elastic systems.

**CEEN 6920 Pavement Material & Design 3 s.h.**

Design methods for flexible, rigid and other wheel-supporting pavements to include investigation, testing and preparation of subgrade, base course and pavement materials, design of various pavement mixtures, stresses in pavements, pavement design, and strengthening existing pavements.

**Prereq.:** CEEN 3720 and CEEN 4881.

**Cross-Listed:** CEEN 5820.

**CEEN 6921 Groundwater and Surface Water Modeling 3 s.h.**

Mathematical simulation of hydrodynamic processes and pollutant transport in subsurface and surface water environments.

**Prereq.:** CEEN 3716 Fluid Mechanics and CEEN 3736 Fundamentals of Environmental Engineering.

**CEEN 6923 Pavement Rehabilitation 3 s.h.**

Engineering concepts and information needed to maintain and rehabilitate pavements. Project evaluation, testing, and analysis. Design of rigid and flexible overlays and other methods of rehabilitation. Selection of rehabilitation alternatives. Analysis of the effects of maintenance activities on pavement performance. Initial and life cycle cost analysis of various rehabilitation alternatives.

**Prereq.:** CEEN 3720, CEEN 4881.

**CEEN 6930 Sediment and Contaminant Transport 3 s.h.**

Understanding of sediment and contaminant transport in fluvial environments. Topics include sediment characteristics, incipient motion, scour, bankfull discharge, advection, and mixing.

**Prereq.:** CEEN 3717 or equivalent.

**CEEN 6932 Natural Systems Engineering 3 s.h.**

Introduction to the features, functions and values of natural aquatic systems, and engineering approaches to analysis and restoration design. Focus on wetlands and streams. Topics include regulations, wetland delineation, constructed wetland design, basic stream geomorphology, and stream restoration design.

**Prereq.:** CEEN 3736 or permission of instructor.

**Cross-Listed:** CEEN 5832.

**CEEN 6941 Structural Mechanics 3 s.h.**

Study of beams under lateral load; beams with combined lateral load and thrust; buckling beams on elastic foundations; applications of Fourier series and virtual work principles to beam type structures; stress and strain in three dimensions; applications to flexure of beams and plates and to constrained torsion; elements of engineering theory of plates.

**CEEN 6947 Finite Element Analysis 3 s.h.**

An introduction to finite element techniques as applied to problems in structural mechanics. Direct and variational methods of element formulation with application to beams, beam columns, frames, arches, thin plates, and shells.

**CEEN 6951 Construction Project Management 3 s.h.**

An integrated approach to construction project management. Advanced topics of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) and its application in construction project scheduling. Resource allocation and leveling, construction cost control, computer simulation of construction operations, and expert systems construction.

**CEEN 6952 Foundation Engineering 3 s.h.**

Principles of mechanics of materials applied to foundation problems; stresses and deformations in soils, consolidation theory; shallow and deep foundation design.

**CEEN 6953 Flow Through Porous Media 3 s.h.**

Analysis of seepage volume and stresses due to flow of water through soils in connection with dams, slopes, excavations, subsurface drainage, and wells.

**CEEN 6956 Advanced Soil Mechanics 3 s.h.**

Development of shear strength theories, Mohr-Coulomb-Hvorslev equation, critical path concept, stability of slopes, lateral earth-pressure theories, development of bearing capacity equations.

**Prereq.:** CEEN 4881 or equivalent.

**CEEN 6957 Structural Stability 3 s.h.**

A study of the elastic stability of engineering structures, beam columns, static buckling of elastic beams, frames, plates, and shells, dynamic stability of beams and plates.

**CEEN 6958 Structural Dynamics 3 s.h.**

Analysis of the response of structures to air blasts and earthquake motions; development of both the normal mode and frequency response methods in dealing with periodic and nonperiodic excitations.

**CEEN 6959 Advanced Steel Design 3 s.h.**

Advanced topics in the structural design of girders, frames, and trusses. Light gauge metal structures. Use of modern alloys and hybrid systems.

**CEEN 6961 Advanced Concrete Design 3 s.h.**

Consideration of advanced design techniques for reinforced concrete members and structures such as composite and prestressed concrete beams, box girders, and slabs.

**CEEN 6965 Special Topics 3 s.h.**

The application, in civil engineering, of special topics selected by the faculty from fields of current research interest or special emphasis. May be repeated up to six semester hours.

**CEEN 6967 Biological Treatment Processes 3 s.h.**

Theory and design of biological processes used in the treatment of municipal and industrial wastewaters, and in the remediation of hazardous wastes.

**Prereq.:** CEEN 3736.

**CEEN 6972 Advanced Topics in Environmental Engineering 3 s.h.**

Advanced concepts related to the transport, reaction, phase distribution, and fate of pollutants in both the natural environment and treatment systems.

**Prereq.:** CEEN 3736.

**CEEN 6973 Watershed Modeling 3 s.h.**

Application of hydrologic principles for modeling point and non-point source pollution at the watershed scale; the nutrient and sediment transport simulation using SWAT model; understanding the fundamental processes of pollutant movement through the soils and overland flow; application of data driven modeling in Water Resources Engineering.

**CEEN 6975 Physical and Chemical Treatment Processes 3 s.h.**

Theory and design of physical and chemical processes used in the treatment of water supplies, wastewater, and hazardous wastes.

**Prereq.:** CEEN 3736.

**CEEN 6976 Design of Small Dams 3 s.h.**

Flood routing, reservoir engineering. Hydraulic design of small gravity, earth fill and rock fill dams, spillways, and energy dissipaters.

**Prereq.:** CEEN 3717 and CEEN 6977.

**CEEN 6977 Hydrology 3 s.h.**

Precipitation; hydrologic abstractions; runoff; urban and small watershed hydrology; frequency analysis; digital simulation.

**CEEN 6978 Water Resources Policy and Management 3 s.h.**

International, national, and local water resources case studies, laws, policies, and management strategies are discussed. The need and demand for water; technical, economic, financial, social, environmental, and political considerations; data requirements; multipurpose projects.

**CEEN 6979 Water Quality Modeling 3 s.h.**

Mathematical modeling of physical, chemical, and biological processes in natural systems; development of computer models to simulate the fate and transport of pollutants in lakes, streams, and estuaries; application of models to evaluate water resource management options.

**Prereq.:** CEEN 3736 Fundamentals of Environmental Engineering.

**Cross-Listed:** CEEN 5879.

**CEEN 6982 Foundation Engineering 3 s.h.**

Analysis and design of various foundations, including abutments, piers, piles, and footings; slope stability of embankments.

**Prereq.:** CEEN 4881 and CEEN 5855.

**CEEN 6983 Bridge Engineering 3 s.h.**

Analysis and design of concrete and steel bridges; specifications and code requirements; design detailing; effects of natural and man-made hazards on bridges; implications of bridge failures.

**Prereq.:** CEEN 5855 and CEEN 5856.

**CEEN 6989 Graduate Projects 1-3 s.h.**

Special projects involving research, analysis, design, or other independent investigation, undertaken by the M.S. student under the direction of a graduate faculty member with the approval of the department chair. Credit will be determined in each case based on the nature and extent of the project.

**CEEN 6990 Thesis 1-9 s.h.**

Hours arranged. May be repeated.