

# Civil Engineering (CE)

---

## CE 511 - INTRO GEOGRAPHICAL INFO SYS

Semester Hours: 3

Introduces vector, raster and tabular concepts, emphasizing the vector approach. Topics include: spatial relationships, map features, attributes, relational database, layers of data, data ingesting, digitizing from maps, projections, output, applications, and availability of public data sets.

## CE 520 - URBAN TRANSPORTATION PLANNING

Semester Hours: 3

Planning of highway systems and terminals as part of a complete planning approach; public transportation system planning; transportation planning studies, projection analysis, plan formulation, and programming.

## CE 541 - OPEN CHANNEL HYDRAULICS

Semester Hours: 3

Design and analysis of erodible and non-erodible channels. Uniform flow, channel roughness, gradually and spatially varied flow, rapidly varied flow, hydraulic jumps, gradually varied unsteady flow, flood routing, flow measurements, channel models, channel and culvert design.

## CE 549 - INTRO ENVIRONMENTAL ENGR

Semester Hours: 3

Engineering aspects of air, water, and thermal pollution. Hydrologic cycle, water sources and uses; industrial and other sources of primary and secondary pollutants. Transport process in environmental problems and in their control.

## CE 550 - ENVIRONMENTAL CONTROL

Semester Hours: 3

Engineering design and synthesis of environmental control systems. Control of multiphase systems with application to air and water pollution control.

## CE 552 - INDUSTRIAL WASTE TREATMENT

Semester Hours: 3

Advanced topics in the area of hazardous waste management and water quality control. Emphasis on industrial waste, including hazardous waste management. Topics include: generation, storage, collection, transfer, disposal, recycling, economic, environmental, and regulatory considerations.

## CE 554 - SOLID & HAZARDOUS WASTE MGMT

Semester Hours: 3

Waste characterization, minimization, collection, treatment, transport, and disposal. Landfill design and incineration options. Leachate characteristics and potential groundwater contamination. Prerequisite: CE 549.

## CE 555 - WATER QUALITY LABORATORY

Semester Hours: 3

Properties of natural water sources and laboratory methods associated with water and wastewater treatment systems. Students design and demonstrate a water treatment system to bring a water sample into compliance with drinking water standards.

## CE 556 - WATER QUALITY CONTROL PROC

Semester Hours: 3

Principles of public water supply design. Source selection, collection, purification, and distribution for municipal use. Collection of waste waters, their treatment, and disposal. Prerequisite: CE 549.

## CE 557 - HYDROLOGY

Semester Hours: 3

Occurrence and movement of water over the earth's surface for engineering planning and design. Relationship of precipitation to streamflow with frequency analysis, flood routing, and unit hydrograph theory.

## CE 558 - ENVIRONMENTAL ENGR DSGN

Semester Hours: 3

Engineering design and project management of environmental quality/restoration systems. Students will complete a design project focusing on one of the following systems: sanitary landfill, municipal incinerator, or groundwater/site remediation. Lectures will address skills for technical presentations and proposal writing, as well as process design and decision making.

## CE 559 - SEL TOPICS CIVIL ENGINEERING

Semester Hours: 1-6

CE 561 - VIBRATIONS ELASTIC SYS

Semester Hours: 3

Formulation of the equations of motion of discrete and continuous systems, analytical and numerical methods of solution, eigenvalue problems, and dynamic response.

CE 571 - ADVANCED SOIL MECHANICS

Semester Hours: 3

Continuum mechanics applied to soil behavior. Theoretical approaches to consolidation, shear strength, slope stability and soil stabilization.

CE 572 - SOIL DYNAMICS

Semester Hours: 3

Behavior of soils under dynamic, earthquake and blast loading. Analysis of foundation vibration and isolation.

CE 573 - EARTH STRUCTURES ENGINEERING

Semester Hours: 3

Principles of earth structure design. Theories of earth pressures and the design of retaining wall systems including gravity, cantilever, mechanically stabilized earth, flexible sheet pile, and anchored wall systems. Methods of stability analyses for retaining walls, earth slopes, and embankment design.

CE 574 - APP MECHANICS OF SOLIDS

Semester Hours: 3

Stresses and strains at a point, theories of failures, stress concentration factors, thick-walled cylinders, torsion of noncircular members, curved beams, unsymmetrical bending, and shear center.

CE 577 - EXP TECH SOLID MECHANICS

Semester Hours: 3

Experimental methods to determine stress, strain, displacement, velocity, and acceleration in various media. Theory and laboratory applications of electrical resistance strain gages, brittle coatings, and photoelasticity. Application of transducers and experimental analysis of engineering systems.

CE 578 - MATRIX METH STRUCT MECH

Semester Hours: 3

Matrix application to formulation and solution of linear problems in structural mechanics. Stresses, vibrations, and stability of engineering structures.

CE 581 - STRUCTURAL ANALYSIS II

Semester Hours: 3

Reactions, shears, moments and deformations in complex structural systems. Statically indeterminate systems, advanced geometric and energy methods.

CE 583 - REINFORCED CONCRETE DESIGN

Semester Hours: 3

Theory and practice of reinforced concrete design. Theory and design of high strength concrete mixtures. Design of reinforced concrete beams, slabs and columns using the ultimate strength design code of the American Concrete Institute.

CE 584 - STEEL DESIGN

Semester Hours: 3

Principles of the design of steel structures using ASD methods. Analysis and design of structural elements including beams, columns, connection details.

CE 585 - FOUNDATION ENGINEERING

Semester Hours: 3

Design of foundations with emphasis on reinforced concrete, footings, caissons, piles, retaining walls, and mat foundations. Effect of bearing pressure on foundations. Prerequisite: CE 583.

CE 586 - ADV CEMENTITIOUS & COMPOSITE

Semester Hours: 3

Concrete structures, rheology, mechanical properties, environmental durability, dimensional stability, advanced concrete technologies (such as high strength, fiber reinforced, and fracture mechanics), advanced fiber polymer composites, and repair/rehabilitation of concrete structures.

**CE 587 - BRIDGE DESIGN**

Semester Hours: 3

Bridge loads, load distribution, composite beam bridges, bridge bearings, reinforced and prestressed concrete slab and T-beam bridges, bridge evaluations and ratings, and upgrade methodology.

**CE 603 - ADVANCED CONCRETE DESIGN**

Semester Hours: 3

Design of concrete columns; bond, anchorage and reinforcing details; design of two-way slabs; design and analysis of multistory building frames; introduction to prestressed concrete; design of prestressed cross-sections for moment.

**CE 611 - GIS IN CIVIL ENGINEERING**

Semester Hours: 3

Advanced topics in geographical information systems (GIS) with civil engineering applications. Emphasis will be placed on spatial/temporal data analyses using digitized maps and database information in an area of CE specialization. Research project will be required.

**CE 622 - ADVANCED TRAFFIC ENGRG DESIGN**

Semester Hours: 3

In depth analysis of traffic engineering concepts related to intersection analysis (signalized and un-signalized) as well as arterial systems.

**CE 646 - EROSION & SEDIMENTATION**

Semester Hours: 3

River morphology and river response, incipient erosion and its prediction, bed form and roughness, degradation, aggradation, and local scour in alluvial rivers. Design of stable channels, computation of bed load.

**CE 650 - ENVIRONMENTAL IMPACT ANAL**

Semester Hours: 3

National environmental policy act and its implementation. Environmental impact process. Writing an environmental impact statement.

**CE 651 - ENVIRONMENTAL REGULATIONS**

Semester Hours: 3

Basic understanding of environmental law with an appreciation for the practical implementation of regulations for environmental engineers. Includes an overview of the major American environmental laws for protection of water and air resources, as well as permitting requirements and health/safety responsibilities. Prerequisite: CE 549.

**CE 652 - INTRO TO AIR POLLUTION CONTROL**

Semester Hours: 3

Technology of air pollution dealing with air pollutants, effects, sources, combustion processes, and abatement and control technology. Engineering contributions to both the problems and their solutions. Nature of air pollution problem and fundamental technological approaches to its solution.

**CE 653 - GROUNDWATER ENGINEERING**

Semester Hours: 3

Application of engineering principles to the movement of groundwater. Influence of physical and geological environment on groundwater hydraulics. Water well hydraulics and aquifer evaluation. Emphasis on practical groundwater engineering problems. Prerequisites: MA 526 or MAE 693.

**CE 654 - ENVIRONMENTAL TRANSPORT**

Semester Hours: 3

Fundamental principles of mass transport, chemical partitioning/transformations in environmental systems. Practical transport examples for surface water, ground water, and atmospheric systems will be presented and mathematical modeling will be utilized for solutions.

**CE 655 - HAZARDOUS WASTE MGMT**

Semester Hours: 3

Topics include definition of hazardous waste, regulatory considerations, risk assessments, and categories of waste. Current and emerging treatment and disposal technologies will be explored.

**CE 656 - ENV SYSTEMS SAMPLING & ANAL**

Semester Hours: 3

CE 657 - ADVANCED HYDROLOGY

Semester Hours: 3

Hydrologic cycle, including interrelationships between classical and statistical methods of hydrology. Evaluation of governing equations, linearizations, analytical approximations and numerical solution techniques for various boundary conditions. Stochastic hydrologic modeling in both temporal and spatial domains. Prerequisites: ISE 690, MAE 586, MAE 693, and CE 557.

CE 658 - SUSTAINABLE DESIGN

Semester Hours: 3

The built environment has a substantial impact on energy and material resources as well as being a critical determinant of health and productivity. This course covers topics such as site planning and construction variables, energy and water alternatives, and current rating systems. Case studies and field trips of historic and contemporary projects exemplifying various sustainability features will be included.

CE 659 - SEL TOPICS CIVIL ENGINEERING

Semester Hours: 1-6

CE 660 - STRUCTURAL DYNAMICS

Semester Hours: 3

Application of the theory of vibrations to discrete and continuous models of structures. Numerical methods of analysis for both spatial and temporal variables. Model synthesis and step-by-step time integration methods. Finite element applications: substructuring techniques.

CE 662 - GEOTECHNICAL ENGINEERING

Semester Hours: 3

Shallow foundation's immediate and consolidated settlement, advanced deep foundations under lateral and axial loads, design of single and pile groups, soil-pile interaction, introduction to seismology, earthquake characteristics, dynamic soil properties and response, soil profile response spectra, soil liquefaction. Prerequisite: CE 585.

CE 666 - EARTHQUAKE ENGR & STRUCT DYNAM

Semester Hours: 3

This allows structural engineers to consolidate their knowledge on the effect of earthquake ground motions on civil engineering structures. The course will cover the analysis and the theories of structures made of various materials that are located in active seismic zones. Finally, the course will allow structural engineers to acquire new basic knowledge in earthquake engineering that will allow them to communicate better with scientists and engineers of other disciplines in earthquake engineering (e.g. seismologist, geotechnical engineers, etc.,).

CE 671 - CONTINUUM MECHANICS

Semester Hours: 3

Kinematics and kinetics, various coordinate systems, constitutive equations for continuous media; governing partial differential equations from first and second laws of thermodynamics; applications to solids, liquids, and gases.

CE 672 - THEORY OF ELASTICITY

Semester Hours: 3

Formulation of boundary-value problems of classical elasticity. Application to plane problems, prismatic members, and axisymmetric problems. Introduction to three-dimensional problems.

CE 673 - PLASTICITY

Semester Hours: 3

Fundamentals of mechanical behavior of metals and nonmetals for stress states greater than the yield stress state. Deformation and flow theories. Stress-strain relations and yield criteria. Solution of boundary value problems with plastic bodies. Limit analysis of structures.

CE 674 - FINITE ELEMENT ANALYS I

Semester Hours: 3

Finite element theory, variational methods, weighted residuals. Applications to linear partial differential equations in continuous media. Solution of boundary value and initial value problems.

CE 675 - ROCK MECHANICS

Semester Hours: 4

Principles of continuum mechanics applied to the design of structures in rock; tunnels, underground structures and foundations. Joint behavior; stresses; analysis of rock slopes; instrumentation.

**CE 676 - VISCOELASTICITY**

Semester Hours: 3

Mechanical behavior of materials having time-dependent and temperature-dependent material properties. Creep and relaxation phenomena. Elastic-viscoelastic analogies. Formulation of stress-strain laws. Solution of boundary value problems for viscoelastic bodies.

**CE 677 - OPTICAL TECH IN SOLID MECH**

Semester Hours: 3

Overview of conventional methods for experimental stress analysis. Introduction to applied optics with emphasis on non-destructive, laser-based testing methods, fiber optic recording systems, photoelectronic-numerical data acquisition, and computer aided analysis.

**CE 678 - MECHANICS OF COMPOSITE MATERIALS**

Semester Hours: 3

Introduction to composite materials, micro- and macro-mechanical behavior of laminae; bending, buckling and vibration of laminated plates.

**CE 679 - HYPERVELOCITY IMPACT PHENOMENA**

Semester Hours: 3

Fundamental principles of penetration mechanics. Analytical and numerical approaches to perforation and penetration problems. Shock jump conditions, Hugoniot, and equations of state; low, high, and hypervelocity impacts of finite and thin targets.

**CE 681 - ADVANCED STRUCTURAL ANALYSIS**

Semester Hours: 3

Explores modern methods of structural analysis, matrix formulation of flexibility and stiffness methods, and analysis of structures with material and geometric nonlinearities. Also introduces energy methods for indeterminate structures. Prerequisite: CE 581.

**CE 683 - GRADUATE SEMINAR**

Semester Hour: 1

Professional activities designed to promote the skills required to organize and deliver oral technical presentations and to broaden the individual's awareness of technical issues. Required for all students pursuing a graduate degree. Students will be graded "S" (Satisfactory) or "U" (Unsatisfactory) based upon their performance and attendance. Students who do not receive an "S" grade must register for the course until an "S" is obtained.

**CE 696 - GRAD INTERNSHIP CE ENGR**

Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization or government agency that has particular interest and relevance to the graduate student. Permission of CEE faculty member required.

**CE 697 - MASTER'S PLAN II PROJECT**

Semester Hours: 3

Application-oriented student project designed to show competence in an area of civil engineering.

**CE 699 - MASTER'S THESIS**

Semester Hours: 1-9

Required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of nine hours of credit is awarded upon successful completion of master's thesis. The 1 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 1 hour option once in their career.

**CE 722 - SLIDING MODE CONTROL**

Semester Hours: 3

**CE 756 - HAZARDOUS WASTE REMEDIATION**

Semester Hours: 3

Engineering design skills applied to the solution of real world hazardous waste remediation problems. Remedial screening and selection; treatment train development for a Superfund facility.

**CE 762 - WAVE MOTION CONT ELASTIC BODIES**

Semester Hours: 3

Elements of stress wave propagation in bounded elastic media. Propagation of elastic waves in infinite and semi-infinite bodies, cylinders, rods and beams.

CE 765 - RAND VIBRAT ELASTIC SYSTEM

Semester Hours: 3

Dynamic analysis of elastic systems including the response of complex structures to random excitations. Typical excitations include random wind, thermal, earthquake, aerodynamic, and ocean wave phenomena. Probabilistic mechanics methods. Concepts of reliability. Stationary and ergodic processes.

CE 772 - THEORY STRUCT STABILITY

Semester Hours: 3

Energy criterion for stability of elastic structure under conservative loading. Stability concept for general continuous systems. Rigorous and approximate methods of analysis. Buckling of structural elements under impulsive and nonconservative loading. Postbuckling behavior.

CE 773 - THEORY OF SHELLS

Semester Hours: 3

Analysis of thin plates and shells, including higher approximations theories and transverse-shear deformations; illustration of theories by selected problems.

CE 774 - FINITE ELEMENT ANAL II

Semester Hours: 3

Advanced topics in finite element analysis: application to nonlinear partial differential equations in continuum mechanics: theoretical studies of convergence and stability of solutions.

CE 778 - FRACTURE MECHANICS

Semester Hours: 3

CE 779 - ADV PENETRATION MECHANIC

Semester Hours: 3

Advanced analytical modeling of penetration and perforation phenomena, hydrocode development and applications, and similitude analysis.

CE 799 - DOCTORAL DISSERTATION

Semester Hours: 3-9