

Civil Engineering (CVEG)

Courses

CVEG 5000. Graduate Seminar in Civil Engineering. 0 Hours.

A weekly seminar devoted to civil engineering research topics. Appropriate grade to be 'S'. (Typically offered: Fall and Spring)

CVEG 5103. Geosynthetic Applications in Civil Engineering. 3 Hours.

Geosynthetic Applications in Civil Engineering: The functional properties of various geosynthetic materials are defined as they relate to; reinforcement, separation, filtration, and drainage applications. Design procedures are developed for the use of geosynthetics in transportation, environmental and geotechnical applications. Prerequisite: CVEG 3132 and CVEG 3131L or equivalent. (Typically offered: Irregular)

CVEG 5113. Soil Dynamics. 3 Hours.

This course covers propagation of stress waves in elastic and inelastic materials, dynamic loading of soils, and stiffness and damping properties of soils. Use of field and laboratory techniques to determine shear wave velocity of soils. Also includes applications of dynamic soil properties in site stiffness characterization, geotechnical earthquake engineering, evaluation of ground improvement, and design of machine foundations. Prerequisite: CVEG 4143 or graduate standing. (Typically offered: Irregular)

CVEG 5123. Measurement of Soil Properties. 3 Hours.

Consideration of basic principles involved in measuring properties of soils. Detailed analysis of standard and specialized soil testing procedures and equipment. Lecture 2 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: CVEG 4143 or graduate standing. (Typically offered: Irregular)

CVEG 5133. Geotechnical Site Characterization. 3 Hours.

One of primary tasks of geotechnical engineers is to perform in-situ site characterization for engineering design of foundations, retaining structures, roads, bridges and other infrastructure. This course will focus on in-situ investigations performed for the purpose of collecting detailed site characterization data for direct and/or indirect use in geotechnical design. Specifically, we will study various static (e.g., SPT, CPT, VST, DMT, PMT) and dynamic (e.g., CHT, DHT, SW, GPR) in-situ tests used to obtain estimates of stratigraphy, density, strength, stress history, modulus, and permeability of geotechnical materials. We will predominantly focus on site characterization of soil sites, but will mention rock testing and design methods when appropriate. Prerequisite: CVEG 4143 or the equivalent. (Typically offered: Irregular)

CVEG 5143. Transportation Soils Engineering. 3 Hours.

Advanced study of the properties of surficial soils; soil classification systems; pedology; soil occurrence and variability; subgrade evaluation procedures; repeated load behavior of soils; soil compaction and field control; soil stabilization; soil trafficability and subgrade stability for transportation facilities. Prerequisite: CVEG 3132. (Typically offered: Irregular)

CVEG 5153. Earth Retaining Structures. 3 Hours.

This course will focus on the analysis and design of earth retaining structures. Specifically, we will discuss soil and rock property design parameter selection, lateral earth pressures for wall system design, and load and resistance factor design (LRFD) for retaining walls. Wall types discussed include gravity and semi-gravity walls, modular gravity walls, MSE walls, nongravity cantilever walls and anchored walls, and in-situ reinforced walls. Information on wall system feasibility and selection, construction materials and methods, cost information, and design and performance information will be discussed. Prerequisite: CVEG 4143 or equivalent. (Typically offered: Irregular)

CVEG 5163. Seepage and Consolidation. 3 Hours.

Investigation of the flow of water through soils and the time rate of compression of soils. Characterization of the hydraulic conductivity of soils in the field, seepage through earth dams, excavation cut-off walls, and other seepage control systems. Analytical and experimental investigations of soil volume change under hydraulic and mechanical loading. Design of earth and rock dams, well pumping, and vertical and radial consolidation in embankments. Prerequisite: CVEG 4143 or graduate standing. (Typically offered: Irregular)

CVEG 5173. Advanced Foundations. 3 Hours.

Study of soil-supported structures. Topics include drilled piers, slope stability, pile groups, negative skin friction, foundation design from the standard penetration test and Dutch cone, and other specialized foundation design topics. Prerequisite: CVEG 4143 or graduate standing. (Typically offered: Irregular)

CVEG 5183. Geo-Environmental Engineering. 3 Hours.

Study of the geotechnical aspects of waste containment systems and contaminant remediation applications. Analysis and measurement of flow of water and contaminants through saturated and unsaturated soils, clay mineralogy and soil-chemical compatibility, and mechanical and hydraulic behavior of geomembranes, geotextiles, and geosynthetic clay liners. Design and construction aspects of compacted clay and composite landfill liners, drainage systems, and landfill covers. Prerequisite: CVEG 3132 or graduate standing. (Typically offered: Irregular)

CVEG 5193. Geotechnical Earthquake Engineering. 3 Hours.

This course covers stress wave propagation in soil and rock; influence of soil conditions on seismic ground motion characteristics; evaluation of site response using wave propagation techniques; liquefaction of soils; seismic response of earth structures and slopes. Prerequisite: CVEG 4143 or graduate standing. (Typically offered: Irregular)

CVEG 5203. Water Chemistry. 3 Hours.

This course provides a basis for applying principles of physical chemistry to understanding the composition of natural waters and to the engineering of water and wastewater treatment processes. Topics covered include chemical equilibrium (algebraic, graphical, and computer-aided solution techniques); acid-base equilibria and buffering; oxidation and reduction reactions; and solid precipitation and dissolution. Prerequisite: Graduate standing or CVEG 3243 and instructor approval. (Typically offered: Spring)

CVEG 5213. Advanced Water Treatment Design. 3 Hours.

Design of industrial and municipal water treatment plants. Discussion of raw and treated water requirements for several uses. Prerequisite: CVEG 3243. (Typically offered: Spring)

CVEG 5224. Advanced Wastewater Treatment Design. 4 Hours.

Application of advanced techniques for the analysis of wastewater treatment facilities. Physical, chemical and biological processes for removing suspended solids, organics, nitrogen, and phosphorus. Laboratory treatability studies will be used to develop design relationships. Lecture 3 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: CVEG 4243 or graduate standing. (Typically offered: Fall)

CVEG 5233. Microbiology for Environmental Engineers. 3 Hours.

Fundamental and applied aspects of microbiology and biochemistry relating to water quality control, wastewater treatment, and stream pollution. Prerequisite: CVEG 3243. (Typically offered: Irregular)

CVEG 5243. Groundwater Hydrology. 3 Hours.

Detailed analysis of groundwater movement, well hydraulics, groundwater pollution and artificial recharge. Surface and subsurface investigations of groundwater and groundwater management, saline intrusion and groundwater modeling will be addressed. Prerequisite: CVEG 3223. (Typically offered: Irregular)

CVEG 5253. Physical-Chemical Processes for Water and Wastewater Treatment. 3 Hours.

This course provides a fundamental understanding of physical and chemical processes used in the treatment of drinking water and wastewater. Principles of mass balance are applied to understand the impact of reactor hydraulics (ideal and non-ideal flow) and reaction kinetics on process performance and identify important process variables. Chemical processes covered include disinfection, gas transfer, adsorption, and ion exchange; physical processes covered include coagulation, flocculation, sedimentation, filtration, and membranes. Prerequisite: Graduate standing and instructor consent. (Typically offered: Fall Odd Years)

CVEG 5273. Open Channel Flow. 3 Hours.

Open Channel Flow includes advanced open channel hydraulics, flow measurement techniques, a hydrology review, culvert and storm drainage facility design, natural channel classification (fluvial geomorphology) and rehabilitation, computer methods and environmental issues. Prerequisite: CVEG 3213 and CVEG 3223. (Typically offered: Irregular)

CVEG 5293. Water Reuse. 3 Hours.

CVEG 5293 is a graduate-level course that discusses topics related to water reclamation and reuse. Topics include past and current practices of water reuse, health and environmental issues related to water reuse, water technologies and systems for water reuse, and water reuse applications. Prerequisite: CVEG 3243 or equivalent course. (Typically offered: Spring Even Years)

CVEG 5303. Theory of Stability. 3 Hours.

Study of structural members subjected to compression. Analysis of compression members considering support conditions and within frame configurations. Analysis of beams considering lateral torsional buckling. AISC Steel Manual strength equations related to columns and beams are derived and discussed. Prerequisite: Graduate standing. (Typically offered: Irregular)

CVEG 5313. Matrix Analysis of Structures. 3 Hours.

Energy and digital computer techniques of structural analysis as applied to conventional forms, space trusses, and frames. Prerequisite: CVEG 3303 or graduate standing. (Typically offered: Irregular)

CVEG 5323. Structural Dynamics. 3 Hours.

Dynamics response of single and multidegree of freedom systems. Modal analysis. Response spectra. Computer programs for dynamic analysis. Design considerations for structures subjected to time-varying forces including earthquake, wind, and blast loads. Prerequisite: CVEG 3303. (Typically offered: Irregular)

CVEG 5333. Concrete Materials. 3 Hours.

Topics include portland cement production, supplementary cementing materials, fresh and hardened concrete properties, mixture proportioning, chemical admixtures, curing, and specialty concretes. Corequisite: Lab component. Prerequisite: CVEG 4303. (Typically offered: Irregular)

CVEG 5343. Highway Bridges. 3 Hours.

Economics of spans, current design and construction specifications, comparative designs. Possible refinements in design techniques and improved utilization of materials. Prerequisite: CVEG 4313 and CVEG 4303. (Typically offered: Irregular)

CVEG 5353. Prestressed Concrete Design. 3 Hours.

Analysis and design of prestressed concrete beams. Topics include flexural analysis, prestress bond, draping and debonding, allowable stresses, shear analysis and design, camber prediction, and prestress losses. Prerequisite: CVEG 4303. (Typically offered: Irregular)

CVEG 5363. Advanced Topics in Reinforced Concrete. 3 Hours.

Analysis and design of reinforced concrete members. Topics include slender columns, one-way and two-way slab design, strut and tie design, and torsion. Prerequisite: CVEG 4303 or graduate standing. (Typically offered: Irregular)

CVEG 5373. Advanced Structural Steel Design. 3 Hours.

Design of structural steel components using the Load and Resistance Factor Design method. Intensive treatment of simple and eccentric connections, composite construction, plate girders, and plastic analysis and design. Prerequisite: CVEG 4313 or graduate standing. (Typically offered: Irregular)

CVEG 5383. Finite Element Methods in Civil Engineering. 3 Hours.

An understanding of the fundamentals of the finite element method and its application to structural configurations too complicated to be analyzed without computer applications. Application to other areas of civil engineering analysis and design such as soil mechanics, foundations, fluid flow, and flow through porous media. Prerequisite: Graduate standing. (Typically offered: Irregular)

CVEG 5393. Advanced Strength of Materials. 3 Hours.

The course will continue from the basic material addressed in the undergraduate course and investigate in more detail stress analysis as it pertains to civil engineering type problems. Topics addressed in the course will include stress analysis (two-dimensional), constitutive relationships, solutions for two-dimensional problems, flexure, torsion, beams on elastic foundations, and energy methods. Prerequisite: CVEG 2023 or MEEG 3013. (Typically offered: Irregular)

CVEG 5413. Transportation and Land Development. 3 Hours.

Study of interaction between land development and the transportation network. Application of planning, design, and operational techniques to manage land development impacts upon the transportation system, and to integrate land layout with transportation network layout. Prerequisite: Graduate standing. (Typically offered: Irregular)

CVEG 5423. Structural Design of Pavement Systems. 3 Hours.

An introduction to the structural design of pavement systems including: survey of current design procedures; study of rigid pavement jointing and reinforcement practices; examination of the behavioral characteristics of pavement materials and of rigid and flexible pavement systems; introduction to structural analysis theories and to pavement management concepts. Prerequisite: CVEG 4433. (Typically offered: Irregular)

CVEG 5433. Traffic Engineering. 3 Hours.

A study of both the underlying theory and the use of traffic control devices (signs, traffic signals, pavement markings), and relationships to improved traffic flow and safety, driver and vehicle characteristics, geometric design, and societal concerns. Also includes methods to collect, analyze, and use traffic data. Prerequisite: CVEG 3413 or graduate standing. (Typically offered: Irregular)

CVEG 5463. Transportation Modeling. 3 Hours.

The use of mathematical techniques and/or computer software to model significant transportation system attributes. May compare model results with actual measured traffic attributes, using existing data sources and/or collecting and analyzing field data. Pre- or Corequisite: Lab component. Prerequisite: Graduate standing. (Typically offered: Irregular)

CVEG 5503. Construction Safety. 3 Hours.

Construction industry safety management systems, practices, and research to prevent injuries on work sites. Roles, responsibilities, and interaction of construction industry participants in safety management. OSHA organization, regulation framework, and resources. Safety program procedures and practices associated with positive safety performance outcomes. Total cost of injuries to include personal, direct/indirect costs, and workers compensation insurance. Prerequisite: Graduate Standing. (Typically offered: Fall, Spring and Summer)

CVEG 5513. Construction Scheduling. 3 Hours.

Develop an understanding of modern scheduling techniques used for the management of construction projects. Learn the underlying logical principles, calculation methods, and presentation formats for PDM, the most prevalent technique. Load schedules with resources and costs to enable leveling, smoothing, and earned value analysis. Learn to update schedules for actual progress, identify problems, and compress or crash activities. Prerequisite: Graduate Standing. (Typically offered: Fall, Spring and Summer)

CVEG 5523. Construction Productivity. 3 Hours.

This course introduces the student to construction industry productivity measurement, management practices, planning processes, and work methods to improve labor productivity on project sites. Factors that influence labor productivity such as resource supply chain, rework, changes, craft labor motivation, and the workforce environment are included. Roles, responsibilities, and interaction of construction industry participants in productivity management will be examined. Participants will learn construction productivity improvement program tools associated with improved productivity performance including work sampling and activity analysis. Prerequisite: Graduate Standing. (Typically offered: Fall, Spring and Summer)

CVEG 5533. Legal Aspects of Construction. 3 Hours.

Students will identify legal issues in the course of a construction project and learn to determine when and where they or their employers or clients need legal advice. The course covers the most common legal considerations and disputes that arise in the construction and design industries from the perspectives of different industry participants, and it explores the most important contractual terms commonly used in construction industry agreements. The individual lessons address basic aspects of the legal system, liability for negligence and professional malpractice, and a full range of legal risk allocation and risk management strategies, relating to: bidding and proposal practices; project delivery systems; contracting practices; insurance; surety bonds; pricing, scheduling, and payment disputes; contract administration; legal remedies; and alternative dispute resolution methods. Prerequisite: Graduate Standing. (Typically offered: Fall, Spring and Summer)

CVEG 5543. Sustainability in Construction Management. 3 Hours.

Sustainability in Construction Management will explore traditional concepts of construction management through the lens of sustainability. Topics covered will include elements of sustainable design and construction, sustainable project requirements and management, choosing materials and production, sustainability design and construction economics, understanding specifications, community participation, waste management, regulatory agencies, and worker safety and roles. These topics will be viewed through the lens of the three pillars of sustainability: economics, environmental, and social. Prerequisite: Graduate Standing. (Typically offered: Fall, Spring and Summer)

CVEG 5553. Risk and Financial Management in Construction. 3 Hours.

This course prepares students to understand the differences between financial management in a construction company versus financial management in other industries. The course will also teach students how to account for a construction company's financial resources. The students will then learn how to quantitatively analyze financial decisions. Prerequisite: Graduate standing. (Typically offered: Fall, Spring and Summer)

CVEG 5563. Building Information Modeling (BIM) for Design and Construction. 3 Hours.

This course provides students with a comprehensive overview of building information modeling (BIM) within the context of multiple project delivery methods and from the different perspectives of owners, architects/engineers and contractors/subcontractors. The course includes 'hands-on' experiences using BIM software (Autodesk Revit) and will provide students with a basic working knowledge of the software. The curriculum also covers a systems perspective of how BIM works in different contractual relationships and workflows. Finally, the course will provide students with an understanding of how to implement BIM for companies that have not already done so. The course culminates with a student-modeled project in BIM, in conjunction with a real-world example in how your company can implement BIM. Prerequisite: Graduate standing. (Typically offered: Fall, Spring and Summer)

CVEG 562V. Research. 1-6 Hour.

Fundamental and applied research. Prerequisite: Graduate standing. (Typically offered: Fall, Spring and Summer)

CVEG 563V. Special Problems. 1-6 Hour.

Special problems in CVEG. Prerequisite: Graduate standing. (Typically offered: Irregular) May be repeated for up to 6 hours of degree credit.

CVEG 5863. Fundamentals of Sustainability in Civil Engineering. 3 Hours.

Qualify and quantify the economic, environmental, societal and engineering drivers behind sustainability in Civil Engineering. Justification of the feasibility and benefits of sustainability in environmental, geotechnical, structural and transportation through verbal and written communications. Students cannot receive credit for both CVEG 4863 and CVEG 5863. Prerequisite: Graduate standing or instructor consent. (Typically offered: Irregular)

CVEG 5953. Fundamentals of Fracture and Fatigue in Structures. 3 Hours.

The course will cover the concepts of linear-elastic, elastic-plastic and time-dependent Fracture Mechanics as applied to fracture in a variety of materials, structures, and operating conditions. The examples will include fracture in large components such as aircraft, bridges and pressure vessels and also in bones and in soft materials and human tissue. Prerequisite: Graduate standing in Civil, Mechanical or Biomedical Engineering or consent of the instructor. (Typically offered: Fall)

This course is cross-listed with BMEG 5953, MEEG 5953.

CVEG 600V. Master's Thesis. 1-6 Hour.

Master's Thesis. Prerequisite: Graduate standing. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.

CVEG 700V. Doctoral Dissertation. 1-18 Hour.

Doctoral Dissertation. Prerequisite: Candidacy. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.