

# CIVIL ENGINEERING (CIVE)

## CIVE2000 STATICS & MECHANICS MATERIALS I

Introduces solid mechanics including properties of areas and volumes (centroidal axis, center of gravity and moments of inertia), equilibrium of particles and rigid bodies in two and three dimensions, analysis of internal forces in trusses and frames and shear and moment diagrams for beams. **Prerequisites:** MATH1750 or MATH1775; and PHYS1250;

**Corequisite:** MATH1850 or MATH1875 (3 credits) fall

## CIVE2205 INTRODUCTION TO GEOMATICS

This course provides various elements of plane surveying, use of a level, total station and global positioning system; topographical surveying and mapping; error adjustment; area and volume computation; curve layout and site development; use of various computer application programs. (4 credits) fall

## CIVE2300 CAD IN CIVIL ENGINEERING

This course provides the student with an understanding of the role of the engineer on a design team and the importance of standards. It also provides the knowledge and practice of computer-aided design and drafting, and the use of AUTOCAD and CIVIL3D software in civil engineering design. (3 credits) spring

## CIVE2400 CIVIL ENGINEERING MATERIALS

Study of elemental and behavioral properties of steel, aluminum, aggregate, cement, concrete, asphalt, plastics, polymer composites, and wood. Uses in civil engineering and construction engineering applications with consideration to life cycle and longevity are also addressed.

**Prerequisite:** CHEM1100 (3 credits) spring

## CIVE2500 STATICS & MECHANICS MATERIALS II

The study of internal stresses induced by external loads on beams, trusses and axially loaded members of differing materials. Discussion and problems include sectional properties, stress-strain behavior, temperature effects, column buckling and combined stresses. Concepts are illustrated through student participation in laboratory experiments.

**Prerequisite:** CIVE2000 (4 credits) spring

## CIVE3000 FLUID MECHANICS

Fundamental physical and analytical principles of fluid mechanics through the understanding of the: conservation of mass, conservation of energy, and the conservation of momentum equations. A demonstration of the understanding of these fundamentals by solving problems dealing with: fluid properties, fluid statics, pressure on plane and curved surfaces, buoyancy and floatation, kinematics, systems, control volumes, conservation principles, ideal incompressible flow, impulse-momentum, and flow of a real fluid. **Prerequisites:** CIVE2000 and MATH1850 (4 credits) fall

## CIVE3100 ENVIRONMENTAL ENGINEERING

This course provides an introduction to environmental engineering concepts with respect to natural and man-made systems of the built environment. Particular emphasis is placed on material and energy balances and principles of thermodynamics and applied chemistry.

**Prerequisite:** CHEM1100 (4 credits) fall

## CIVE3125 ENGINEERING SYSTEMS ANALYSIS

This course provides an introduction to system optimization and analysis, problem solving and decision making in planning management and design, math modelling of qualitative decision problems, distribution and network models, decision analysis, waiting line models and project scheduling. **Prerequisite:** MATH1850 (3 credits) fall

## CIVE3150 ADVANCED SURVEYING

Building upon competencies developed in the Introduction to Geomatics course, students will develop additional competencies in precise leveling, construction layout, static GPS, site detail mapping with RTK, level adjustment, 3D GPS network adjustment. Additional topics covered include measurement error propagation theory, geodesy, map projections, and the US state plane coordinate system. **Prerequisite:** CIVE2205 or CONM2000 (4 credits) fall

## CIVE3200 STRUCTURAL ANALYSIS

The study of statically determinate and indeterminate structures including: structure determinate/indeterminate checks, structure stable/unstable checks, truss analysis, moment and shear equations and diagrams for structures, influence lines, maximum shears and moments for movable loads, energy method for deflections, moment distribution method for indeterminate beams and frames, slope deflection method for indeterminate beams and frames and an introduction to the stiffness method of analysis. **Prerequisite:** CIVE2500 (4 credits) fall

## CIVE3250 GIS APPLICATIONS IN CIVIL ENGINEERING

Students will gain an understanding of the basic components, functions of and terminology associated with Geographic Information Systems. Each student will create a typical GIS for civil engineering use. In doing so, they will develop specific competencies in: creating and populating geodatabases; basic data manipulation functions; data editing, and georeferencing Spatial and 3D analysis tools, symbology and general cartographic principles will be utilized by the students in the creation of small scale and large-scale models and maps useful in civil engineering design. **Prerequisite:** CIVE2205 or CONM2000 (3 credits) summer

## CIVE3300 SOIL MECHANICS

Study of soil, rock and underground water and their relation to design, construction and operation of civil engineering works. Topics include: origin and composition of rock and soil, soil classification, site exploration and instrumentation, compaction, in-situ stresses, soil compressibility and settlement, shear strength of soil, soil permeability and groundwater flow. Study includes evolution of concepts, derivation of theories, and illustrative applications using actual geotechnical problems and projects. **Prerequisites:** CIVE2000 and CIVE2500 (4 credits) fall

## CIVE3325 EMBANKMENTS, DAMS & SLOPE STABILITY

In this course, the fundamental concepts and principles of design and construction of embankments, earth dams and unsupported slopes are studied. In addition, different methods of slope stability analysis are covered in this class. A project on unsupported slope stability will be assigned to students as a project. Students are asked to design an unsupported slope and validate their design using common geotechnical engineering software. **Prerequisite:** CIVE3300 (3 credits) summer

## CIVE3350 GREEN ENGINEERING

This course will provide a foundation for topics in green engineering. This course will teach students an innovative design perspective needed for a fundamental conceptual shift from the current paradigms of design towards a more sustainable system, based on efficient and effective use of materials, water and energy. **Prerequisite:** CHEM1100 (3 credits)

## CIVE3375 EARTH RETAINING STRUCTURES

Design of earth retaining structures, such as retaining walls, MSE (Mechanically Stabilized Earth), and SRW (Segmented Retaining Walls), Soil Nail Walls, excavation support walls, and waterfront bulkheads. Topics include earth pressures, retaining wall designs, tieback and anchorages, slurry walls, sheet pile selection, soil nails for excavation stabilization and use of geo-synthetics. **Prerequisite:** CIVE3300 (3 credits) summer

**CIVE3400 STRUCTURAL ANALYSIS II**

Study of the use of matrix methods in structural analysis of determinate and indeterminate structures. Using linear algebra, the basics of matrix analysis such as degrees of freedom, coordinate systems, and other features are discussed. The structural elements are developed, such as truss and beam elements, using Virtual Work principles. The Stiffness Matrix and Stiffness Method are developed through Virtual Work. The matrix method is used to solve complex structures which include frames, trusses, elements of varying shapes, elements subjected to non-uniform loading between nodes, the movement of supports, and temperature changes. **Prerequisite:** CIVE3200 (3 credits) spring

**CIVE3425 DYNAMICS OF STRUCTURES**

Study of the principles of kinetics and kinematics related to the behavior of structures and their components under dynamic loads. In this introductory course, only single degree of freedom systems are addressed. Frequencies and periods of damped and undamped systems are addressed. Harmonic, impulse and arbitrary forces are introduced into the single degree of freedom structures. Also, this course will use the seismic methodologies of the International Building Code. **Prerequisite:** CIVE2500 (3 credits) spring

**CIVE3450 LEGAL ASPECTS OF BOUNDARY SURVEYING**

This course is an introduction to real estate law and boundary determination principles that are essential to the practices of land surveying. Real estate law, conveyancing terminology, evidence gathering, and research theory will be taught. Key principles of boundary law will be explored such as the relative weight of evidence, sequential and simultaneous conveyances, easements and rights of way, and the public land survey system. **Prerequisite:** CIVE2205 or CONM2000 (3 credits) spring

**CIVE3500 DESIGN STUDIO LAB**

This experiential studio will link several of the civil engineering disciplines in a series of three two-hour studios per week. The studios will be tied together by a common site and features developed by civil engineering faculty. **Prerequisite:** Junior standing (3 credits)

**CIVE3700 HIGHWAY ENGINEERING**

Introduction to principles of highway engineering, including the history of transportation engineering, fundamentals of traffic flow and driver characteristics, intersection design and control, capacity and level of service of highways and intersections, geometric design of highways, highway drainage, principles of pavements, design of flexible and rigid pavements, and pavement management. **Prerequisite:** CIVE2205 (4 credits) summer

**CIVE3800 SPECIAL TOPICS IN CIVIL ENGINEERING**

Presents topics that are not covered by existing courses and are likely to change from semester to semester. Refer to the Class Schedule for a specific semester for details of offerings for the semester. (1 - 4 credits)

**CIVE3900 HYDRAULIC ENGINEERING**

The course applies principle of fluid mechanics to the design and analysis of hydraulic systems. The course emphasizes open channel flow and addresses topics of interest to the Civil Engineer. Topics include hydraulic grade line calculations, pump design, culvert analysis and design, non-uniform flow, gutters and inlets, water distribution, open channel design. **Prerequisite:** CIVE3000 (4 credits) summer

**CIVE4000 CIVIL ENGINEERING DESIGN PROJECTS**

This course provides the student with an independent, project-based learning opportunity in a topic within the civil engineering discipline. EPIC Course **Prerequisite:** Senior status (4 credits) spring

**CIVE4050 BOUNDARY SURVEYING**

Building on the principles taught in Legal Aspects of Boundary Surveying, special boundary topics such as water boundaries, unwritten transfers, Torrens Title systems. Land Title Surveys, Survey Reports and writing legal descriptions will be covered along with the roles of statute and case law in the boundary determination process. Students will complete a final project that will involve making boundary decisions involving conflicting evidence. **Prerequisites:** CIVE3150 and CIVE3350 (3 credits) summer

**CIVE4100 WATER RESOURCES AND HYDROLOGY**

An introduction to surface water and groundwater hydrological processes and systems, including stormwater management, water supply and contaminant transport and modeling. **Prerequisite:** CIVE3000 (3 credits)

**CIVE4125 CIVIL ENGINEERING & PROJECT MANAGEMENT PRACTICES & PRINCIPLES**

Introduction and development of principles and practices to effectively manage civil projects through all phases, including inception/concept, design, planning, construction commissioning and completion. Emphasis will be placed on Financing, Scheduling, Value Engineering and Evaluation and Project Organization. **Prerequisite:** Senior Status (4 credits) spring

**CIVE4150 LAND USE PLANNING**

An introduction to land use planning and management approaches through the review of the theory and regulations involved in the planning and development of residential / commercial sites, subdivisions, office parks, and industrial parks. **Prerequisite:** CIVE2300 (3 credits) summer

**CIVE4175 ESTIMATING, SCHEDULING & PROJECT CONTROL**

An introduction to the Fundamentals of Construction Management, Construction Estimating, and Construction Scheduling. **Prerequisite:** CIVE2300 (3 credits) summer

**CIVE4200 GEOLOGY FOR CIVIL ENGINEERS**

Study of geological processes, structures and component elements to understand the behavioral effects on civil engineering works and resources, including; types of rocks and their origin, types and transportation of soils, groundwater occurrence and movement, earthquake causes and ramifications, subsurface investigation, and environmental and engineering geology. (3 credits)

**CIVE4225 ENVIRONMENTAL UNIT OPERATIONS**

In this course students will learn to characterize, design and evaluate environmental unit operations using mathematical, chemical and engineering concepts. The general operating fundamentals of physical, chemical and biological systems are presented. Special unit operations designed by environmental engineers are also reviewed and evaluated. This elective course is offered for students interested in environmental engineering and is a required course in the Environmental Engineering minor. **Prerequisite:** CHEM1100; **Corequisite:** CIVE3100 (3 credits)

**CIVE4250 STRUCTURAL STEEL DESIGN**

Introduction to the design of structural steel tension, compression and flexural members including connections. Design for combined loads is also introduced. Both member strength and serviceability requirements are considered. The LRFD philosophy of the latest AISC Steel Construction Manual is employed. **Prerequisite:** CIVE3200 (3 credits)

**CIVE4275 COMMERCIAL AND RESIDENTIAL SITE DESIGN**

This course studies the regulations and engineering principles involved in the planning and development of residential/commercial sites and subdivisions. Topics include lot layout and grading, wetlands regulations, low-impact development, stormwater management, and basic utility service design. **Prerequisites:** CIVE3700 and CIVE3900 (3 credits)

**CIVE4300 FOUNDATION ENGINEERING**

In this course, the fundamental concepts and principles of shallow and deep foundation design and in-service behavior are studied and applied. Conditions where shallow foundations are not appropriate are reviewed as is selection of appropriate types of deep foundations. Two foundation design projects are included in course work. **Prerequisite:** CIVE3300 (3 credits)

**CIVE4350 REINFORCED CONCRETE DESIGN**

Introduction to the design of reinforced concrete members including beams, columns and one-way slabs. Both member strength and serviceability requirements are considered. The design approach is ultimate strength consistent with the provisions of the latest edition of ACI-318. Relevant connection details associated with the design elements are also addressed. The use of commercial software to verify the student's design will be used to supplement the course. **Prerequisite:** CIVE3200 (3 credits)

**CIVE4375 WATER AND WASTEWATER TREATMENT**

This course provides an introduction to the principles of water and wastewater treatment, including the various treatment options and unit operation design. (3 credits)

**CIVE4400 MUNICIPAL PLANNING**

This course covers the regulations and engineering principles involved in the planning and development of residential and commercial sites, office parks, and industrial parks. **Prerequisite:** CIVE3900 (3 credits)

**CIVE4425 TRAFFIC SYSTEMS ANALYSIS**

Subjects include traffic signals and controls, traffic system analysis, microscopic level simulations, VBA coding, level of service analysis. **Prerequisite:** CIVE3700 (3 credits) spring

**CIVE5500 CIVIL ENGINEERING CAPSTONE DESIGN**

This course provides the student with a comprehensive, multidisciplinary, group, project-based civil engineering capstone design opportunity and allows these projects to be performed in an EPIC format. **Prerequisite:** CIVE4000 (4 credits) summer

**CIVE7000 CONSTRUCTION ENGINEERING MANAGEMENT**

This course presents principles and practices to effectively manage civil projects through all phases, including inception/concept, design, planning, construction commissioning and completion. Within this framework, students will learn the methodologies and tools necessary for each aspect of the process as well as the theories upon which these are built. Emphasis will be placed on estimating, life cycle cost analysis, financing structures, scheduling, value engineering, sustainability, project evaluation and project organization. (3 credits)

**CIVE7200 SUSTAINABLE INFRASTRUCTURE**

This course is an overview of sustainability engineering as it relates to infrastructure. Sustainable design principles will be assessed as they relate to urban planning, energy demand, water resources, transportation, building materials, and waste management. The course will include the review of the impact of infrastructure development on environmental management including water, storm water, energy, air quality, sprawl, and waste production, treatment, and storage. (3 credits)

**CIVE7275 ENVIRONMENTAL BIOLOGICAL SYSTEMS**

This course presents biological principles with an emphasis on biological processes in environmental engineering applications. Topics include aerobic and anaerobic microorganisms, biological wastewater processes, biological nutrients removal, disinfection, mechanisms and kinetics of biological reactions, and mass balances of biological reactors. The course will cover theory and practical applications using case studies. (3 credits)

**CIVE7300 TRAFFIC ANALYSIS & SAFETY**

Subjects include traffic capacity studies, traffic signals and control speeds studies, intersection analysis, traffic volume studies, sight distance evaluation, pedestrian facilities, multi-modal systems and traffic safety analysis. (3 credits)

**CIVE7350 CONSTRUCTION OPERATIONS, METHODS & QUALITY CONTROL**

This course imparts the knowledge and skills for students to achieve success in construction operations, methods and quality management systems (QMS) by understanding and evaluating civil engineering management principles as a formalized system that has documents, processes, procedures, and responsibilities in order to achieve quality policies and objectives. Topics in this course include the fundamentals and applications of engineering aspects of lifting and rigging, crane selection, erection and stability, dewatering and pumping, equipment production, productivity analysis and improvement, and temporary erosion control. (3 credits)

**CIVE7375 CONTAMINANT FATE AND TRANSPORT**

This course introduces the concepts of contaminant fate and transport processes in the environment, with consideration to exchanges across phase boundaries and the effects of reactions on environmental transport. Topics include equilibrium conditions at environmental interfaces; partitioning and distribution of contaminants in the environment; transport and exchange processes in surface water (dispersion and sorption); the movement of non-aqueous phase liquids in ground-water; and transport processes in the atmosphere. The level of coursework expects an undergraduate background in fluid mechanics, mass balances, and chemistry. (3 credits)

**CIVE7450 TEMPORARY STRUCTURES**

This course explores the design of temporary structures used in construction. Temporary structures include scaffolding, ground support systems, equipment bridges/trestles, concrete falsework and form work, cofferdams, and temporary support of existing structures. The focus is on safety and the engineering basics for the design of temporary structures. (3 credits)

**CIVE7500 ADVANCED FOUNDATION ENGINEERING**

In this course students' understanding of the principles and practices of foundation design are expanded beyond the basic introductory. In the first half of the course, students will learn many details and advanced applications related to the design of shallow foundations. During the second half, students will learn about numerous complex fundamentals inherent to the design of deep foundations. The level of coursework expects an undergraduate background in soil mechanics and foundation engineering. (3 credits)

**CIVE7550 ADVANCED SOIL MECHANICS**

This course focuses on the details of soil characteristics. It presents multiple soil-mechanics topics, including origin of soil, 1-D and 2-D flow through soil, settlement of soils due to excessive loading, shear strength of soil and stress paths, and stability of slopes. (3 credits)

**CIVE7575 PHYSICAL & CHEMICAL TREATMENT PROCESSES**

This course presents the physical and chemical principles for the treatment of dissolved and particulate contaminants in water and wastewater. These concepts will provide an understanding of the design of commonly used unit operations in treatment systems. Topics in the course include water characteristics, reactor dynamics/reaction kinetics, filtration, coagulation/flocculation, sedimentation, adsorption, disinfection, chemical oxidation, particulate removal, phase transfer processes, and redox processes. The level of coursework expects an undergraduate background in chemistry, physics, integral and differential calculus and an introductory course in environmental engineering at the undergraduate level. (3 credits)

**CIVE7600 ADVANCED STEEL DESIGN**

The course addresses advanced topics in structural steel design following the LRFD and AISC design specification. Structural steel topics included design of plate girders, composite steel members, and moment frames. Connection design will include bolted and welded connections using the instantaneous center approach, braced frame connections and moment frame connections. Seismic design of selected topics will also be addressed. The use of commercial software to verify student's design will be used to supplement the course. (3 credits)

**CIVE7650 INFRASTRUCTURE RENEWAL**

This course is designed for engineers and managers involved in infrastructure development, sustainability, and replacement. Topics include asset management, inspection, evaluation, maintenance, and renewal alternatives for waste collection and water distribution systems, surface and subsurface drainage, pavements, bridges, culverts, buildings, and other structures. (3 credits)

**CIVE7675 WATER REUSE APPLICATIONS**

This course focuses on the practical applications of water reuse in the built environment. Students will develop an understanding of water reclamation and reuse, regulations and guidelines, health risk analyses, and health and environmental considerations. The course will cover topics in satellite treatment systems, onsite and decentralized systems, distribution and storage of reclaimed water, irrigation and agricultural uses, industrial uses of reclaimed water, and environmental and recreational uses of reclaimed water. The level of coursework expects an undergraduate background in fluid mechanics, mass balances, and pumps. (3 credits)

**CIVE7800 GRADUATE SPECIAL TOPICS IN CIVIL ENGINEERING**

Presents topics that are not covered by existing courses and are likely to change from semester to semester. Refer to the Class Schedule for a specific semester for details of special topics course offerings. (3 credits)

**CIVE8100 ENGINEERING MODELING & ANALYSIS**

Computational approaches to modeling with applications in construction, structures, transportation, water resources and other civil engineering areas; matrix computations, digital terrain modeling, network applications and algorithms, heuristic optimization. Development of the finite element method with an emphasis on understanding the fundamental principles governing the analysis technique. Applications to two-dimensional solids with particular attention to applications in structural engineering. (3 credits)

**CIVE8250 ENGINEERING ESTIMATING & SCHEDULING**

Estimating subjects include quantity take-off methods, cost estimating, engineering economics and value engineering. Scheduling subjects include construction sequencing, CPM network analysis, activity time analysis, resource scheduling and time-cost trade-off. (3 credits)

**CIVE8400 HIGHWAY DESIGN & TRANSPORTATION PLANNING**

Design of roadway systems, including vertical and horizontal curves, super elevation, vertical and horizontal clearances, acceleration and deceleration, intersection and interchanges, traffic impact and capacity analysis and transportation planning. (3 credits)

**CIVE8550 SITE PLANNING & DEVELOPMENT**

The course provides a comprehensive review of land development for previously undeveloped and developed land. Engineering topics include land use and zoning requirements, earthworks, grading and land-forming, materials management, utility design and layout, road and parking works, environmental design and site work sequencing. Management topics include project financing, permitting, bidding and contracting. (3 credits)

**CIVE8700 BRIDGE DESIGN**

The course addresses the design of highway bridges using the AASHTO LRFD design specifications. Bridge types and the bridge selection process are discussed. The course addresses the design limit states, loads, load combinations, distribution factors and the principle of probabilistic design. The design of both steel (I-shaped and box girders) and concrete (AASHTO Standard I-shapes and bulb tees) are covered. Bridge design for other infrastructure system such as rail and transit will be discussed. The use of commercial software to verify student's design will be used to supplement the course. (3 credits)

**CIVE8900 DIRECTED PROJECTS**

This course provides the opportunity to develop and complete an independent project in the student's area of specialty that incorporates knowledge, tools, and techniques developed in the program. Students will work with a professor in their subdiscipline to create a scope of work, review current standards and literature, and develop a paper of journal quality to potentially be submitted to a professional or research journal. (3 credits) fall, spring