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

CIVE2900  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 and 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 shear 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
This course applies the principles of fluid mechanics to the design and analysis of hydraulic systems. The course emphasizes open channel flow and other topics of interest to the civil engineer. Topics include hydraulic grade line calculations, pump design, culvert analysis and design, base flow elevation studies using Hydro-CAD, non-uniform flow, gutters and inlets, water distribution, and 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. **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)

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: CIVE3300 (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

CIVE5000 PRESTRESSED CONCRETE DESIGN
This course introduces the design of prestressed concrete. It will address topics in prestressed concrete design following the ACI 318 and Building Code Requirements. Topics include the design elements for flexure, shear, torsion, compression and tension, two-way floor system and deflection. (3 credits)

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: Senior status (4 credits) summer

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)

CIVE8000 PROJECT MANAGEMENT PRINCIPLES & PRACTICES
Introduction and development of principles and practices to effectively manage civil projects through all phases, including inception, design, planning, construction commissioning and completion. Emphasis will be placed on Financing, Scheduling and Evaluation and Project Organization. (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. Prerequisites: CIVE8000 and CIVE8200 (3 credits)

CIVE8200 ENVIRONMENTAL SYSTEMS
Overview of infrastructural development. Sustainable design features for facilities including municipal, transit, industrial, telecommunications, and waste management. Impact of infrastructure development on environmental management including storm water quality and quantity, soil and channel erosion, air quality, sprawl, and waste production, treatment, and storage. (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. Prerequisite: CIVE8000 and CIVE8100 and CIVE8200 (3 credits)

CIVE8300 TRAFFIC ANALYSIS & SAFETY
Subjects include traffic capacity studies, traffic signals and controls, speed studies, intersection analysis, traffic volume studies, sight distance evaluation, pedestrian facilities, multi-modal systems and traffic safety analysis. Prerequisite: CIVE8000 and CIVE8100 and CIVE8200 (3 credits)

CIVE8350 CONSTRUCTION OPERATIONS, METHODS & QUALITY CONTROL
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. Prerequisite: CIVE8000 and CIVE8100 and CIVE8200 (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)

CIVE8450 TEMPORARY STRUCTURES
Fundamentals of engineered structures at a jobsite including construction loads, formwork, falsework and scaffolding, shoring and reshoring, concrete maturation and early strength evaluation, bracing, anchorage, cofferdams and relevant codes and standards. Prerequisite: CIVE8000 and CIVE8100 and CIVE8200 (3 credits)

CIVE8500 GEOTECHNICAL ENGINEERING FOR INFRASTRUCTURE
The diverse geotechnical and foundation engineering issues in design of infrastructure are covered, including technical principles and practical application of geotechnical design for both shallow and deep foundations, buried pipes, embankments and dams. The course emphasizes first the appropriate interpretation of site subsurface conditions as revealed through test borings and lab testing results. The selection of appropriate possible types of foundation systems and the design of foundations through appropriate analyses is covered. Load conditions on buried pipes and culverts are studied. Compaction of soil for earth embankments and earth dams is also studied, as are the potential for settlement and its mitigation. For each type structure, the designating of necessary construction constraints and specification content is reviewed. (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. Prerequisite: CIVE8000 and CIVE8100 and CIVE8200 (3 credits)
CIVE8600  ADVANCED STEEL & CONCRETE DESIGN
The course continues from basic steel and concrete design coursework. The course addresses advanced topics in structural steel and reinforced concrete design following the LRFD, AISC design specification and the ACI 318, Building Code Requirements. Structural steel topics included design of plate girders, composite steel and concrete members, and moment frames. Connection design will include bolted and welded connections using the instantaneous center approach, braced frame connections and moment frame connections. Reinforced concrete topics include the design of two-way slabs, deep beams using non-linear strain distribution and the strut and tie method, slender columns, and pile cap foundations. Seismic design of selected topics for both materials will also be addressed. The use of commercial software to verify student’s design will be used to supplement the course. (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 1-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. **Prerequisite:** CIVE8000 and CIVE8100 and CIVE8200 (3 credits)

CIVE8800  INFRASTRUCTURE RENEWAL
This course addresses fundamental engineering practices to inspect, evaluate, maintain, repair and replace aging infrastructure. Infrastructure systems studied in this course include bridges, tunnels, dams, utilities and highway and other transportation systems. The course will focus on infrastructure systems, primarily in urban settings. (3 credits)

CIVE8950  CAPSTONE
The course provides the student the opportunity to develop and complete an independent project in her/his chosen area of specialty that incorporates knowledge, tools and techniques developed in the program. Students may elect to perform a research-based project in their area of specialty provided on-campus or off-campus resources are available. **Prerequisite:** Final semester standing or by permission of the Department Chair (3 credits)