

# Course Descriptions

## 1. Required Courses

### **CIVE 205     Engineering Drawing** **1(0, 0, 2)**

Drawing equipment, lettering, Geometric construction, sketching, dimensioning, orthographic projections, points, lines, areas and solids, principal and auxiliary views, skew lines, distances between points, lines and plane surfaces, piercing points, shadow, perspective, surface development, applications.

**Prerequisite: CSC 101.**

### **CIVE 210     Statics** **3(3, 0, 0)**

A course outlining vector mechanics of forces and moments; free-body diagrams; equilibrium of particles and rigid bodies in two and three dimensions; plane and space trusses; frames and machines; axial, shear, and moment diagrams of beams and simple frames; friction; center of gravity and centroid; area moment of inertia; computer applications.

**Prerequisite: PHYS 101**

**Co-requisite: MATH 101.**

### **CIVE 211     Structural Mechanics** **3(3, 0, 0)**

A course on stresses, strains, and stress-strain relationship; tension and compression; torsion of circular bars; bending and shear stresses in beams; combined stresses; stress transformation and Mohr's circle.

**Prerequisite: CIVE 210.**

### **CIVE 215     Computer Aided Engineering Drawing** **1(0, 0, 2)**

Introduction to Computer Aided Drawing (AutoCAD) Software, Drawing limits, grid setting and drawing aids, coordinate system, Drawing tools ( point, line , ray, multi-line, poly-line, polygons, rectangle, arc, circle, ellipse), Modify tools ( copy, erase, offset, move, rotate, lengthen, terminate, fillet, chamfer, array), Layers, Zoom, dimensions, text, hatch, isometric drawing.

**Perquisite: CIVE 205.**

### **CIVE 220     Engineering Materials** **3(3, 0, 0)**

This course introduces Civil Engineering materials that include cement, aggregates, admixtures, plain concrete, steel, masonry, plastics and polymers. Concrete mix design, concrete curing and durability; construction equipment and technologies; hot and cold weathering concreting.

**Prerequisite: CHEM 101, CHEM 101L.**

### **CIVE 220L   Engineering Materials Lab** **1(0, 0, 2)**

Hands-on laboratory experiments to introduce students to testing different materials including cement, aggregates, admixtures, plain concrete, steel, masonry, and plastics.

**Co-requisite: CIVE 220.**

### **CIVE 240     Fluid Mechanics** **3(3, 0, 0)**

An introductory course on fluid behavior emphasizing conservation of mass, momentum, and energy and dimensional analysis; study of fluid motion in terms of the velocity field, fluid acceleration, the pressure field, and the viscous effects; applications of Bernoulli's equation, Navier- Stokes, and modeling; flow in ducts, potential flows, and boundary layer flows.

**Prerequisite: MATH 202, CIVE 211.**

### **CIVE 240L   Fluid Lab** **1(0, 0, 2)**

Hydrostatic, Fluids in motion, Open channel flow, Uniform flow, Non-uniform flow, Flow through pipelines, Flow over weirs and under sluice gates, Hydraulic machinery, Water pumps, Flow water Measurement.

**Co-requisite: CIVE 240.**

**CIVE 250      Environmental Engineering** **3(3, 0, 0)**

A course that introduces the fundamentals of environmental engineering. A screening course of major topics in environmental engineering including water and wastewater, environmental hydrology, environmental hydraulics and pneumatics, air, solid waste, noise, environmental modeling, and hazardous waste.

*Prerequisite: CHEM 101.*

**CIVE 260      Surveying** **2(1, 0, 2)**

A course on the theory of measurements and errors; linear measurements; surveying instruments; leveling; angles, bearings, and azimuths; stadia measurements; traversing–field aspects; traverse computations and adjustment; topographic surveying; triangulation.

*Prerequisite: MATH 101.*

**CIVE 260L      Surveying Lab** **1(0, 0, 1)**

Surveying lab covers the three basic surveying tools – the tape, level and transit/theodolite – along with proper field procedures for basic surveying, which include taking field notes, taping and EDM, leveling, bearings and azimuths, topography, and mapping. In addition, more advanced tools such as Total Station is also introduced.

*Co-requisite: CIVE 260.*

**CIVE 310      Structural Analysis I** **3(3, 0, 0)**

An introductory course covering stability and determinacy of structures; influence lines; deflection of beams and frames by double integration method, moment-area theorems, and conjugate beam; principle of virtual work and applications on beams, frames and trusses; introduction to indeterminate structures; approximate analysis of building frames.

*Prerequisite: CIVE 211.*

**CIVE 320      Concrete I** **3(3, 0, 0)**

A course that covers the mechanical properties of concrete materials; ultimate strength theory of flexure and shear; flexural and shear design of beams; service load behavior; bond properties of reinforcing bars; design of solid and ribbed one-way slabs; design of short, slender and bi-axially columns.

*Prerequisite: CIVE 220L, CIVE 211.*

**CIVE 330      Geotechnical Engineering** **3(3, 0, 0)**

A course on engineering geology, soil classification and index properties; soil structure and moisture; compaction; seepage; effective stress concept; compressibility and consolidation; stress and settlement analysis; shear strength.

*Prerequisite: CIVE 240.*

**CIVE 330L      Geotechnical Engineering Lab** **1(0, 0, 2)**

Water content determination, liquid and plastic limits, shrinkage limit, grain size distribution (sieve analysis), hydrometer analysis, compaction, in-situ field density, constant and falling head permeability tests, unconfined compression test, tri-axial test, direct shear test.

*Co-requisite: CIVE 330.*

**CIVE 340      Engineering Hydrology** **3(3, 0, 0)**

Outlining hydrologic cycle; precipitation, evaporation, transpiration, and infiltration; rainfall-runoff analysis; stream flow measurement; hydrograph analysis; frequency analysis; flood routing; simulation models; urban hydrology; hydrologic design.

*Prerequisite: CIVE 240.*

**CIVE 351      Water and Wastewater Treatment and Laboratory** **3(2, 0, 2)**

A course that examines the quality and treatment methods of water and wastewater; testing for physical, chemical, and biological parameters.

*Prerequisite: CIVE 240L, CIVE 250.*

**CIVE 360      Transportation Engineering** **3(2, 0, 2)**

A course that introduces the field of transportation engineering through a presentation of the basics of traffic engineering, traffic flow theory, and pavement design. A laboratory component consists of carefully structured experiments that reinforce students' understanding of the academic concepts and principles.

*Prerequisite: STAT 230, CIVE 260.*

**CIVE 400     Internship for CE Students****(1 Credit)**

An eight- to twelve-week professional training course in Civil Engineering.

*Prerequisite:* **Summer 4<sup>th</sup> year and 108 credits.**

**CIVE 410     Structural Analysis II****3(3, 0, 0)**

A course on the solution of statically indeterminate structures by flexibility (force) and stiffness methods for plane and space trusses and frames introduction to the direct stiffness method; influence lines for indeterminate structures; computer applications.

*Prerequisite:* **CIVE 310.**

**CIVE 412     Steel Design****3(3, 0, 0)**

A course that examines loads on structures; philosophies of design: LRFD versus ASD; behavior, analysis, and design (according to AISC) of tension members, bolted connections, welded connections, compression members, and beams.

*Prerequisite:* **CIVE 310.**

**CIVE 430     Foundation Engineering****3(3, 0, 0)**

A course that covers site investigations; evaluation of data from field and laboratory tests; estimation of stresses in soil masses; applications of principles of soil mechanics to determination of bearing capacity and settlement of spread footings, mats, single piles, and pile groups.

*Prerequisite:* **CIVE 330.**

**CIVE 460     Highway Engineering****3(3, 0, 0)**

A course that examines road vehicle performance; principles of geometric design and highways; horizontal and vertical alignment; earthwork; intersections and interchanges; parking facilities; basic traffic models; queuing theory and traffic analysis; travel demand forecasting.

*Prerequisite:* **CIVE 360.**

**CIVE 461     Pavement Design****3(3, 0, 0)**

A course examining highway and airport pavement design; flexible and rigid pavement types and wheel loads; stresses in flexible and rigid pavements; pavement behavior under moving loads; soil stabilization.

*Prerequisite:* **CIVE 360.**

**CIVE 461L   Pavement Lab****1(0, 0, 2)**

A course examining tests on mineral aggregate such as sieve analysis, specific gravity, absorption and CBR; the test on asphalt binder such as penetration, specific gravity, viscosity, softening point, ductility and flash and fire point, and Tests on asphalt paving mixtures using Marshal test, Skid Resistance, Extraction Test and stripping test.

*Prerequisite:* **CIVE 360, Co-CIVE 461.**

**CIVE 471     Quantity Surveying and Cost Estimation****2(2, 0, 0)**

Quantity surveying of earth, concrete reinforcing steel, electro-mechanical and finishing works; classification of costs; understanding the concepts of analogues, parametric and bottom-up detailed estimating techniques and applying those techniques in performing cost estimating of construction works with consideration to cost indexing, contingencies, and profits for determining unit rates and preparing final estimates and priced Bill of Quantities.

*Prerequisite:* **COEN 300, CIVE 260, CIVE 320, CIVE 330**

**CIVE 472     Contracts and Specifications****2(2, 0, 0)**

A course on the structure of contract documents, bidding requirements, general and detailed contract specifications, types of contracts, arbitration and legal requirements. Building structural specifications. Building finishing's specification.

*Co-requisite:* **COEN 401, CIVE 471**

**CIVE 480     Construction Management****3(3, 0, 0)**

A course on organizing for construction projects; pre-construction activities; bidding and contracts; fundamentals of construction planning, monitoring, and control; application of construction control

tools: CPM, materials management, operations analysis, and quality control.

*Co-requisite: CIVE 471, CIVE 472.*

**CIVE 498      Final Year Project I      (1 Credit)**

A chosen design topic of wide range of civil engineering application including structural, geotechnical, transportation, highway, material, hydrologic, water resources and environment and preparation of a detailed execution program for **CIVE 499**, through Define the project, State the objectives, Complete a literature survey, Set project specifications and master plan, Select a design method or experimental matrix.

*Prerequisite: Senior Standing, 108 credits, CIVE 320, CIVE 360, CIVE 351.*

**CIVE 499      Final Year Project II      (3 Credits)**

A supervised project in groups of normally three students aimed at providing practical design experience in a civil engineering application.

*Prerequisite: CIVE 498.*

**COEN 300      Engineering Economy      3(3, 0, 0)**

A course that covers principles, basic concepts and methodology for making rational decisions in the design and implementation of real engineering projects; time value of money, depreciation, comparing alternatives, effect of taxes, inflation, capital financing and allocation, and decision under uncertainty.

*Prerequisite: STAT 230.*

**COEN 401      Communication Skills and Ethics      1(1, 0, 0)**

A course on engineering ethics covering responsibility in engineering; framing the moral problem; organizing principles of ethical theories; computers, individual morality, and social policy; honesty, integrity, and reliability; safety, risk, and liability in engineering; engineers as employees; engineers and the environment; international engineering professionalism; and future challenges.

*Prerequisite: ENGL 102.*

## 2. Elective Courses

### ➤ *Elective Courses - General*

**CIVE 403      Special Topics in Civil Engineering      3(3, 0, 0)**

Any selected topic in the state-of-the-art in Civil Engineering.

*Prerequisite: discretion of advisor, 80 credits.*

**CIVE 470      Introduction to Geographic Information Systems      3(3, 0, 0)**

An introductory course on Geographic Information Systems (GIS) and their applications in the planning and engineering fields, alternatives in computer-based graphics, data concepts and tools, network data management and planning applications, and implementation issues.

*Prerequisite: CIVE 260*

### ➤ *Elective Courses - Structural*

**CIVE 411      Bridges      3(3, 0, 0)**

A course that discusses types of bridges; influence lines; loads and their distribution on bridges; serviceability of bridges; methods of design of bridge deck, superstructure, and substructure.

*Prerequisites: CIVE 310 and CIVE 320.*

**CIVE 420      Concrete II      3(3, 0, 0)**

A course that builds upon Concrete I and covers continuous beams; wall footings, concentrically and eccentrically loaded single column footings, and combined footings; staircases; bearing walls; cantilever retaining walls; two-way slabs.

*Prerequisite: CIVE 320.*

**CIVE 421      Special Topics in Concrete      3(3, 0, 0)**

A course that reviews reinforced concrete design; wind load on structures; seismic design of structures; design of shear walls; brackets, corbels, and deep girders; torsion in concrete members; circular, rectangular, and elevated water tanks; spherical, conoidal, and ellipsoidal domes.

*Prerequisite: CIVE 420.*

**CIVE 422      Pre-Stressed Concrete      3(3, 0, 0)**

A course on materials characteristics; prestress losses; working strength design procedures; composite construction; ultimate flexural strength and behavior; shear design; continuous pre-stressed concrete members.

*Prerequisite: CIVE 420.*

➤ *Elective Courses - Geotechnics*

**CIVE 423      Strength and Rehabilitation of Concrete Structural Systems      3(3, 0, 0)**

A course on assessment of structural deficiency using analytical and field test methods; strengthening materials; strengthening of structural members in flexure, shear, and axial load; upgrading of gravity load-designed members for earthquake load resistance.

*Prerequisite: CIVE 320.*

**CIVE 431      Applied Foundation Engineering      3(3, 0, 0)**

A course on braced excavations, retaining structures, deep foundations, slope stability, and computer applications.

*Prerequisite: CIVE 330.*

**CIVE 432      Environmental Geotechnics      3(3, 0, 0)**

A course on geotechnical practice in environmental protection and restoration; methods of soil and site characterization for sifting of waste repositories and site restoration; influence of physical and chemical processes in soils on the evaluation of contaminant distribution; design of waste containment systems including landfills, slurry walls, and soil stabilization; the applicability and use of geosynthetics; technologies for site restoration and cleanup.

*Prerequisite: CIVE 330.*

**CIVE 433      Soil and Site Improvement      3(3, 0, 0)**

A course that covers compaction, admixture stabilization, foundation soil treatment, reinforced soil and composite materials, and material sites reclamation.

*Prerequisite: CIVE 330.*

**CIVE 434      Geotechnical Earthquake Engineering      3(3, 0, 0)**

A course on causative mechanisms of earthquake, earthquake magnitudes, ground motion; influence of soil conditions on site response; seismic site response analysis; evaluation and modeling of dynamic soil properties; analysis of seismic soil-structure interaction; evaluation and mitigation of soil liquefaction and its consequences; seismic code provisions and practice; seismic earth pressures seismic slope stability and deformation analysis, seismic safety of dams and embankments, seismic performance of pile foundations, and additional current topics.

*Prerequisite: CIVE 330.*

➤ *Elective Courses - Transportation*

**CIVE 462      Urban Transportation Planning I      3(3, 0, 0)**

An introductory course on methods and models used in transportation planning with emphasis on the urban context.

*Prerequisite: CIVE 360.*

**CIVE 463      Traffic Engineering      3(3, 0, 0)**

A course outlining traffic engineering studies; traffic control of signalized and unsignalized intersections; signal control hardware and maintenance; arterial performance and operations; network optimization.

*Prerequisite: CIVE 360.*

**CIVE 464    Transportation Systems Analysis    3(3, 0, 0)**

A course on transportation and traffic problems in modern society. Among the topics covered are travel forecasting problems and methods; theoretical techniques for traffic flow description and management; highway, railway, and runway capacity and performance characteristics; economic considerations; cost functions.

***Prerequisite: CIVE 360.***

**CIVE 465      Design and Management of Transport Operations      3(3,0,0)**

A course that covers the application of quantitative techniques from operations research and probabilistic analysis to transportation problems. Applications covered include: pickup and delivery systems, emergency urban services, facility location, and network problems.

## CIVE 466    Transportation Economics    3(3, 0, 0)

A course that investigates the application of economic principles to the evaluation of projects and policies in the transport sector such as transport project benefits, costs, and financing, and pricing in the transport sector.

***Prerequisite: CIVE 360 and COEN 300.***

➤ *Elective Courses - Water Resources*

**CIVE 440     Hydraulics and Laboratory     3(2, 0, 2)**

Flow in conduits, flow in open channels, flow measurements, and laboratory experiments.

**CIVE 441     Hydraulic Structures** **3(3, 0, 0)**

A course that covers closed conduit flow, water distribution systems, transient analysis, open channel flow, flood control, culvert hydraulics, design of various hydraulic structures.

**CIVE 443      Groundwater Hydrology      3(3, 0, 0)**

A course that deals with properties of groundwater, groundwater movement, general flow equations, steady-state well hydraulics, seepage forces, unsteady well hydraulics, infiltration, and groundwater modeling.

**Prerequisite:** CIVE 340.

## CIVE 444    Hydraulics of Open Channels    3(3, 0, 0)

A course that examines gradually varied flow theory and analysis, spatially varied flow, and numerical modeling of unsteady flow in open-channels. ***Prerequisite: CIVE 240.***

<b>CIVE 445</b>	<b>Coastal Engineering</b>	<b>3(3, 0, 0)</b>
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A course on small-amplitude wave theory, finite-amplitude wave theory, conoidal waves, solitary wave theory, wave refraction, diffraction, and reflection, wave forces, and design of maritime structures (e.g., breakwaters). **Prerequisite:** CIVE 240.

<b>CIVE 446</b>	<b>Transport Phenomena in Surface and Subsurface Waters</b>	<b>3(3, 0, 0)</b>
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A course on advection, diffusion, and dispersion of pollutants; transport in rivers and estuaries; transport in groundwater; numerical modeling; design of wastewater discharge system.

## CIVE 447 Water Resources Systems: Planning and Management 3(3, 0, 0)

A course that introduces the main concepts and principles of water resources planning and management; logical steps in engineering planning and decision making; water resources systems analysis, modeling, simulation, and optimization; economic and financial analysis; flood protection and reservoir operation; and water resources management case studies.

**CIVE 448    GIS for Water Resources and Environmental Engineering    3(3, 0, 0)**

A course that introduces the concepts and principles of Geographic Information Systems (GIS) from the perspective of water resources and environmental engineering. It provides coverage of state-of-the-art GIS methods and tools, specifically targeting water resources and environmental applications including: spatial and terrain analysis, geo-statistical analysis, watershed delineation and identification of river networks, representation of groundwater and aquifer systems, time series analysis, and development of GIS integrated water and environmental models. ***Prerequisite: CIVE 260.***

➤ *Elective Courses – Environmental*

**CIVE 450      Methods of Environmental Sampling and Analysis      3(3, 0, 0)**

A course on sampling techniques and instrumental methods in environmental sciences; determination of pollutants in water, air, and soil; analytical techniques; adaptation of procedures to specific matrices; case studies. ***Prerequisite: CIVE 250.***

**CIVE 451      Environmental Chemistry and Microbiology      3(3, 0, 0)**

A course that deals with organic, inorganic, and physical chemistry; chemical equilibrium; reaction kinetics; acidity, alkalinity; composition, morphology, and classification of microorganisms; energy, metabolism, and synthesis; growth, decay, and kinetics; biological water quality indicators.

**CIVE 452      Environmental Management and Decision Making      3(3, 0, 0)**

A course that deals with mathematical programming techniques, multi-objective optimization, and the generation of alternatives, as these are used in environmental systems analysis and management; as well as introducing how considerations such as economics, uncertainty, equity, and other sociopolitical parameters may influence environmental management and decision-making.

**CIVE 453      Water and Sewage Works Design      3(3, 0, 0)**

A course that examines the design of water and wastewater schemes, including design reports and a literature search on the development of conventional treatment processes.

**CIVE 454 Solid Waste Management I 3(3, 0, 0)**

A course on nature and effects of solid wastes including hazardous wastes; engineering management principles, practices, and techniques for management of solid wastes administration; solid waste generation, storage, collection and transport, processing, resource recovery, and disposal; trip to a local facility.

***Prerequisite: CIVE 351.***

<b>CIVE 455</b>	<b>Solid Waste Management II</b>	<b>3(3, 0, 0)</b>
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A course on the design of solid waste disposal schemes, including design reports and a literature search on the development of conventional treatment and disposal processes. **Prerequisite:** CIVE 454.

<b>CIVE 456</b>	<b>Air Pollution and Control</b>	<b>3(3, 0, 0)</b>
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An introductory course on air pollutants, sources, and effects; emissions estimates, regulations, and monitoring techniques; particulate matter characterization; meteorology and atmospheric dispersion; air pollution control processes. **Prerequisite:** CIVE 250.

<b>CIVE 457</b>	<b>Industrial/Hazardous Waste Management</b>	<b>3(3, 0, 0)</b>
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A course that deals with sources, quantity, and quality of industrial wastes; basic industrial waste treatment processes; major industries, types of wastes, and existing treatment practices; disposal and fate of industrial wastes.

**Prerequisites:** CIVE 451.

**CIVE 458    Environmental Impact Assessment                      3(3, 0, 0)**

A course that outlines theories and procedures of assessing environmental impact; analysis of the

**Prerequisite:** CIVE 250.

**3(3, 0, 0)**

***Prerequisite: discretion of advisor, 80 credits.***