

# CIVIL ENGINEERING (CIV)

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## **CIV 201 ENGINEERING GRAPHICS (2 Hours)**

This course is designed to equip students with skills to visualize and represent three-dimensional objects graphically. The course covers principles of computer-aided drafting and design (CADD) and includes substantial use of the AutoCAD software or equivalent. Students learn orthographic projection, two and three-dimensional drafting and pictorial drawings, graphics and charts as well as applications in various engineering approaches.

## **CIV 222 ENGINEERING MECHANICS I (3 Hours)**

This course covers the calculus-based statics of particles and rigid bodies, equilibrium, distributed forces, centroids, structures, trusses, frames, machines, forces in beams and cables, friction, moments of inertia, as well as real life examples for engineering applications and systems approach.

## **CIV 223 ENGINEERING MECHANICS II (3 Hours)**

This course covers calculus-based kinematics and kinetics of particles, planar kinetics of a rigid body including force and acceleration, work and energy, impulse and momentum, and vibrations with real life examples.

## **CIV 240 STRENGTH OF MATERIALS (3 Hours)**

The course covers topics including forces and stresses, axial loading, torsion, pure bending, transverse loading, shear force and bending moment diagrams, transformation of stress and strain, design of beams and shafts, deflection of beams, statically indeterminate problems, and real-life examples.

## **CIV 310 ENGINEERING SURVEYING (2 Hours)**

Prerequisite: PHY 211; Co-requisite: CIV 311.

Plane surveying, measurement of distances and angles, differential leveling, traverse adjustment and area computations, topographic surveying and contours, horizontal and vertical curves, surveying computations, elements of site plan, professional ethics in surveying.

## **CIV 320 STRUCTURAL ANALYSIS (3 Hours)**

Prerequisite: EN 240.

Analysis of statically determinate and indeterminate structures for fixed and moving loads. Equations of equilibrium and compatibility. Influence lines, and shear and moment envelopes. Analysis of forces and deflections in structures by methods of moment distribution, consistent deformation, and virtual work, computer analysis of structures, real life examples.

## **CIV 330 FLUID MECHANICS LECTURE (3 Hours)**

Prerequisite: EN 223, 240, and MATH 368; Co-requisite: CIVL 330.

Fluid properties and definition; fluid statics; fluid dynamics; Bernoulli equation and linear momentum; viscous flow; drag forces and boundary layer concepts; ideal flow; velocity potential and stream functions; dimensional analysis and dynamic similitude, real life problems.

## **CIV 340 INTRO TO ENVIRONMENTAL ENGINEER (3 Hours)**

## **CIV 355 ENGINEERING ECONOMY (3 Hours)**

This course covers the economic principles of multidisciplinary engineering problems and applications of the principles in real-world projects. The course acquaint students with calculations of capitalized costs, present worth, prospective rates of return, and annual costs, and economy of equipment replacement, market forces, and firm analysis.

## **CIV 360 DESIGN OF STEEL STRUCTURES (3 Hours)**

Prerequisite: CIV 320.

Engineering properties of steel, behavior and design of members subjected to fatigue, and combined loading and compression, plate girders composite beams, open-web joists and connections. Methods of allowable design stress, and load resistance factor design. Elements of plastic analysis and design. Framing systems and loads for industrial buildings and bridges, design constraints.

## **CIV 370 WATER RESOURCES ENGINEERING (3 Hours)**

Prerequisite: CIV 330 and CIVL 330.

This course is designed to review the fundamentals and practices of water resources engineering. Students will explore water resources engineering processes in the theoretical and applied realm in the fields of closed conduit (pipe) flow, open channel flow, surface water hydrology, and groundwater flow. Application of probability and statistical concepts along with the legal, economic and environmental considerations to the analysis and design of complex hydraulic and hydrologic systems will prepare interested student for future careers in water supply, wastewater, flood plain, storm water, and groundwater management.

## **CIV 380 INTRO TO GEOTECHNICAL ENGINEER (3 Hours)**

Prerequisite: EN 240, and CIV 330.

Co-requisite: CIVL 380. Engineering soil classification, flow of water in soils, soil permeability and seepage, concepts of effective stress, stress and compressibility of soils, primary and secondary consolidation settlement, time rate of settlement, soil compaction, soil shear strength, introduction to slope stability, critical thinking and engineering judgment.

## **CIV 390 INTRO TO TRNSPRTN ENGINEERING (3 Hours)**

Co-requisite: CIV 380. Introduction to planning practice and procedure, design, operation, management, and maintenance of transportation systems, with emphasis on urban issues. General characteristics of transportation engineering systems including streets, highways, transit, airways. Capacity considerations including time-space diagrams. Elementary dynamics of traffic and functional consideration of routes and terminals. Components of transportation engineering facility design including geometric design, earthwork, and pavements.

## **CIV 410 CAPSTONE DESIGN I (3 Hours)**

Prerequisite: CIV 340, 360, 390, and senior standing in civil engineering.

Group projects are introduced for senior students to work in teams to analyze and design civil engineering systems, and to consider various factors for design. These projects are aimed at understanding multi-disciplinary systems, interaction between design and construction professionals, realistic design constraints, economical issues, professional practice issues including importance of professional licensure and continuing education, contemporary issues, procurement of work, bidding vs. quality based selection processes. Oral presentation and written report are required.

## **CIV 411 CAPSTONE DESIGN II (3 Hours)**

Prerequisite: or co-requisite: CIV 410.

Continuation of Capstone Design I. Group projects for senior students to work in teams to design civil engineering systems. Understanding of multi-disciplinary systems, interaction between design and construction professionals, realistic design constraints, professional practice issues including importance of professional licensure and continuing education, procurement of work, bidding vs. quality based selection processes, engineering professionalism and ethics. Oral presentation and written report are required.

**CIV 420 DESIGN OF CONCRETE STRUCTURES (3 Hours)**

Prerequisite: CIV 320.

Engineering properties of concrete for design, analysis and design of reinforced concrete beams, columns, one-way and two-way slabs, footings, retaining walls, and frames, design of multi-story buildings, design constraints, major design project, introduction to prestressed concrete.

**CIV 430 FOUNDATION ENGINEERING (3 Hours)**

Prerequisite: CIV 380.

Shallow foundation analysis and factors to consider for design, subsurface investigations for design, bearing capacity and settlement, mat foundations, piles, caissons, lateral earth pressures and retaining walls, site improvement techniques, design of sheet pile walls and support systems, critical thinking and engineering judgment, ethical considerations.

**CIV 431 TRAFFIC ENGINEERING (3 Hours)****CIV 432 BRIDGE DESIGN (3 Hours)**

Prerequisite: CIV 360

This course covers design of new bridges and evaluation of existing bridges in accordance with current American Association of State Highway and Transportation Officials (AASHTO) specifications. The procedures and requirements of bridge design and evaluation will be discussed, and the corresponding AASHTO code provisions will be explained through examples. Main topics include overview and history of bridge engineering, bridge design and evaluation methods and procedures, bridge superstructure design, bridge substructure design, fatigue and fracture of steel bridges, bridge load rating, advanced methods and technologies for bridge condition assessment, and case studies.

**CIV 441 WATER AND WASTEWATER TREATMENT (3 Hours)**

Prerequisite: CHEM 141, CHML 141, CIV 340, and CIVL 340.

Theories, engineering principles, and design of modern water supply and wastewater treatment processes. Physical-chemical process, including screening, sedimentation, aeration, coagulation, flocculation, filtration, absorption, softening, and disinfection. Biological processes including activated sludge process and anaerobic processes for wastewater and sludge digestion, with emphasis on urban issues. Completion of a design project.

**CIV 451 COMPTR METHODS IN CIV ENGINEER (3 Hours)**

This course is designed to acquaint Civil Engineering students with the uses of computer programs including Microsoft Excel, MATLAB, MathCAD, ArcGIS-based HEC-RAS and HEC-HMS, and MicroStation in solving civil engineering problems and designing civil engineering systems.

**CIV 452 Construction Project Management (3 Hours)**

Prerequisite: CIV 201, CIV 240, and CIV 355

The course covers fundamental knowledge of Construction Management functions including Project Management, Cost Management, Time Management, Quality Management, Contract Management, and Safety Management. Emphasis is put on the application of each function throughout the project phases in developing problem solving skills for real world engineering applications.

**CIV 453 CONSTRUCTION ESTIMATING (3 Hours)**

Prerequisite: CIV 201, CIV 240, and CIV 355

The course covers the fundamental knowledge of quantity take-off and cost estimating of construction resources including materials, labor, and equipment. Topics include types of cost estimates, budget estimates, preconstruction services estimates, quantity take-off, self performed work estimates, subcontractor work estimates, and bid preparation in developing problem solving skills for real world engineering applications.

**CIV 454 CONSTRUCTION SCHEDULING (3 Hours)**

Prerequisite: CIV 355

This course aims to increase and improve the working knowledge of students in project scheduling and to train them as professional construction managers as stated in the program mission. Students will be provided an understanding of planning, scheduling, and monitoring of construction projects including development of critical path networks, Gantt bar charts and construction cost control and reporting practices. The students will also learn how to use the software tools to accurately prepare and analyze the project schedule and to effectively communicate the schedule to the management team.

**CIV 455 BUILDING INFORMATION MODELING AND INTEGRATED PROJECT DELIVERY (3 Hours)**

Prerequisite: CIV 355

This course covers the Building Information Modeling (BIM) and Integrated Project Delivery (IPD) approaches that address and resolve the perceived inefficiencies in the construction industry. BIM covers geometry, spatial relationships, geographic information, quantities, and properties of building components and can be used to demonstrate the entire building lifecycle including the processes of construction and facility operation. IPD deals with the integration of people, systems, business structures and practices into a single process and collaboratively harness the talents and insights of all participants on a particular construction project in order to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.

**CIV 461 PROF & ETHCL IS IN CIVIL ENGIN (1 Hour)**

Prerequisite: senior standing in civil engineering.

The task of this course is to reflect on the professional and ethical responsibilities of engineers, which can sometimes conflict with technical responsibilities. This course will articulate an ethical framework for engineers by critically reflecting on engineering practice and examining the ethical challenges that confront engineers working within teams and organizations. The course covers issues such as the social responsibility of engineers, attitudes, truth-telling and disclosure, whistleblowing, professionalism, contemporary issues, and risk-assessment.

**CIV 466 ADVD DESIGN OF HYDRAULIC STRUC (3 Hours)**

Prerequisite: CIV 370.

Analysis and characteristics of flow in open channels (natural and artificial); channel design considerations including uniform flow (rivers, sewers), flow measuring devices (weirs, flumes), gradually varied flow (backwater and other flow profiles, flood routing), rapidly varied flow (hydraulic jump, spillways), and channel design problems (geometric considerations, scour, channel stabilization, sediment transport); analysis and design of hydraulic structures such as dams, spillways, etc., based on economic, environmental, ethical, political, societal, health, urban issues, and safety considerations.

**CIV 468 HAZARDOUS WASTE ENGINEERING (3 Hours)**

Prerequisite: CHEM 241, CHML 241, CIV 340, and CIVL 340.

Comprehensive study of the complex, interdisciplinary engineering principles involved in hazardous waste handling, collection, transportation, treatment, and disposal. Also covered are waste minimization, site re-mediation, and regulations important for engineering applications. Design constraints, engineering judgment, and ethical responsibility are covered. Contemporary hazardous waste issues and urban issues are also addressed.

**CIV 475 PAVEMENT DESIGN (3 Hours)**

Prerequisite: CIV 380 and 390.

Aggregate, binder systems. Theory and design of pavement structures, rigid and flexible pavement design, subgrade materials, pavement management, nondestructive testing, pavement maintenance, design constraints, infrastructure maintenance, major design project.

**CIV 476 ADVANCED DESIGN OF STEEL STRUCTURE (3 Hours)**

Prerequisite: CIV 360.

Behavior and design of members subjected to fatigue, dynamic, combined loading. Methods of allowable design stress, and load resistance factor design. Design of continuous beams, plate girders, composite beams, open-web joists, connections, torsion and plastic analysis and design. Framing systems and loads for industrial buildings and bridges, design constraints and a major design project.

**CIV 477 ADVANCED DESIGN OF CONCRETE STRUCTURE (3 Hours)**

Prerequisite: CIV 420.

Theory and design of reinforced concrete continuous beams, slender columns, two-way slabs, footings, retaining walls, shear walls and multi-story buildings. Design for torsion and design constraints. Framing systems and loads for buildings and bridges, design constraints and a major design project.

**CIV 481 SPECIAL PROBLEMS IN CIVIL ENGINEERING (3 Hours)**

Prerequisite: departmental approval.

Individual investigation in a recognized major area of civil engineering of particular interest to the students that are not normally covered in regular courses. May include a co-op project.

**CIV 491 INTERNSHIPS IN CIVIL ENGINEERING I (1-3 Hours)****CIV 492 INTERNSHIPS IN CIVIL ENGINEERING II (1-3 Hours)**