

# CIVIL ENGINEERING (CIVE)

## **CIVE 101 Introduction to Civil Engineering Fundamentals (3 Units)**

Corequisite: MATH 149 or higher math or appropriate AP test score. Introduction to Civil Engineering. Basic concepts of civil engineering practice including communication skills, problem solving skills, professional ethics/goals, and teamwork. Introduction to professional level software including spreadsheets, database, and mathematical computation. (Formerly 4300:101)

## **CIVE 102 Tools for Civil Engineering (3 Units)**

Prerequisite: CIVE 101. Building on concepts of engineering practices learned in Tools I further developing communication skills, problem solving skills, professional ethics/goals, statistics and model-building, and teamwork. Advanced use of professional level software including CAD, MATLAB and Excel. (Formerly 4300:102)

## **CIVE 201 Statics (3 Units)**

Corequisites: MATH 222 and PHYS 291. Forces, resultants, couples; equilibrium of force systems; distributed forces; centers of gravity, analysis of simple structures; moments of inertia; kinematics. (Formerly 4300:201)

## **CIVE 202 Introduction to Mechanics of Solids (3 Units)**

Prerequisite: CIVE 201. Axial force, bending moment diagrams, axial stress and deformation; stress-strain diagrams; torsion; flexural stress; flexural shearing stress; compound stresses; indeterminate beams; columns. (Formerly 4300:202)

## **CIVE 306 Theory of Structures (3 Units)**

Prerequisite: CIVE 202. Stability and determinacy; statically determinate trusses and frames; approximate frame analysis influence lines; moving loads; virtual work analysis; moment area theorem; theorem of three moments; moment distribution for continuous beams and frames. (Formerly 4300:306)

## **CIVE 313 Soil Mechanics (3 Units)**

Prerequisites: CIVE 202 and admission to an engineering major within the College of Engineering and Polymer Science or permission. Physical properties of soils. Soil water and groundwater flow. Stresses, displacements, volume changes, consolidation within a soil mass. Soil strength. Compaction. (Formerly 4300:313)

## **CIVE 314 Foundation Design (3 Units)**

Prerequisites: CIVE 313 and full admission to an engineering major in the College of Engineering and Polymer Science. Subsurface exploration, shallow foundations, earth retaining structures, deep foundations (Formerly 4300:314)

## **CIVE 321 Introduction to Environmental Engineering (3 Units)**

Prerequisites: CHEM 153 and MATH 222. Basic principles of ecosystems, microbiology, chemical reactions, and material flow that environmental engineers use to protect our water, air and soil. (Formerly 4300:321)

## **CIVE 323 Water Supply & Pollution Control (3 Units)**

Prerequisite: CIVE 321 and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisite: MATH 335. Water and wastewater characteristics, criteria, quantities and distribution. Water and wastewater treatment process flowsheets, design and operation. Wastewater and residue disposal. (Formerly 4300:323)

## **CIVE 341 Hydraulic Engineering (3 Units)**

Prerequisites: MECE 310 and admission to an engineering major within the College of Engineering and Polymer Science. This course will focus on presentation and application of fundamental hydraulic principles in both the classroom and laboratory. Examination of flow in pipelines and pipe networks, pumps and pumping stations, hydrology, flow in open channels, groundwater hydraulics, and design of hydraulic structures will be studied. Emphasis will be placed on proper application of principles, data interpretation and analysis, problem solving, and report writing. (Formerly 4300:341)

## **CIVE 361 Transportation Engineering (3 Units)**

Prerequisites: Junior standing and admission to an engineering major within the College of Engineering and Polymer Science. Introductory survey of transportation topics including transportation planning requirements and techniques, introduction to design of highways, airports and railroads and introduction to traffic engineering. (Formerly 4300:361)

## **CIVE 380 Engineering Materials Laboratory (3 Units)**

Prerequisites: CIVE 202 and admission to an engineering major within the College of Engineering and Polymer Science. Fundamentals and applications of materials science, mechanics of solids and study of laboratory instrumentation and standard techniques in testing of engineering materials. (Formerly 4300:380)

## **CIVE 401 Steel Design (3 Units)**

Prerequisites: CIVE 306 and admission to an engineering major within the College of Engineering and Polymer Science. Tension, compression members; open web joists; beams; bearing plates; beam-columns; bolted, welded connections. (Formerly 4300:401)

## **CIVE 403 Reinforced Concrete Design (3 Units)**

Prerequisites: CIVE 306 and admission to an engineering major within the College of Engineering and Polymer Science. Ultimate strength analysis and design; compression steel; diagonal tension; stirrups; development length; one-way slab; T-beams; two-way slabs; columns; isolated and combined footings. (Formerly 4300:403)

## **CIVE 404 Advanced Structural Design (3 Units)**

Prerequisites: CIVE 401 and CIVE 403. Composite design; plate girders; plastic design; cantilever retaining walls; torsion in R/C members; deflection of R/C members; continuous girder bridge design. (Formerly 4300:404)

## **CIVE 407 Advanced Structural Analysis (3 Units)**

Prerequisite: CIVE 306. Energy methods for beams and frames. Stiffness and flexibility formulations for framed structures using classical and matrix methods. Introduction to stability and plastic analysis. Warping-Torsion behavior of beams. Analysis of axisymmetric circular plates and membrane shells. (Formerly 4300:407)

## **CIVE 414 Design of Earth Structures (3 Units)**

Prerequisite: CIVE 314 or permission. Design of earth structures: dams, highway fills, cofferdams, etc. Embankment construction techniques, quality control, embankment analysis, instrumentation, foundation soil stabilization, seepage analysis and control. Design problem. Graduate students will perform more advanced analysis and design. (Formerly 4300:414)

## **CIVE 418 Soil & Rock Exploration (3 Units)**

Prerequisite: CIVE 314 or permission. Site exploration criteria and planning. Conventional boring, sampling and in situ testing methods. Theory and application of geophysics and geophysical methods including seismic, electrical resistivity, gravity, magnetic and radioactive measurements. Air photo interpretation. (Formerly 4300:418)

**CIVE 423 Chemistry for Environmental Engineers (3 Units)**

Prerequisite: One year of college chemistry. General, physical, organic biochemistry, equilibrium, and colloid chemistry concepts applied to Environmental Engineering. Concepts are used in water and wastewater laboratory. (Formerly 4300:423)

**CIVE 424 Water-Wastewater Laboratory (1 Unit)**

Corequisite: CIVE 323 or permission. Analysis of water and wastewater. (Formerly 4300:424)

**CIVE 426 Environmental Engineering Design (3 Units)**

Prerequisite: CIVE 323. An introduction to the physical, chemical and biological processes utilized in the treatment of water and wastewater, with design parameters emphasized. (Formerly 4300:426)

**CIVE 427 Water Quality Modeling & Management (3 Units)**

Prerequisite: CIVE 323. Analysis and simulation of the physical, chemical and biochemical processes affecting stream quality. Development of management strategies based upon the application of water quality modeling techniques to environmental systems. (Formerly 4300:427)

**CIVE 428 Hazardous & Solid Wastes (3 Units)**

Prerequisite: Senior standing or permission of instructor. Hazardous and solid waste quantities, properties and sources are presented. Handling, processing, storage and disposal methods are discussed with non-technical constraints outlined. (Formerly 4300:428)

**CIVE 441 Hydraulic Design (3 Units)**

Prerequisite: CIVE 341. Collection and critical evaluation of hydraulic data related to actual design problem selected by instructor. Development and analysis of design alternatives. Preparation of reports. (Formerly 4300:441)

**CIVE 443 Applied Hydraulics (3 Units)**

Prerequisites: CIVE 341 and admission to an engineering major within the College of Engineering and Polymer Science. Review of design principles: urban hydraulics, stream channel mechanics, sedimentation, coastal engineering. (Formerly 4300:443)

**CIVE 445 Hydrology (3 Units)**

Prerequisite: CIVE 341. Surface water hydrology, water cycle, precipitation, evaporation, stream flow. Principles of hydrologic systems and their analysis. Hydrologic simulation, reservoir planning and water supply studies. Analysis of rainfall and floods. (Formerly 4300:445)

**CIVE 448 Hydraulics Laboratory (1 Unit)**

Prerequisite: CIVE 341. Introduction to laboratory and field devices for hydraulic measurements. Reduction and presentation of hydraulic data. Individual assignments of model studies of hydraulic structures. (Formerly 4300:448)

**CIVE 450 Urban Planning (2 Units)**

Historical developments in urban planning; urban planning techniques and patterns; comprehensive master planning studies; planning regulations; design problems; class projects; class project presentation. (Formerly 4300:450)

**CIVE 451 Computer Methods of Structural Analysis (3 Units)**

Prerequisite: CIVE 306. Computer methods of structural analysis. Finite element software and interactive graphics. Stiffness concepts and matrix formulation of beams; modeling of simple and complex structural systems; vibration analysis using microcomputers. (Formerly 4300:451)

**CIVE 452 Structural Vibrations & Earthquakes (3 Units)**

Prerequisite: CIVE 306. Vibration and dynamic analysis of structural systems with one, two, or more degrees of freedom; beams, frames, buildings and bridges. Numerical methods of analysis. Elastic-plastic systems. Earthquake analysis of design. Earthquake codes. (Formerly 4300:452)

**CIVE 453 Optimum Structural Design (3 Units)**

Prerequisite: CIVE 306. Basic concepts in structural optimization. Mathematical programming methods including unconstrained minimization, multidimensional minimization and constrained minimization. (Formerly 4300:453)

**CIVE 454 Advanced Mechanics of Materials (3 Units)**

Prerequisite: CIVE 202 or equivalent. Three-dimensional state of stress and strain analysis. Unsymmetric bending of straight and curved members with shear deformation. Beams on elastic foundations. Saint Venant's torsional problems. Inelastic analysis of bending and torsional members. Introduction to energy method. Instability behavior of prismatic members. (Formerly 4300:454)

**CIVE 463 Transportation Planning (3 Units)**

Prerequisite: CIVE 361. Theory and techniques for development, analysis and evaluation of transportation system plans. Emphasis on understanding and using tools and professional methods available to solve transportation planning problems, especially in urban areas. (Formerly 4300:463)

**CIVE 464 Highway Design (3 Units)**

Prerequisite: CIVE 361. Study of modern design of geometrical and pavement features of highways. Design problem and computer use. Graduate students will produce a more complete design. (Formerly 4300:464)

**CIVE 465 Pavement Engineering (3 Units)**

Prerequisite: CIVE 361. Theories of elasticity, of viscoelasticity and of layered systems as applied to pavements. Pavement materials characterization; pavement design, pavement restoration for rigid and flexible pavements. (Formerly 4300:465)

**CIVE 466 Traffic Engineering (3 Units)**

Prerequisite: CIVE 361. Vehicle and urban travel characteristics, traffic flow theory, traffic studies, accidents and safety, traffic signs and marking, traffic signal planning, traffic control and transportation administration. (Formerly 4300:466)

**CIVE 467 Advanced Highway Design (3 Units)**

Prerequisites: CIVE 464, autoCAD capability, or permission. Computer-aided geometrical design of highways including survey data input, digital terrain modeling, cross-section templates, horizontal and vertical roadway design, earthwork computations, and advanced topics. (Formerly 4300:467)

**CIVE 468 Highway Materials (3 Units)**

Prerequisites: CIVE 361 and CIVE 380 or permission. Properties of aggregates, manufacture and properties of portland cement concrete, properties of asphaltic materials, design and testing of hot mix asphalt pavement mixes and of surface treatments. Laboratory preparation of specimens and determination of properties. Graduate student requirement: Graduate students will be required to perform an additional eight-hour asphalt laboratory (Absorption recovery of asphalt from solution) and to prepare a paper on a highway materials topic. (Formerly 4300:468)

**CIVE 471 Construction Administration (3 Units)**

Prerequisites: Junior standing and full admission to an engineering major in the College of Engineering and Polymer Science. Construction management functions, scheduling techniques for construction projects, scheduling PERT networks and linear operations, estimating building projects, construction contracts and legal structure, construction finance, engineering economics, equipment productivity, machine power, equipment selection and utilization, equipment cost, construction safety, construction trends, LEED construction. (Formerly 4300:471)

**CIVE 472 Construction Engineering (3 Units)**

Prerequisite: Senior standing or permission. Construction equipment selection and management. Techniques of various engineering construction operations including blasting, tunneling, concrete framework and dewatering. (Formerly 4300:472)

**CIVE 473 Construction Materials (2 Units)**

Prerequisites: CIVE 380 and CHEE 305. Composition, structure and mechanical behavior of structural materials such as concrete, wood, masonry, plastics and composite materials. Discussion of applications and principles of evaluating material properties. (Formerly 4300:473)

**CIVE 474 Underground Construction (2 Units)**

Prerequisite: CIVE 314. Description of practices and techniques of underground construction. Selection of proper method for individual job. Design of underground openings, support systems and linings. (Formerly 4300:474)

**CIVE 480 Reliability-Based Design (4 Units)**

Prerequisite: STAT 261 and senior standing. Probability concepts in civil engineering. Risk analysis and reliability based design. (Formerly 4300:480)

**CIVE 482 Special Projects: Civil Engineering (1-3 Units)**

Prerequisites: Senior standing and permission. Directed individual or group research or study in student's field of interest. Topic subject to approval by adviser. (Formerly 4300:482)

**CIVE 489 Fundamental of Engineering Exam Review (0 Units)**

Prerequisite: Senior standing. This course is intended to prepare civil engineering students for the Fundamentals of Engineering Exam, which is to be taken prior to graduation. (Formerly 4300:489)

**CIVE 490 Senior Design in Civil Engineering (3 Units)**

Prerequisites: CIVE 323, CIVE 341, CIVE 361, CIVE 403, senior standing and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisites: CIVE 314 and CIVE 401. A civil engineering design project that emphasizes interdisciplinary teamwork to solve a substantial, currently relevant problem. (Formerly 4300:490)

**Gen Ed:** Capstone

**CIVE 497 Honors Project (1-3 Units)**

(May be repeated for a total of six credits) Prerequisite: Senior standing in Honors Program. Individual creative project or design relevant to civil engineering, supervised by faculty member of the department. (Formerly 4300:497)