

# CIVIL ENGINEERING (CE)

**NOTE: All prerequisites for Civil Engineering (CE) courses must be completed with a grade of "C-" or better.**

## Civil Engineering (CE) Courses

### CE 1301. Introduction to Civil Engineering. (1-0) 1 Credit Hour.

Prerequisites: Completion of or concurrent enrollment in MAT 1093 and WRC 1013. Engineering as a career, engineering ethics, and approaches to engineering problem formulation and solution using principles of design and decision making. Generally offered: Fall, Spring. Course Fees: L001 \$10; LRE1 \$25; STSE \$10.

### CE 2103. Civil Engineering Measurements. (2-3) 3 Credit Hours.

Prerequisite: CE 1301 and MAT 1213 (or MAT 1214 in previous catalogs). Principles of measurement and error analysis; application of equipment to acquire, analyze, and control data in civil engineering systems; and introduction to plane surveying. Generally offered: Fall, Spring, Summer. Course Fee: LRE1 \$25; STSE \$30.

### CE 2313. Computer-Aided Design in Civil Engineering. (3-0) 3 Credit Hours.

Prerequisites: EGR 1403 and completion of or concurrent enrollment in CE 2103. Organization and programming of civil engineering problems for computer solutions; application of computer-aided design in civil engineering. (Formerly CE 4313. Credit cannot be earned for both CE 4313 and CE 2313.) Generally offered: Fall, Spring, Summer. Course Fees: LRE1 \$25; STSE \$30; DL01 \$75.

### CE 2633. Environmental Engineering. (3-0) 3 Credit Hours.

Prerequisites: CE 1301 and CHE 1103. Principles, analysis, and design related to environmental monitoring, protection, and remediation systems. Topics include environmental quality and legislation, modeling, water treatment, wastewater treatment, solid and hazardous waste management, air and noise pollution, and radioactive waste management. Generally offered: Fall, Spring. Course Fees: DL01 \$75; LRE1 \$25; STSE \$30.

### CE 3103. Mechanics of Solids. (2-3) 3 Credit Hours.

Prerequisite: EGR 2103 and completion of or concurrent enrollment in EGR 3423. Internal forces and deformations in solids; stress, strain, and their relations; stresses and deflections in beams column theory and analysis; and engineering applications. (Same as ME 3813. Credit cannot be earned for both CE 3103 and ME 3813.) Generally offered: Fall, Spring. This course has Differential Tuition. Course Fee: DL01 \$75.

### CE 3113. Structural Analysis. (3-0) 3 Credit Hours.

Prerequisite: CE 3103. Forces and deflections in structural systems; considers stationary and moving loads and exact and approximate methods. Generally offered: Fall, Spring. This course has Differential Tuition.

### CE 3173. Numerical Methods. (2-3) 3 Credit Hours.

Prerequisite: EGR 2323 or EGR 3423. Use of numerical methods in solving civil and environmental engineering problems. Techniques for mathematical solutions of linear simultaneous equations; splines; root finding methods; finite differences; numerical integration; numerical solutions to ordinary differential equations; error analysis. Case studies in various civil engineering areas. (Same as EGR 3173. Credit cannot be earned for both EGR 3173 and CE 3173.) Generally offered: Fall, Spring. This course has Differential Tuition.

### CE 3213. Reinforced Concrete Design. (2-3) 3 Credit Hours.

Prerequisites: CE 3113 and completion of or concurrent enrollment in CE 3243. Ultimate strength theory and design for reinforced concrete members. Generally offered: Fall, Spring. This course has Differential Tuition. Course fee: DL01 \$75.

### CE 3223. Highway Engineering. (3-0) 3 Credit Hours.

Prerequisites: CE 2103 and completion of or concurrent enrollment in EGR 3713. General characteristics of highway design; horizontal and vertical alignment, cross-sections, earthwork, drainage, and pavement; and economic analysis. (Formerly CE 4123. Credit cannot be earned for both CE 4123 and CE 3223.) Generally offered: Fall, Spring. This course has Differential Tuition. Course fee: DL01 \$75.

### CE 3233. Steel Design. (2-3) 3 Credit Hours.

Prerequisite: Completion of or concurrent enrollment in CE 3113 and CE 3243. Analysis and design of steel tension members, beams, columns, and bolted or welded connections. Generally offered: Fall, Spring. This course has Differential Tuition.

### CE 3243. Properties and Behavior of Engineering Materials. (2-3) 3 Credit Hours.

Prerequisites: CE 3103 and STA 2303. Structure, properties, and behavior of engineering materials; measurement and analysis of material properties and behavior. Laboratory exercises illustrate typical material behavior and selected principles of mechanics. Generally offered: Fall, Spring. This course has Differential Tuition. Course fee: L001 \$30.

### CE 3413. Geotechnical Engineering and Applications. (2-3) 3 Credit Hours.

Prerequisite: CE 3103. Exploration, sampling, and in-situ measurements; laboratory testing; review of fundamental properties of soil and rock; flow-through porous media; the effective stress principle and computation of in-situ stress distributions; shear strength of soils and one-dimensional consolidation settlement; introduction to slope stability. Generally offered: Fall, Spring. This course has Differential Tuition. Course fee: L001 \$30; DL01 \$75.

### CE 3603. Fluid Mechanics. (2-3) 3 Credit Hours.

Prerequisite: EGR 2513. This course covers fluid properties, fluid statics and dynamics, including hydrostatic pressure and forces, conservation of mass and momentum principles, and Bernoulli and Work-Energy equations. Course concepts and tools are implemented to solve various engineering problems, including pipe flows and external flows. Concepts are demonstrated and quantified through laboratory experiments. Generally offered: Fall, Spring. This course has Differential Tuition. Course Fee: DL01 \$75.

### CE 4013. Civil Engineering Systems Analysis. (3-0) 3 Credit Hours.

Prerequisite: EGR 3713. Technical elective course. Systems approach to optimization and problem solving; operations research applications in civil engineering; mathematical modeling and analysis techniques including linear programming, dynamic programming, decision analysis and use of software to solve linear and nonlinear programming problems. (Formerly CE 3713. Credit cannot be earned for both CE 4013 and CE 3713.) This course has Differential Tuition. Course Fees: LRE1 \$25; STSE \$30.

### CE 4103. Advanced Steel Design. (3-0) 3 Credit Hours.

Prerequisite: CE 3233. Technical elective course. Connection design, welded and bolted, moment-resistant connections, plate girders, column stability, bracing design, and seismic design of frames. This course has Differential Tuition. Course Fee: DL01 \$75.

**CE 4133. Advanced Reinforced Concrete. (3-0) 3 Credit Hours.**

Prerequisite: CE 3213. Technical elective course. Design of concrete building systems including continuous one-way and two-way slab systems as well as vertical and lateral load resisting members such as slender columns and shear walls. This course has Differential Tuition.

**CE 4143. Introduction to Timber Design. (3-0) 3 Credit Hours.**

Prerequisite: Completion of or concurrent enrollment in CE 3113 and CE 3243. Technical elective course. Design philosophy and methodology for timber structures. Flexure design, axial load design, and shear design of basic timber components. (Formerly CE 3253 and CE 4253. Credit can only be earned for one of the following: CE 4143, CE 3253, or CE 4253.) This course has Differential Tuition. Course Fee: DL01 \$75.

**CE 4153. Prestressed Concrete. (3-0) 3 Credit Hours.**

Prerequisite: CE 3213. Technical elective course. Design of statically determinate and indeterminate structures, estimation of prestress loss, flexure and shear strength, deflections and stress control, composite construction, and continuous span theory. This course has Differential Tuition.

**CE 4163. Advanced Structural Analysis. (3-0) 3 Credit Hours.**

Prerequisite: CE 3113. Technical elective course. The class focuses on the matrix analysis method applied to structural analysis. The course will cover all the facets of the structural analysis method including the assembly of element and structure stiffness matrices, fixed end force and moment vectors, and nodal displacements. This course has Differential Tuition.

**CE 4173. Dynamics and Vibrations. (3-0) 3 Credit Hours.**

Prerequisite: CE 3113. Technical elective course. The class focuses on the fundamentals of structural dynamics, including single degree-of-freedom and multi-degree-of-freedom systems. The course presents common analysis techniques used to calculate the dynamic response of structures to different types of time-varying loads. This course has Differential Tuition.

**CE 4183. Experimental Stress Analysis. (3-0) 3 Credit Hours.**

Prerequisite: CE 3103 or ME 3813. Technical elective course. After completing the course students should be able to recognize and properly use different types of sensors for applications in experimental analysis of structures. Students should have acquired an understanding of the basic principles used to develop the sensors discussed in the class, to evaluate the quality of the data obtained from measurements, and to make adjustments to improve the quality of test data if necessary. This course has Differential Tuition.

**CE 4193. Fundamentals of Traffic Engineering. (3-0) 3 Credit Hours.**

Prerequisite: STA 2303. This is an introductory course that prepare students for more advanced classes on focused topics in traffic engineering. The course covers the full spectrum of key topics ranging from characteristics of the transportation system, analysis of flow and capacity, traffic counts, determination of level of service of various types of roads, traffic operations, traffic control devices, pedestrian/bicycle facilities, traffic safety, to introduction to Intelligent Transportation Systems (ITS). It will also introduce to students the basic theories behind the operation of signalized and un-signalized intersections. The course also provides an opportunity to get an introduction to emerging techniques in the area of transportation engineering. This course has Differential Tuition. Course Fee: DL01 \$75.

**CE 4223. Introduction to Masonry Design. (3-0) 3 Credit Hours.**

Prerequisite: Completion of or concurrent enrollment in CE 3113 and CE 3243. Technical elective course. Design philosophy and methodology for masonry structures. Flexure design, axial load design, and shear design of basic masonry components. (Formerly CE 3253 and CE 4253. Credit can only be earned for one of the following: CE 4223, CE 3253, or CE 4253.) This course has Differential Tuition. Course Fee: DL01 \$75.

**CE 4283. Design of Buildings for Lateral Loads. (3-0) 3 Credit Hours.**

Prerequisite: Completion of or concurrent enrollment in CE 3213 and CE 3233. Technical elective course. Understanding and application of lateral loads to the design of steel, concrete, wood and masonry structures. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**CE 4293. Geographic Information Systems (GIS). (3-0) 3 Credit Hours.**

Prerequisite: CE 2103 or GEO 4023. Technical elective course. Introduces vector, raster and tabular concepts, emphasizing the vector approach. Topics include: spatial relationships, map features, attributes, relational database, layers of data, data ingesting, digitizing from maps, projections, output, applications, and availability of public data sets. Focus will be placed on spatial/temporal data analyses using digitized maps and database information in an area of Civil Engineering specialization. This course has Differential Tuition. Course Fee: DL01 \$75.

**CE 4303. Hydrometeorology. (3-0) 3 Credit Hours.**

Prerequisite: CE 3603. Technical elective course. The main objective of this course is to familiarize the student with topics related to local and global distribution of freshwater. Conceptualizations of the water balance/budget are developed using principles of physical hydrology and meteorology. Emphasis will be on recent research and modern methods for data analysis and modeling. Real-life events and phenomena will be discussed. In addition to the text, material will be presented from other sources. Guest instructors will give presentations on some case studies. This course has Differential Tuition.

**CE 4403. Advanced Characterization of Highway Materials. (3-0) 3 Credit Hours.**

Prerequisite: CE 3243. Technical elective course. Basic and advanced level of the fundamentals of material response to static and repeated loading; emphasis on the deformation and fatigue behavior of asphalt mixtures, constitutive modeling for mixtures, microstructure characterization for mixtures, nondestructive testing of pavements, asphalt binder characterization, unbound materials (base and sub-base materials) evaluation and characterization. This course has Differential Tuition.

**CE 4453. Transportation Engineering. (3-0) 3 Credit Hours.**

Prerequisite: CE 3223. Technical elective course. Study of the Highway Capacity Manual, traffic stream parameters and relationships, analytical techniques in traffic engineering such as capacity analysis, queuing theory, and traffic simulation. Design and operation of advanced traffic management systems including signalization, real-time motorist information, urban incident management, and ITS concepts. (Formerly CE 4233. Credit cannot be earned for both CE 4453 and CE 4233.) This course has Differential Tuition.

**CE 4463. Foundation Engineering. (3-0) 3 Credit Hours.**

Prerequisite: CE 3413. Technical elective course. Shallow and deep foundations including: footings, slabs on-grade, cofferdams, sheet-pile walls, drilled shafts, piles and retaining walls. (Formerly CE 4413. Credit cannot be earned for both CE 4463 and CE 4413.) Generally offered: Fall. This course has Differential Tuition. Course fee: DL01 \$75.

**CE 4543. Project Design and Construction Management. (3-0) 3 Credit Hours.**

Prerequisites: EGR 3713, CE 3113, CE 3173, and either CE 3213 or CE 3233. Civil Engineering design process, project specifications, and construction management. Topics covered include design process/practices, project proposals, pricing, specifications, bidding strategies, project management/scheduling and project financing. The course forms the student teams for CE 4813 Civil Engineering Design and identifies projects. Students are trained on how to write Request for Proposals (RFPs) for the identified projects and how to write engineering consulting proposals in reply to the RFP. Students are also trained on how to present proposals to a panel of senior engineers at the end of the semester. Course must be taken the semester prior to taking CE 4813. (Formerly CE 3543. Credit cannot be earned for both CE 3543 and CE 4543.) This course has Differential Tuition. Course fee: DL01 \$75.

**CE 4603. Water Resources Engineering. (3-0) 3 Credit Hours.**

Prerequisites: CE 3173, CE 2633, and CE 3603. Analysis and design of surface and subsurface water resource facilities. Design of water supply, wastewater collection, and storm water systems. Generally offered: Fall, Spring. This course has Differential Tuition. Course fee: DL01 \$75.

**CE 4613. Environmental Chemistry. (3-0) 3 Credit Hours.**

Prerequisite: CE 4633. Technical elective course. This course explores the chemistry of the environment, the chemistry underlying environmental problems and solutions to environmental problems. Emphasis is placed on thermodynamics and kinetics of reaction cycles; sources, sinks and transport of chemical species; and quantitation of chemical species. Examples are selected from the chemistry of natural and contaminated air, water, and soil. (Same as ES 3153. Credit cannot be earned for both CE 4613 and ES 3153.) This course has Differential Tuition.

**CE 4633. Water and Wastewater Treatment. (2-3) 3 Credit Hours.**

Prerequisites: CE 2633 and CE 3603. The application of chemical, biochemical, and physical processes to water treatment, wastewater treatment, and pollution control. This course has Differential Tuition. Course fee: L001 \$10; DL01 \$75.

**CE 4723. Hydraulic Systems Design. (3-0) 3 Credit Hours.**

Prerequisite: CE 3603. Technical elective course. Analysis and design of water resource systems; dam and reservoir design for recharge, flood control, and water supply and demand forecasting, optimization of multi-objective systems, and allocations planning and management. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**CE 4733. Applied Hydrology. (3-0) 3 Credit Hours.**

Prerequisite: CE 3603. Technical elective course. Hydrologic cycle, precipitation, hydrologic abstractions, surface runoff; unit hydrographs; synthetic hydrographs; peak discharge relationships; flood frequency analysis; flood and reservoir routing; and groundwater hydrology. (Formerly CE 3723. Credit cannot be earned for both CE 4733 and CE 3723.) This course has Differential Tuition.

**CE 4813. Civil Engineering Design. (3-0) 3 Credit Hours.**

Prerequisite: CE 4543, either CE 3223 or CE 4463, and either CE 4603 or CE 4633. Opportunity to apply design skills to execution of an open-ended integrated civil engineering design project, including field and laboratory investigations, numerical and scale modeling, design, and formal oral and written presentation of results. Considers safety, reliability, environmental, economic, and other constraints, as well as ethical and social impacts. Generally offered: Fall, Spring. This course has Differential Tuition. Course Fee: L001 \$30.

**CE 4911. Independent Study. (0-0) 1 Credit Hour.**

Prerequisites: Permission in writing (form available) from the instructor, the School Director and Dean of the College. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

**CE 4912. Independent Study. (0-0) 2 Credit Hours.**

Prerequisites: Permission in writing (form available) from the instructor, the School Director, and Dean of the College. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

**CE 4913. Independent Study. (0-0) 3 Credit Hours.**

Prerequisites: Permission in writing (form available) from the instructor, the School Director and Dean of the College. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

**CE 4953. Special Studies in Civil Engineering. (3-0) 3 Credit Hours.**

Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.