Department of Civil and Environmental Engineering

The Department of Civil Engineering offers a Bachelor of Science degree in Civil Engineering.

Description of Program

The Civil and Environmental Engineering (CEE) Department is one of the four College of Engineering departments. It is housed in the Biosciences and Engineering Building (BSE). The (B.S.) degree in Civil Engineering (CE) was first offered in 1982. The Civil Engineering B.S. program is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://www.abet.org).

Mission Statement

The faculty of the Department of Civil and Environmental Engineering are committed to excellence in teaching, research, and service to the community and the engineering profession. The Civil and Environmental Engineering Department’s mission is to provide our students an education that integrates fundamental science and engineering skills with design principles to solve engineering problems. Our programs provide students opportunities for graduate education, to acquire life-long learning skills, and to participate in research that advances the discipline and benefits society. Students will be prepared to become professional engineers and leaders in the Civil and Environmental Engineering profession.

Bachelor of Science Degree in Civil Engineering

The Department of Civil and Environmental Engineering offers an ABET-accredited bachelor’s degree that, in terms of graduating class size, ranks in the 80th percentile nation-wide. The Department is committed to excellence in teaching, research, and service to the community and the engineering profession. The Civil and Environmental Engineering department’s mission is to provide our students an education that integrates fundamental science and engineering skills with design principles to solve engineering problems. Our programs provide students opportunities for graduate education, to acquire life-long learning skills, and to participate in research that advances the discipline and benefits society. Students will be prepared to become professional engineers and leaders in the Civil and Environmental Engineering profession.

Civil Engineering Educational Objectives

The American Society of Civil Engineers (ASCE) defines Civil Engineering as “The profession in which a knowledge of the mathematical and physical sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the progressive well-being of humanity in creating, improving, and protecting the environment; in providing facilities for community living, industry, and transportation; and in providing structures for the use of humanity.”

The faculty of the Department of Civil and Environmental Engineering has established a specific set of program objectives to support the mission and the goals of the Department and to meet the requirements of ABET accreditation under the Criteria for Accrediting Engineering Programs (2009). Civil Engineering Bachelor of Science graduates are expected to attain the following program educational objectives (PEOs):

- meet the expectations of their employers,
- will endeavor to become licensed professional engineers, and
- are able to pursue graduate studies, if so desired.

The minimum number of semester credit hours required for the Bachelor of Science (B.S.) in Civil Engineering is 128, including at least 39 at the upper-division level. All candidates for this degree must fulfill the Core Curriculum requirements, the General Engineering requirements, and the Civil Engineering degree requirements prior to graduation. Each is explained in detail.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Civil Engineering must fulfill the University Core Curriculum requirements in the same manner as other students. If courses are taken to satisfy both degree requirements and Core Curriculum requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

MAT 1214 may be used to satisfy the core requirement in Mathematics, as well as one of the General Engineering requirements. PHY 1943 and PHY 1963 may be used to satisfy the core requirement in Life and Physical Sciences, as well as two of the General Engineering requirements. ECO 2023 may be used to satisfy the core requirement in Social and Behavioral Sciences. CS 1173 may be used to satisfy the core requirement in the Component Area Option.

Core Curriculum Component Area Requirements (http://catalog.utsa.edu/undergraduate/bachelorsdegreeeregulations/degreerequirements/corecurriculumcomponentarearequirements)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year Experience Requirement</td>
<td>3</td>
</tr>
<tr>
<td>Communication</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>Life and Physical Sciences</td>
<td>6</td>
</tr>
<tr>
<td>Language, Philosophy and Culture</td>
<td>3</td>
</tr>
<tr>
<td>Creative Arts</td>
<td>3</td>
</tr>
<tr>
<td>American History</td>
<td>6</td>
</tr>
<tr>
<td>Government-Political Science</td>
<td>6</td>
</tr>
<tr>
<td>Social and Behavioral Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Component Area Option</td>
<td>3</td>
</tr>
<tr>
<td>Total Credit Hours</td>
<td>42</td>
</tr>
</tbody>
</table>

General Engineering Requirements

In addition to the Core Curriculum requirements, all degree-seeking Civil Engineering students must complete the following 25 semester credit hours:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 1103</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>EGR 2323</td>
<td>Applied Engineering Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>EGR 3713</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1214</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MAT 1224</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>or EGR 1324</td>
<td>Calculus II for Engineers</td>
<td></td>
</tr>
</tbody>
</table>
Department of Civil and Environmental Engineering

PHY 1943  Physics for Scientists and Engineers I  4
& PHY 1951  and Physics for Scientists and Engineers I Laboratory
 PHY 1963  Physics for Scientists and Engineers II  4
& PHY 1971  and Physics for Scientists and Engineers II Laboratory

Total Credit Hours  25

Gateway Courses
Students pursuing the B.S. degree in Civil Engineering must successfully complete each of the following Gateway Courses with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete these courses within two attempts, including dropping a course with a grade of "W" or taking an equivalent course at another institution, will be required to change his or her major.

EGR 2323  Applied Engineering Analysis I
MAT 1214  Calculus I

Civil Engineering Degree Requirements
In addition to Core Curriculum and General Engineering requirements, students seeking a B.S. degree in Civil Engineering are required to take 70 semester credit hours of Civil Engineering courses. Of these 70 credit hours, 64 are from required courses, while 3 can be satisfied from CE elective courses and while the remaining 3 can be satisfied with Life and Physical Science courses.

A. Required courses
CE 1301  Introduction to Civil Engineering  1
CE 2103  Civil Engineering Measurements  3
CE 2313  Computer-Aided Design in Civil Engineering  3
CE 2633  Environmental Engineering  3
CE 3103  Mechanics of Solids  3
CE 3113  Structural Analysis  3
CE 3173  Numerical Methods  3
CE 3213  Reinforced Concrete Design  3
CE 3223  Highway Engineering  3
CE 3233  Steel Design  3
CE 3243  Properties and Behavior of Engineering Materials  3
CE 3413  Geotechnical Engineering and Applications  3
CE 3603  Fluid Mechanics  3
CE 4463  Foundation Engineering  3
CE 4543  Project Design and Construction Management  3
CE 4603  Water Resources Engineering  3
CE 4633  Water and Wastewater Treatment  3
CE 4813  Civil Engineering Design  3
EGR 1403  Technical Communication  3
EGR 2103  Statics  3
EGR 2513  Dynamics  3
STA 2303  Applied Probability and Statistics for Engineers  3

B. Civil Engineering technical electives
Select one of the following courses. Alternatively, students with a grade point average of 3.0 or higher may choose to satisfy this requirement by taking graduate courses offered by the Department of Civil and Environmental Engineering (Department Chair approval required).

CE 4103  Advanced Steel Design
CE 4133  Advanced Reinforced Concrete
CE 4143  Introduction to Timber Design
CE 4153  Prestressed Concrete
CE 4163  Advanced Structural Analysis
CE 4173  Dynamics and Vibrations
CE 4183  Experimental Stress Analysis
CE 4223  Introduction to Masonry Design
CE 4283  Design of Buildings for Lateral Loads
CE 4293  Geographic Information Systems (GIS)
CE 4303  Hydrometeorology
CE 4403  Advanced Characterization of Highway Materials
CE 4453  Transportation Engineering
CE 4613  Environmental Chemistry
CE 4723  Hydraulic Systems Design
CE 4733  Applied Hydrology
GEO 4023  Engineering Geology

C. Life and Physical Sciences
Select one of the following courses:

AST 1013  Introduction to Astronomy
AST 1033  Exploration of the Solar System
BIO 1233  Contemporary Biology I
BIO 1243  Contemporary Biology II
BIO 1404  Biosciences I
BIO 1414  Biosciences II
ES 1213  Environmental Geology
ES 2013  Introduction to Environmental Science I
ES 2023  Introduction to Environmental Science II
ES 3103  Environmental Microbiology
GEO 1013  The Third Planet
GEO 1103  Physical Geology
GEO 4023  Engineering Geology

Total Credit Hours  70

The elective courses allow some specialization in one of the traditional Civil Engineering areas, namely, Environmental, Geotechnical, Hydraulics, Structures and Transportation. Senior Civil Engineering students, in their last semester of study, are strongly encouraged to take the Fundamentals of Engineering (FE) Examination as administered by the National Council of Examiners for Engineering and Surveying (http://ncees.org). Graduates are expected to pursue life-long learning and obtain their Professional Engineering license.

This curriculum is designed to meet the student learning outcomes defined by the Accreditation Board of Engineering and Technology and the American Society of Civil Engineers. More specifically, it integrates design throughout the curriculum starting with the freshman introductory course, CE 1301 Introduction to Civil Engineering, and ending with the senior capstone Civil Engineering Design course CE 4813. Design components are contained in most required Civil Engineering courses, such as CE 3213 Reinforced Concrete Design, CE 3233 Steel Design, CE 3413 Geotechnical Engineering and Applications, CE 4633 Water and Wastewater Treatment, CE 4223 Highway Engineering, and CE 4603 Water Resources Engineering. Design elements are also included in many technical elective courses. The design experience culminates in the senior capstone design course, CE 4813 Civil Engineering Design. In this
course, students work in multidisciplinary teams involving three or more civil engineering areas and solve practical civil engineering problems drawing upon most of their prior coursework experience. These projects culminate in formal presentations evaluated by professional engineers.

The following provides a summary table of the recommended courses by semester for the B.S. degree in Civil Engineering.

**B.S. in Civil Engineering – Recommended Four-Year Academic Plan**

**First Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>AIS 1203</td>
<td>Academic Inquiry and Scholarship (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CE 1301</td>
<td>Introduction to Civil Engineering</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CHE 1103</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CS 1173</td>
<td>Data Analysis and Visualization (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MAT 1214</td>
<td>Calculus I (core and major)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>WRC 1013</td>
<td>Freshman Composition I (Q) (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Credit Hours</strong></td>
<td><strong>17</strong></td>
</tr>
<tr>
<td>Spring</td>
<td>CE 2103</td>
<td>Civil Engineering Measurements</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>EGR 1403</td>
<td>Technical Communication</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MAT 1224</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PHY 1943</td>
<td>Physics for Scientists and Engineers I (core and major)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PHY 1951</td>
<td>Physics for Scientists and Engineers I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>WRC 1023</td>
<td>Freshman Composition II (Q) (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Credit Hours</strong></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

**Second Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>CE 2633</td>
<td>Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>EGR 2103</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>EGR 2323</td>
<td>Applied Engineering Analysis I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PHY 1963</td>
<td>Physics for Scientists and Engineers II (core and major)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PHY 1971</td>
<td>Physics for Scientists and Engineers II Laboratory</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>American History core</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Credit Hours</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>Spring</td>
<td>CE 2313</td>
<td>Computer-Aided Design in Civil Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CE 3103</td>
<td>Mechanics of Solids</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ECO 2023</td>
<td>Introductory Microeconomics (core)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>EGR 2513</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>STA 2303</td>
<td>Applied Probability and Statistics for Engineers</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Life &amp; Physical Sciences elective</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Credit Hours</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Third Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>CE 3113</td>
<td>Structural Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

**Fourth Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>CE 4463</td>
<td>Foundation Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CE 4543</td>
<td>Project Design and Construction Management</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CE 4603</td>
<td>Water Resources Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>POL 1133 or POL 1213</td>
<td>Texas Politics and Society (core) or Civil Rights in Texas and America</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>American History core</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Credit Hours</strong></td>
<td><strong>15</strong></td>
</tr>
<tr>
<td>Spring</td>
<td>CE 4633</td>
<td>Water and Wastewater Treatment</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CE 4813</td>
<td>Civil Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CE Technical elective</td>
<td>Creative Arts core</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Language, Philosophy &amp; Culture core</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Credit Hours</strong></td>
<td><strong>15</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credit Hours</strong></td>
<td><strong>128</strong></td>
</tr>
</tbody>
</table>

**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 $20; STSE $10.

**CE 2103.** Civil Engineering Measurements. (2-3) 3 Credit Hours. 
Prerequisites: CE 1301 and MAT 1214. 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 Fees: LRE1 $20; 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 $20; STSE $30.

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: LRE1 $20; STSE $30.

CE 3103. Mechanics of Solids. (2-3) 3 Credit Hours.
Prerequisites: EGR 2103 and completion of or concurrent enrollment in EGR 2323. Internal forces and deformations in solids; stress, strain, and their relations; stresses and deflections in beams column theory and analysis; and engineering applications. Generally offered: Fall, Spring. Course Fees: LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; STSE $30.

CE 3173. Numerical Methods. (3-0) 3 Credit Hours.
Prerequisites: CS 1173 and EGR 2323. Use of computing languages (with an emphasis on VisualBasic) and numerical methods in solving civil and environmental engineering problems. Techniques for computer solution of linear and nonlinear simultaneous equations; eigenvalues; finite differences; numerical integration; numerical solutions to ordinary differential equations. Case studies in various civil engineering areas. Generally offered: Fall, Spring. Course Fees: LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; STSE $30.

CE 3233. Steel Design. (2-3) 3 Credit Hours.
Prerequisites: 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. Course Fees: LRE1 $20; STSE $30.

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. Course Fees: L001 $30; LRE1 $20; STSE $30.

CE 3413. Geotechnical Engineering and Applications. (2-3) 3 Credit Hours.
Prerequisites: CE 3103 and completion of or concurrent enrollment in CE 3173. 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. Course Fees: L001 $30; LRE1 $20; STSE $30.

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.) Course Fees: LRE1 $20; 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. Course Fees: LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; STSE $30.

CE 4143. Introduction to Timber Design. (3-0) 3 Credit Hours.
Prerequisites: 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 cannot be earned for both CE 4143 and CE 3253 or CE 4253.) Course Fees: LRE1 $20; STSE $30.

CE 4153. Prestressed Concrete. (3-0) 3 Credit Hours.
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. Course Fees: LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; STSE $30.

CE 4183. Experimental Stress Analysis. (3-0) 3 Credit Hours.
Prerequisite: CE 3103 or ME 3813. Technical elective course. 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. Course Fees: LRE1 $20; STSE $30.

CE 4223. Introduction to Masonry Design. (3-0) 3 Credit Hours.
Prerequisites: 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 cannot be earned for both CE 4223 and CE 3253 or CE 4253.) Course Fees: LRE1 $20; STSE $30.

CE 4283. Design of Buildings for Lateral Loads. (3-0) 3 Credit Hours.
Prerequisites: 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. Course Fees: LRE1 $20; 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. Course Fees: LRE1 $20; STSE $30.

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 hydology 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. Course Fees: LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; STSE $30.

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.) Course Fees: LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; STSE $30.

CE 4543. Project Design and Construction Management. (3-0) 3 Credit Hours.
Prerequisites: EGR 3713, 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.) Course Fees: LRE1 $20; STSE $30.

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

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.) Course Fees: LRE1 $20; STSE $30.
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. (Formerly CE 3633. Credit cannot be earned for both CE 3633 and CE 4633.) Course Fees: L001 $10; LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; 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.) Course Fees: LRE1 $20; STSE $30.

CE 4813. Civil Engineering Design. (3-0) 3 Credit Hours.
Prerequisites: CE 3223, CE 4543, and CE 4603. 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. Course Fees: L001 $30; LRE1 $20; STSE $30.

CE 4911. Independent Study. (0-0) 1 Credit Hour.
Prerequisites: Permission in writing (form available) from the instructor, the student’s advisor, the Department Chair 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. Course Fees: LRE1 $20; STSE $10.

CE 4912. Independent Study. (0-0) 2 Credit Hours.
Prerequisites: Permission in writing (form available) from the instructor, the student’s advisor, the Department Chair 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. Course Fees: LRE1 $20; STSE $20.

CE 4913. Independent Study. (0-0) 3 Credit Hours.
Prerequisites: Permission in writing (form available) from the instructor, the student’s advisor, the Department Chair 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. Course Fees: LRE1 $20; STSE $30.

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. Course Fees: LRE1 $20; STSE $30.