

# SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING, AND CONSTRUCTION MANAGEMENT

## Description of the Programs

The School of Civil & Environmental Engineering, and Construction Management (CECM) is one of the five schools/departments of the Klesse College of Engineering and Integrated Design (KCEID). It is housed jointly in the Biotechnology Sciences and Engineering Building (BSE), on the main campus, for the Civil and Environmental Engineering program; and on the downtown campus, for the Construction Science and Management program. The school offers two undergraduate degrees, one in Civil Engineering and another in Construction Science and Management. The Bachelor of Science (B.S.) degree in Civil Engineering (CE) was first offered in 1982, and the Bachelor of Science (B.S.) degree in Construction Science and Management (CSM) was first offered in 2008. The Civil Engineering B.S. program is currently accredited by the Engineering Accreditation Commission of ABET, [www.abet.org](http://www.abet.org/) (<http://www.abet.org/>), and the Construction Science and Management B.S. program is currently accredited by the American Council of Construction Education, [www.acce-hq.org](https://www.acce-hq.org/) (<https://www.acce-hq.org/>).

## Civil Engineering Mission Statement

The faculty of the Civil and Environmental Engineering Division are committed to excellence in teaching, research, and service to the community and the engineering divisions. The Civil and Environmental Engineering program'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 Direct Admission Criteria

Applicants entering UTSA as Freshmen or Freshmen Transfers (fewer than 12 transferable semester credit hours) will be directly admitted to the CE program if they:

- meet all UTSA undergraduate admission requirements,
- qualify for enrollment in MAT 1214 Calculus I, or a higher level mathematics course, and
- are ranked in the top 10 percent of their high school class (no minimum SAT or ACT scores required), *or*
- are ranked below the top 10 percent of their high school class and have a minimum 1200 SAT<sup>1</sup> or 25 ACT score.

Applicants with SAT<sup>1</sup> scores below 1200 or ACT scores below 25 may undergo admission by committee review.

Transfer requirements for direct admission to the CE program for students who have earned 12 or more transferable semester credit hours:

- meet all UTSA undergraduate transfer admission requirements, and
- have completed MAT 1214 Calculus I and WRC 1013 Freshman Composition I, or the equivalents, with grades of "C-" or better, and
- meet grade point average requirements:

1. applicants with a transfer grade point average of 3.00 or higher may be granted direct admission to the major, or
2. applicants with a transfer grade point average below 3.00 may be granted admission to the College by committee review.

Applicants who do not meet Civil Engineering admission requirements will be admitted to the Engineering, Math, and Sciences Studies in the University College. Students have three semesters to complete Calculus I with a grade of "C-" or better and meet the Civil Engineering Transfer Requirements.

## "C-" Grade Rule

A grade of "C-" or better in any science, engineering, or mathematics course required for an engineering degree, or any other course that is a prerequisite to a required CE or Engineering (EGR) course, indicates satisfactory preparation for further engineering education. Any course assigned a grade below a "C-" must be repeated before enrolling in any course for which it is a prerequisite. This requirement is subject to both the Gateway Course and Three-Attempt Limit rules.

## Gateway Courses

Students pursuing a degree in Civil Engineering must successfully complete Gateway Courses with a grade of "C-" or better in no more than two attempts. If the student does not successfully complete a Gateway Course in two attempts, then the student is required to change their major.

For the purpose of this policy, dropping a course with a grade of "W" or taking an equivalent course at another institution of higher education counts as an attempt at taking the course.

## Three-Attempt Limit

Students pursuing a Civil Engineering degree must successfully complete all science, engineering, and math courses for their program with a grade of "C-" or better in no more than three attempts. A student unable to achieve the "C-" Grade Rule within three enrollments (attempts) shall be required to change their major.

For the purpose of this policy, dropping a course with a grade of "W" or taking an equivalent course at another institution of higher education counts as an attempt at taking the course.

## Construction Science and Management Mission Statement

The mission of the Construction Science and Management (CSM) Division at the University of Texas at San Antonio is to provide quality construction education for the next generation of construction professionals and leaders. The Division has established the following objectives to achieve this mission:

- Provide quality education to meet the current and future needs of the construction industry in the region based on a solid foundation in ethical, managerial, and technical principles.
- Prepare the next generation of construction professionals with an understanding of sustainable and responsible practice.

- Enhance the construction profession through scholarly research and professional development.

## Construction Science and Management Direct Admission Criteria

Available openings within the CSM program are limited and, therefore, entry is competitive. Top-performing students from high school will be admitted directly into the major. Successful applicants entering the University from high school and transfer students that meet the program requirements will be admitted into Academic Studies (XACP) in the University College. Students in Academic Studies will be reviewed before registration each academic semester and students will be accepted to the CSM major based on their grade point average (GPA) and number of available seats.

Applicants entering UTSA as Freshmen will be directly admitted to the CSM major if they:

- meet all UTSA undergraduate admission requirements, and
- are ranked in the top 10 percent of their high school class (no minimum SAT or ACT scores required), *or*
- are ranked in the top 25 percent of their high school class and have a minimum 1170 SAT<sup>1</sup> or 24 ACT score, *or*
- are ranked in the top 50 percent of their high school class and have a minimum 1220 SAT<sup>1</sup> or 25 ACT score.

*\* New SAT scores combine Evidence-Based Reading and Writing and Math.*

Transfer students with less than 12 transferable semester credit hours will be directly admitted to the CSM major if they:

- meet all UTSA undergraduate transfer admission requirements, and
- have a minimum transfer grade point average (GPA) of 3.0.

Transfer students with 12 or more transferable semester credit hours will be directly admitted to the CSM major if they:

- meet all UTSA undergraduate transfer admission requirements, and
- have a minimum transfer GPA of 3.1.

Freshmen and Transfer students who do not meet the above requirements, but meet UTSA's general admission requirements will be admitted to "Construction Science and Management" Studies in University College where students will be able to work towards meeting the prerequisites needed to declare CSM as their major. Students in Construction Science and Management Studies will be reviewed before registration each academic semester and students will be accepted to the CSM major based on their grade point average (GPA) and the number of available seats.

Current UTSA students interested in CSM are first considered by the Department for Academic Studies (XACP) admission and then considered for possible admission into the CSM program. Change of major applications will be reviewed before registration each academic semester. Students will be accepted to the major based on their GPA and the number of available seats.

Students not accepted into the CSM program are encouraged to improve their GPA and re-submit the application.

## Laptop Program

Students must have a laptop (notebook) computer upon entering the CE and CSM programs. The computer should be upgradeable in order to be

of productive use for the duration of the academic program. For further and specific information concerning laptop requirements for each major, please see <https://ceid.utsa.edu/students/computer-requirements/>.

## Student Work

CE and CSM faculty reserve the right to retain, exhibit, and reproduce work submitted by students. Work submitted for grading is the property of KCEID and remains such until it is returned to the student.

<sup>1</sup> Based on the new SAT score range

- B.S. degree in Civil Engineering (p. 2)
- B.S. degree in Construction Science and Management (p. 5)

## Bachelor of Science Degree in Civil Engineering

The School of Civil & Environmental Engineering, and Construction Management offers an ABET-accredited bachelor's degree in civil engineering that, in terms of graduating class size, ranks in the 80th percentile nation-wide. The School is committed to excellence in teaching, research, and service to the community and the profession. The Civil Engineering program's mission is to provide our students an education that integrates fundamental science and engineering skills with design principles to solve engineering problems. Our program provides 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 Civil and Environmental Engineering Division has established a specific set of program objectives to support the mission and the goals of the School and to meet the requirements of ABET accreditation under the Criteria for Accrediting Engineering Programs. 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.

## Student Outcomes

Graduates of the UTSA Civil Engineering Program will demonstrate the following student outcomes.

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to communicate effectively with a range of audiences.
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## 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/bachelorsdegreeregulations/degree/requirements/corecurriculumcomponentarearequirements/>)

|                                   |   |
|-----------------------------------|---|
| First Year Experience Requirement | 3 |
| Communication                     | 6 |
| Mathematics                       | 3 |
| Life and Physical Sciences        | 6 |
| Language, Philosophy and Culture  | 3 |
| Creative Arts                     | 3 |
| American History                  | 6 |
| Government-Political Science      | 6 |
| Social and Behavioral Sciences    | 3 |

|                           |           |
|---------------------------|-----------|
| Component Area Option     | 3         |
| <b>Total Credit Hours</b> | <b>42</b> |

## General Engineering Requirements

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

| Code                      | Title  | Credit Hours |
|---------------------------|--|--------------|
| CHE 1103                  | General Chemistry I  | 3            |
| EGR 2323                  | Applied Engineering Analysis I   | 3            |
| EGR 3713                  | Engineering Economic Analysis  | 3            |
| MAT 1214                  | Calculus I   | 4            |
| MAT 1224<br>or EGR 1324   | Calculus II<br>Calculus II for Engineers   | 4            |
| PHY 1943<br>& PHY 1951    | Physics for Scientists and Engineers I<br>and Physics for Scientists and Engineers I<br>Laboratory   | 4            |
| PHY 1963<br>& PHY 1971    | Physics for Scientists and Engineers II<br>and Physics for Scientists and Engineers II<br>Laboratory | 4            |
| <b>Total Credit Hours</b> |  | <b>25</b>    |

## 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.

| Code     | Title                          | Credit Hours |
|----------|--------------------------------|--------------|
| 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.

| Code                       | Title                                      | Credit Hours |
|----------------------------|--|--------------|
| <b>A. Required courses</b> |  |              |
| 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 (School Director approval required).

|          |  |   |
|----------|--|---|
| EGR 3303 | Engineering Co-op                              | 3 |
| 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  | 3 |
| AST 1033            | Exploration of the Solar System  |   |
| BIO 1233            | Contemporary Biology I   |   |
| BIO 1243            | Contemporary Biology II  |   |
| BIO 1203 & BIO 1201 | Biosciences I for Science Majors and Biosciences I Laboratory for Science Majors   |   |
| BIO 1223 & BIO 1221 | Biosciences II for Science Majors and Biosciences II Laboratory for Science Majors |   |
| 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 3223 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          |   | Credit Hours |
|---------------------|---|--------------|
| <b>Fall</b>         |   |              |
| AIS 1203            | Academic Inquiry and Scholarship (core)                 | 3            |
| CE 1301             | Introduction to Civil Engineering                       | 1            |
| CHE 1103            | General Chemistry I                                     | 3            |
| CS 1173             | Data Analysis and Visualization (core)                  | 3            |
| MAT 1214            | Calculus I (core and major)                             | 4            |
| WRC 1013            | Freshman Composition I (core)                           | 3            |
| <b>Credit Hours</b> |   | <b>17</b>    |
| <b>Spring</b>       |   |              |
| CE 2103             | Civil Engineering Measurements                          | 3            |
| EGR 1403            | Technical Communication                                 | 3            |
| MAT 1224            | Calculus II   | 4            |
| PHY 1943            | Physics for Scientists and Engineers I (core and major) | 3            |
| PHY 1951            | Physics for Scientists and Engineers I Laboratory       | 1            |

|                                   |   |           |
|-----------------------------------|---|-----------|
| WRC 1023                          | Freshman Composition II (core)  | 3         |
| <b>Credit Hours</b>               |   | <b>17</b> |
| <b>Second Year</b>                |   |           |
| <b>Fall</b>                       |   |           |
| CE 2633                           | Environmental Engineering   | 3         |
| EGR 2103                          | Statics   | 3         |
| EGR 2323                          | Applied Engineering Analysis I  | 3         |
| PHY 1963                          | Physics for Scientists and Engineers II (core and major)                  | 3         |
| PHY 1971                          | Physics for Scientists and Engineers II Laboratory                        | 1         |
| American History (core)           |   | 3         |
| <b>Credit Hours</b>               |   | <b>16</b> |
| <b>Spring</b>                     |   |           |
| CE 2313                           | Computer-Aided Design in Civil Engineering                                | 3         |
| CE 3103                           | Mechanics of Solids   | 3         |
| ECO 2023                          | Introductory Microeconomics (core)  | 3         |
| EGR 2513                          | Dynamics  | 3         |
| STA 2303                          | Applied Probability and Statistics for Engineers                          | 3         |
| Life & Physical Sciences Elective |   | 3         |
| <b>Credit Hours</b>               |   | <b>18</b> |
| <b>Third Year</b>                 |   |           |
| <b>Fall</b>                       |   |           |
| CE 3113                           | Structural Analysis   | 3         |
| CE 3173                           | Numerical Methods   | 3         |
| CE 3233                           | Steel Design  | 3         |
| CE 3243                           | Properties and Behavior of Engineering Materials                          | 3         |
| CE 3603                           | Fluid Mechanics   | 3         |
| <b>Credit Hours</b>               |   | <b>15</b> |
| <b>Spring</b>                     |   |           |
| CE 3213                           | Reinforced Concrete Design  | 3         |
| CE 3223                           | Highway Engineering   | 3         |
| CE 3413                           | Geotechnical Engineering and Applications                                 | 3         |
| EGR 3713                          | Engineering Economic Analysis   | 3         |
| POL 1013                          | Introduction to American Politics (core)                                  | 3         |
| <b>Credit Hours</b>               |   | <b>15</b> |
| <b>Fourth Year</b>                |   |           |
| <b>Fall</b>                       |   |           |
| CE 4463                           | Foundation Engineering  | 3         |
| CE 4543                           | Project Design and Construction Management                                | 3         |
| CE 4603                           | Water Resources Engineering   | 3         |
| POL 1133<br>or POL 1213           | Texas Politics and Society (core)<br>or Civil Rights in Texas and America | 3         |
| American History (core)           |   | 3         |
| <b>Credit Hours</b>               |   | <b>15</b> |

|                                       |                                |            |
|---------------------------------------|--------------------------------|------------|
| <b>Spring</b>                         |                                |            |
| CE 4633                               | Water and Wastewater Treatment | 3          |
| CE 4813                               | Civil Engineering Design       | 3          |
| CE Technical elective                 |                                | 3          |
| Creative Arts (core)                  |                                | 3          |
| Language, Philosophy & Culture (core) |                                | 3          |
| <b>Credit Hours</b>                   |                                | <b>15</b>  |
| <b>Total Credit Hours</b>             |                                | <b>128</b> |

## Bachelor of Science Degree in Construction Science and Management

The School of Civil and Environmental Engineering, and Construction Management offers an ACCE-accredited bachelor's degree in construction science and management that combines courses in construction science, design and business to educate managers for the construction industry. The minimum number of semester credit hours required for the degree, including Core Curriculum requirements, is 120, at least 39 of which need to be at the upper-division level. Students obtaining a Bachelor of Science (B.S.) degree in Construction Science and Management pursue management careers in a wide variety of occupations throughout the construction industry. The degree also provides students with the opportunity to continue with their studies in a graduate program.

The curriculum prepares students to manage the construction process on the job site and effectively interact with architects, engineers, owners and other professionals who compose the team required by the complexities of modern construction projects. Project owners recognize the need for timely project delivery, indoor/outdoor environmental quality, and short-term and life-cycle costing. Therefore, the curriculum emphasizes environmentally sustainable building practice, project and cost controls, communication skills, understanding the technical aspects of construction and the construction process, and the application of information technology to the construction industry. In addition to the formal academic curriculum, students are required to complete a construction management internship in the construction industry between their junior and senior years. The program maintains a close partnership with the construction industry to provide graduates with various opportunities.

All candidates seeking this degree must fulfill the Core Curriculum requirements and the degree requirements

### Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Construction Science and Management must fulfill University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both degree requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both 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 1043 or MAT 1053 may be used to satisfy the core requirement in Mathematics.

ES 2023 and GEO 1013 should be used to satisfy the core requirement in Life and Physical Sciences.



ECO 2023 should be used to satisfy the core requirement in Social and Behavioral Sciences.

COM 2113 should be used to satisfy the Component Area Option requirement.

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

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

## Degree Requirements

| Code | Title | Credit Hours |
|------|-------|--------------|
|------|-------|--------------|

### A. Construction Science and Management Program sequence. Must be completed with a grade of "C-" or better in each course.

1. Required courses in design, construction science, and project management:

|          |   |   |
|----------|---|---|
| CSM 2113 | Construction Materials and Methods                        | 3 |
| CSM 2143 | Construction Materials and Testing                        | 3 |
| CSM 3113 | Construction Surveying                                    | 3 |
| CSM 3123 | Technical Communication                                   | 3 |
| CSM 3143 | Structures I  | 3 |
| CSM 4013 | Construction Estimating I                                 | 3 |
| CSM 4023 | Construction Estimating II                                | 3 |
| CSM 4143 | Structures II   | 3 |
| CSM 4513 | Project Management  | 3 |
| CSM 4523 | Project Planning and Scheduling                           | 3 |
| CSM 4533 | Building Information Modeling for Construction Management | 3 |
| CSM 4613 | Sustainable Building Practice                             | 3 |
| CSM 4623 | Construction Safety                                       | 3 |
| CSM 4633 | Construction Law  | 3 |
| CSM 4643 | Mechanical, Electrical and Plumbing Systems               | 3 |
| CSM 4713 | Construction Capstone                                     | 3 |
| CSM 4933 | Summer Internship   | 3 |

2. Required business and related courses:

|          |   |   |
|----------|---|---|
| ACC 2013 | Principles of Accounting I                                    | 3 |
| BLW 3013 | Business Law for Small Business Owners                        | 3 |
| FIN 3003 | Survey of Finance   | 3 |
| GBA 2013 | Legal, Social and Ethical Issues in Business                  | 3 |
| MGT 3013 | Introduction to Organization Theory, Behavior, and Management | 3 |

3. One course in physics:

|  |  |           |
|--|--|-----------|
| PHY 1603   | Algebra-based Physics I                                | 3         |
| 4. One course in statistics:   |  |           |
| STA 1053   | Basic Statistics                                       | 3         |
| <b>B. Two prescribed or preapproved electives selected from the following list, with a grade of "C-" or better in each course:</b> |  |           |
| CSM 4913   | Independent Study                                      |           |
| CSM 4953   | Special Studies in Construction Science and Management |           |
| FIN 3013   | Principles of Business Finance                         |           |
| GEO 3343   | Introduction to Geospatial Technologies                |           |
| IS 1403  | Business Information Systems Fluency                   |           |
| MGT 3003   | Business Communication and Professional Development    |           |
| MGT 3253   | Interpersonal Communication                            |           |
| MGT 4893   | Management Strategy                                    |           |
| MKT 3013   | Principles of Marketing                                |           |
| MS 3043  | Business Statistics with Computer Applications II      |           |
| MS 3053  | Management Science and Operations Technology           |           |
| MS 3073  | Business Intelligence and Analytics                    |           |
| MS 3403  | Logistics Management                                   |           |
| MSC 2012   | Leadership and Decision Making                         |           |
| SPN 2023   | Intermediate Spanish II                                |           |
| <b>Total Credit Hours</b>  |  | <b>78</b> |

## B.S. in Construction Science and Management – Recommended Four-Year Academic Plan

Students are strongly encouraged to complete WRC 1013, WRC 1023, MAT 1043 or MAT 1053, and PHY 1603 in their first year.

*"In order to facilitate required prerequisite completions on schedule throughout the curriculum, students are strongly encouraged to complete CSM 2113, CSM 3123, CSM 4513, and CSM 4533 in their second year."*

### First Year

| Fall                                    | Credit Hours  |           |
|---|---|-----------|
| First Semester (Fall or Spring)         |   |           |
| AIS 1203                                | Academic Inquiry and Scholarship (core)                                     | 3         |
| MAT 1043 or MAT 1053                    | Introduction to Mathematics (core) <sup>1</sup> or Mathematics for Business | 3         |
| WRC 1013                                | Freshman Composition I (core)   | 3         |
| American History (core)                 |   | 3         |
| Language, Philosophy and Culture (core) |   | 3         |
| <b>Credit Hours</b>                     |   | <b>15</b> |

### Spring

|                                  |   |   |
|----------------------------------|---|---|
| Second Semester (Fall or Spring) |   |   |
| ES 2023 or GEO 1013              | Introduction to Environmental Science II (core) or The Third Planet | 3 |
| PHY 1603                         | Algebra-based Physics I <sup>1</sup>                                | 3 |
| WRC 1023                         | Freshman Composition II (core)                                      | 3 |

|                                   |   |           |
|-----------------------------------|---|-----------|
| American History (core)           |   | 3         |
| Creative Arts (core)              |   | 3         |
| <b>Credit Hours</b>               |   | <b>15</b> |
| <b>Second Year</b>                |   |           |
| <b>Fall</b>                       |   |           |
| Third Semester (Fall or Spring)   |   |           |
| CSM 2113                          | Construction Materials and Methods <sup>2</sup>                         | 3         |
| CSM 3123                          | Technical Communication <sup>2</sup>                                    | 3         |
| COM 2113                          | Public Speaking   | 3         |
| GEO 1013<br>or ES 2023            | The Third Planet (core)<br>or Introduction to Environmental Science II  | 3         |
| MGT 3013                          | Introduction to Organization Theory, Behavior, and Management           | 3         |
| <b>Credit Hours</b>               |   | <b>15</b> |
| <b>Spring</b>                     |   |           |
| Fourth Semester (Fall or Spring)  |   |           |
| CSM 2143                          | Construction Materials and Testing                                      | 3         |
| CSM 4513                          | Project Management <sup>2</sup>   | 3         |
| CSM 4533                          | Building Information Modeling for Construction Management <sup>2</sup>  | 3         |
| CSM 4623                          | Construction Safety   | 3         |
| STA 1053                          | Basic Statistics  | 3         |
| <b>Credit Hours</b>               |   | <b>15</b> |
| <b>Third Year</b>                 |   |           |
| <b>Fall</b>                       |   |           |
| Fifth Semester (Fall or Spring)   |   |           |
| ACC 2013                          | Principles of Accounting I  | 3         |
| CSM 3143                          | Structures I  | 3         |
| CSM 4013                          | Construction Estimating I   | 3         |
| CSM 4643                          | Mechanical, Electrical and Plumbing Systems                             | 3         |
| ECO 2003<br>or ECO 2023           | Economic Principles and Issues (core)<br>or Introductory Microeconomics | 3         |
| <b>Credit Hours</b>               |   | <b>15</b> |
| <b>Spring</b>                     |   |           |
| Sixth Semester (Fall or Spring)   |   |           |
| CSM 4023                          | Construction Estimating II  | 3         |
| CSM 4143                          | Structures II   | 3         |
| CSM 4523                          | Project Planning and Scheduling   | 3         |
| CSM 4633                          | Construction Law  | 3         |
| FIN 3003                          | Survey of Finance   | 3         |
| <b>Credit Hours</b>               |   | <b>15</b> |
| <b>Summer</b>                     |   |           |
| CSM 4933                          | Summer Internship   | 3         |
| <b>Credit Hours</b>               |   | <b>3</b>  |
| <b>Fourth Year</b>                |   |           |
| <b>Fall</b>                       |   |           |
| Seventh Semester (Fall or Spring) |   |           |
| CSM 4613                          | Sustainable Building Practice   | 3         |

|                                  |   |            |
|----------------------------------|---|------------|
| GBA 2013                         | Legal, Social and Ethical Issues in Business                              | 3          |
| POL 1013                         | Introduction to American Politics (core)                                  | 3          |
| CSM 3113                         | Construction Surveying (may also be taken in the Eighth Semester)         | 3          |
| Prescribed Elective              |   | 3          |
| <b>Credit Hours</b>              |   | <b>15</b>  |
| <b>Spring</b>                    |   |            |
| Eighth Semester (Fall or Spring) |   |            |
| BLW 3013                         | Business Law for Small Business Owners                                    | 3          |
| CSM 4713                         | Construction Capstone   | 3          |
| POL 1133<br>or POL 1213          | Texas Politics and Society (core)<br>or Civil Rights in Texas and America | 3          |
| Prescribed Elective              |   | 3          |
| <b>Credit Hours</b>              |   | <b>12</b>  |
| <b>Total Credit Hours</b>        |   | <b>120</b> |

<sup>1</sup> Students are strongly encouraged to complete MAT 1043 or MAT 1053 and PHY 1603 in their first year.

<sup>2</sup> Students are strongly encouraged to complete CSM 2113, CSM 3123, CSM 4513, and CSM 4533 in their second year.

## 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.

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 \$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.**

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. (Same as ME 3813. Credit cannot be earned for both CE 3103 and ME 3813.) Generally offered: Fall, Spring. Differential Tuition: \$165. 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. Differential Tuition: \$165.

**CE 3173. Numerical Methods. (3-0) 3 Credit Hours.**

Prerequisites: CS 1173 and EGR 2323. Use of computing languages and numerical methods in solving civil and environmental engineering problems. Techniques for computer solution of linear and nonlinear simultaneous equations; splines; root finding methods; eigenvalues; finite differences; numerical integration; numerical solutions to ordinary differential equations; error analysis. Case studies in various civil engineering areas. Generally offered: Fall, Spring. Differential Tuition: \$165.

**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. Differential Tuition: \$165. 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. Differential Tuition: \$165. Course fee: DL01 \$75.

**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. Differential Tuition: \$165.

**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. Differential Tuition: \$165. 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. Differential Tuition: \$165. Course fee: L001 \$30; DL01 \$75.

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

Prerequisite: EGR 2513. Fluid properties, fluid statics concepts, equations of fluid flow in pipes and open channels, and flow-through porous media. Generally offered: Fall, Spring. Differential Tuition: \$165. 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.) Differential Tuition: \$165.

**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. Differential Tuition: \$165. 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. Differential Tuition: \$165.

**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.) Differential Tuition: \$165. 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. Differential Tuition: \$165.

**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. Differential Tuition: \$165.

**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. Differential Tuition: \$165.

**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. Differential Tuition: \$165.



**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. Differential Tuition: \$165. Course fee: DL01 \$75.

**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.) Differential Tuition: \$165. Course fee: DL01 \$75.

**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. Differential Tuition: \$165.

**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. Differential Tuition: \$165. 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. Differential Tuition: \$165.

**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. Differential Tuition: \$165.

**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.) Differential Tuition: \$165.

**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. Differential Tuition: \$165. 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.) Differential Tuition: \$165. 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. Differential Tuition: \$165. 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.) Differential Tuition: \$165.

**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. Differential Tuition: \$165. 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. Differential Tuition: \$165.

**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.) Differential Tuition: \$165.

**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. Differential Tuition: \$165. 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. Differential Tuition: \$55.

**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. Differential Tuition: \$110.

**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. Differential Tuition: \$165.

**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. Differential Tuition: \$165.

## **Construction Science and Management (CSM) Courses**

**CSM 2113. Construction Materials and Methods. (3-0) 3 Credit Hours.**

Prerequisite: Enrollment as an Architecture, Interior Design, or Construction Science and Management major or permission of instructor. Introduction to materials, methods, equipment and sequences of the construction process including structural elements, components, and assemblies. Course Fees: SAP1 \$25; STSA \$15; DL01 \$75.

**CSM 2143. Construction Materials and Testing. (3-0) 3 Credit Hours.**

Prerequisites: CSM 2113, PHY 1603, and enrollment as a Construction Science and Management major or permission of instructor. Analysis of materials and methods used in the design and construction process with a particular emphasis on quality control, quality assurance, and testing including soils, concrete, steel, masonry, and wood. Course Fees: SAP1 \$25; STSA \$15; DL01 \$75.

**CSM 3113. Construction Surveying. (3-0) 3 Credit Hours.**

Prerequisite: Enrollment as a Construction Science and Management major or permission of instructor. Practical applications of surveying, including distance, grade and angular measurements, surveying equipment and its application to construction layout and control, surveying documentation and fieldwork. (Formerly CSM 3111. Credit cannot be earned for both CSM 3113 and CSM 3111.) Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 3123. Technical Communication. (3-0) 3 Credit Hours.**

Prerequisites: MAT 1043 or MAT 1053 and enrollment as a Construction Science and Management major or permission of instructor. Visualization, interpretation and communication of graphical geometry in construction design and engineering; graphical analysis of problems; plan reading; computer aided design, and fundamentals of information modeling software; introduction to common quantitative tools in construction. Course Fees: SAP1 \$25; STSA \$15; DL01 \$75. Differential Tuition: \$165.

**CSM 3143. Structures I. (3-0) 3 Credit Hours.**

Prerequisites: PHY 1603 and enrollment as a Construction Science and Management major or permission of instructor. Introduction to the physical principles that govern classical statics and strengths of materials through the design of concrete, timber, and steel components of structures. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4013. Construction Estimating I. (3-0) 3 Credit Hours.**

Prerequisites: CSM 2113 and CSM 3123. Introduction to estimating procedures for buildings related to quantity surveying, cost of materials and labor, life-cycle costs, and applicable software. (Formerly ARC 4013. Credit cannot be earned for both CSM 4013 and ARC 4013.) Generally offered: Spring. Course Fees: SAP1 \$25; STSA \$15; DL01 \$75. Differential Tuition: \$165.

**CSM 4023. Construction Estimating II. (3-0) 3 Credit Hours.**

Prerequisites: CSM 2143 and CSM 4013. Continuation of CSM 4013 with emphasis on pricing work, subcontracting, and bidding strategies utilizing applicable software. (Formerly ARC 4023. Credit cannot be earned for both CSM 4023 and ARC 4023.) Generally offered: Fall, Spring. Course Fees: SAP1 \$25; STSA \$15; DL01 \$75. Differential Tuition: \$165.

**CSM 4143. Structures II. (3-0) 3 Credit Hours.**

Prerequisite: CSM 3143. Analysis and design of structural members in steel, reinforced concrete, reinforced masonry and their relationship to design and construction. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4513. Project Management. (3-0) 3 Credit Hours.**

Prerequisite: CSM 3123. Introduction to project management of the construction process and integration with allied professions. Introduction to applicable software. (Formerly ARC 4613. Credit cannot be earned for both CSM 4513 and ARC 4613.) Generally offered: Fall, Spring. Course Fees: SAP1 \$25; STSA \$15; DL01 \$75. Differential Tuition: \$165.

**CSM 4523. Project Planning and Scheduling. (3-0) 3 Credit Hours.**

Prerequisite: CSM 4513. Continuation of CSM 4513 with emphasis on scheduling and project delivery methods utilizing applicable software. (Formerly ARC 4623. Credit cannot be earned for both CSM 4523 and ARC 4623.) (Formerly titled "Construction Management II.") Generally offered: Fall, Spring. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4533. Building Information Modeling for Construction Management. (3-0) 3 Credit Hours.**

Prerequisite: CSM 3123. Introduction to techniques used in development and management of Building Information Models. Emphasis on constructability and management. Generally offered: Spring. Course Fees: SAP1 \$25; STSA \$15; DL01 \$75. Differential Tuition: \$165.

**CSM 4613. Sustainable Building Practice. (3-0) 3 Credit Hours.**

Prerequisite: Enrollment as a Construction Science and Management major or permission of instructor. Ethics and application of environmental sustainability practice in building construction. Introduction to U.S. Green Building Council LEED program standards, methods, and procedures as applied to construction documents interpretation and construction. Generally offered: Fall, Spring. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4623. Construction Safety. (3-0) 3 Credit Hours.**

Prerequisite: Enrollment as a Construction Science and Management major or permission of instructor. Development and management of safety programs, worker's compensation, OSHA compliance, safety policies, standards, and record keeping. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4633. Construction Law. (3-0) 3 Credit Hours.**

Prerequisite: Enrollment as a Construction Science and Management major or permission of instructor. Legal and ethical aspects of construction contracts, bonds, insurance, and bidding. Owner, architect, contractor, and subcontractor relationships. Generally offered: Fall, Spring. Course Fees: SAP1 \$25; STSA \$15; DL01 \$75. Differential Tuition: \$165.

**CSM 4643. Mechanical, Electrical and Plumbing Systems. (3-0) 3 Credit Hours.**

Prerequisite: CSM 4533 or permission of instructor. Building systems with an emphasis on design, installation and control of heating, ventilation and cooling, plumbing and drainage, electrical, fire and lightning protection systems. Generally offered: Fall. Course Fees: DL01 \$75; SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4713. Construction Capstone. (3-0) 3 Credit Hours.**

Prerequisites: CSM 4023, CSM 4523, CSM 4633, and CSM 4643. Senior capstone project emphasizing integration of the design and construction processes. Project delivery systems, project development, estimating, scheduling and project controls of various types of construction projects. Generally offered: Fall, Spring, Summer. Course Fees: DL01 \$75; SAP1 \$25; STSA \$15. Differential Tuition: \$165.

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

Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, the School Director, and the Dean of the College in which the course is offered. Scholarly research 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, may apply to a bachelor's degree. Generally offered: Fall. Course Fees: SAP1 \$25; STSA \$5. Differential Tuition: \$55.

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

Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, the School Director, and the Dean of the College in which the course is offered. Scholarly research 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, may apply to a bachelor's degree. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4931. Summer Internship. (0-0) 1 Credit Hour.**

Prerequisite: CSM 4623. This is a part-time, on-site, construction work experience. Supervision by qualified construction manager and intern mentor to prepare the intern for building construction management functions. Instructor prior approval of details for individual work experience required. Must be repeated for credit and taken in consecutive five-week summer sessions. Generally offered: Summer. Course Fees: SAP1 \$25; STSA \$5. Differential Tuition: \$55.

**CSM 4932. Internship. (0-0) 2 Credit Hours.**

Prerequisite: CSM 4623. This is a part-time, on-site, construction work experience. Supervision by qualified construction manager and intern mentor to prepare the intern for building construction management functions. Instructor prior approval of details for individual work experience required. Generally offered: Fall, Spring. Course Fees: SAP1 \$25; STSA \$10. Differential Tuition: \$110.

**CSM 4933. Summer Internship. (0-0) 3 Credit Hours.**

Prerequisite: CSM 4623. This is a full-time, on-site, construction work experience during summer semester. Supervision by qualified construction manager and intern mentor to prepare the intern for building construction management functions. Instructor prior approval of details for individual work experience required. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4943. Internship I. (0-0) 3 Credit Hours.**

Prerequisite: CSM 4623. This is a part-time, on-site, construction work experience during fall or spring semesters. Supervision by qualified construction manager and intern mentor to prepare the intern for building construction management functions. Instructor prior approval of details for individual work experience required. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.

**CSM 4946. Internship II. (0-0) 6 Credit Hours.**

Prerequisite: CSM 4623. This is a full-time, on-site, construction work experience during fall or spring semesters. Supervision by qualified construction manager and intern mentor to prepare the intern for building construction management functions. Instructor prior approval of details for individual work experience required. Course Fees: SAP1 \$25; STSA \$30. Differential Tuition: \$330.

**CSM 4953. Special Studies in Construction Science and Management. (0-6) 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 the topics vary, but not more than 3 hours for CSM 4951, 6 hours for CSM 4953, or 12 hours for CSM 4956, regardless of discipline, will apply to a bachelor's degree. Course Fees: SAP1 \$25; STSA \$15. Differential Tuition: \$165.