

# MS IN CIVIL ENGINEERING

**Total units required for the MS: 30 - Includes research or independent study and units required in area of specialization (see Program Requirements below)**

## Program Description

Civil Engineering encompasses a broad range of professional activities. The four years of undergraduate preparation for the Bachelor of Science degree are devoted to fundamental analytical principles and basic design applications. For technical competence in specialized areas and continued effectiveness on the job, graduate study is becoming increasingly necessary.

The Civil Engineering Department offers a graduate program of study leading to a Master of Science degree in Civil Engineering in the following areas of specialization:

- **Environmental Engineering** - analysis, design, and management of natural and engineered water systems including drinking water, wastewater, and stormwater; solid and hazardous waste management and regulations; air quality management and pollution control technologies;
- **Geotechnical Engineering** - properties and behavior of soil; seepage analysis with application to design of foundation, retaining structures, earth dams and slopes; soil improvement and ground stabilization; geosynthetics inclusions, soil dynamics, and earthquake engineering;
- **Structural Engineering** - advanced structural analysis methods; structural systems; advanced concrete and steel analysis and design applied to buildings and bridges; seismic analysis and design;
- **Transportation Engineering** - transportation engineering and planning, traffic flow theory, and system management applicable to all modes with emphasis on highway and multi modal transportation; interdisciplinary study with other areas of civil engineering as well as with non-engineering areas may also be arranged; and
- **Water Resources Engineering** - advanced hydraulics and hydrologic design and analysis of water systems, modeling of hydraulic and hydrologic water systems, hydrometeorology analysis, steady and non-steady analysis of groundwater movement of confined and unconfined aquifers, modeling of groundwater movement, and planning, management, and operation of water resource systems.

The MS in Civil Engineering consists of a choice of courses within a specialization, a choice of elective courses, a writing intensive course, a mathematics or statistics course, and culminating requirements; all selected by the student and approved by an advisor.

## Admission Requirements

Admission as a classified graduate student in Civil Engineering requires:

- an undergraduate degree in Civil Engineering; and
- a minimum 2.8 GPA.

In addition, the merit of past academic endeavor and/or professional experience, potential for future study, and professional goals may also be considered for granting admission through submission of the civil engineering department supplemental application form.

Applicants who have deficiencies in admission requirements that can be removed by specified additional preparation may be admitted with conditionally classified graduate status.

Students with a baccalaureate degree in engineering majors other than Civil Engineering (e.g., Electrical and Electronic, Industrial, Mechanical, or Surveying) or in other non-engineering scientific disciplines (e.g., Mathematics, Physics, or Geology) who wish to pursue the graduate program in Civil Engineering may be considered on an individual basis. Such students may be admitted as conditionally classified students and will be required to complete a specifically designed list of undergraduate prerequisite courses in engineering and/or mathematics, physics, and chemistry to correct undergraduate deficiencies. Such a student must have an approved study program on file with the Department while undertaking this qualifying work. Upon completion of these courses with a GPA of 2.8 or better, the student may apply for classified graduate status in Civil Engineering.

## Admission Procedures

All prospective graduate students, including Sacramento State graduates, must submit:

- an online application for admission; and
- one set of official transcript from all colleges and universities attended, *other than Sacramento State*.
- Civil Engineering department supplemental application form included in the online application.
- GRE test score if a student does not have an ABET-accredited engineering degree.
- GRE test score if a student does not meet the minimum 2.8 GPA requirement.

*For more admissions information and application deadlines, please visit the Office of Graduate Studies website (<http://csus.edu/gradstudies/>).*

After being admitted, students must meet with an advisor and complete a Graduate Student Advising Form (obtainable in the Civil Engineering Department). This advising form must be kept current and on file in the Department Office.

## Minimum Units and Grade Requirements for the Degree

Total units Required for the MS: 30; includes research or independent study and units required in specializations (see Program Requirements below)

Minimum Cumulative GPA: 3.0. No course in the program of study may have a grade below "C+".

## Advancement to Candidacy

Each student must file an application for Advancement to Candidacy, indicating a proposed program of graduate study. This procedure should begin as soon as the graduate student has:

- removed any deficiencies in admission requirements;
- obtained classified graduate status;
- completed at least 12 units in the graduate program with a minimum 3.0 GPA, including at least three courses at the 200-level;
- taken the Graduate Writing Intensive (GWI) course in the degree program within the first two semesters of coursework at California State University, Sacramento; and


- selected and obtained approval for a culminating requirement (Plan A, B, or C).

Advancement to Candidacy form is submitted online. The student fills out the form after planning a degree program in consultation with their faculty advisor. The completed form is then approved by the Graduate Coordinator of the Department and submitted to the Office of Graduate Studies. Any subsequent deviations from an approved Advancement to Candidacy form would require the submission of a petition for exception form.

All graduate degree programs are subject to general University requirements for graduate degrees, explained in the *Graduate Degree Requirements* section of this catalog.

## Program Requirements

Total number of required units for degree is 30. Variable units are listed due to variable culminating requirement units.

| Code  | Title  | Units |
|---|--|-------|
| <b>Specialization Courses (15 Units)</b>                                      |  |       |
| 15 units are required as outlined in the Specialization Courses section below |  | 15    |
| <b>Mathematics/Statistics (3 Units)</b>                                       |  |       |
| Select one of the following: <sup>1</sup>                                     |  | 3     |
| ENGR 201  | Engineering Analysis I   |       |
| ENGR 202  | Engineering Analysis II  |       |
| ENGR 203  | Engineering Statistics   |       |
| <b>Writing (3 Units)</b>  |  |       |
| CE 200  | Civil Engineering Professional Writing  | 3     |
| <b>Elective Courses (3-6 Units)</b>   |  |       |
| Select 3 or 6 units of electives <sup>2,3</sup>                               |  | 3 - 6 |
| <b>Culminating Requirement (3-6 Units)</b>                                    |  |       |
| Select one of the following CE 500 requirements: <sup>3</sup>                 |  | 3 - 6 |

### Plan A

Master's Thesis (3 or 6 units) Approval by the faculty thesis advisor and by a second faculty or an expert in the area of study is required. The thesis must comply with University standards for format and is filed in the University Library. The Master's Thesis should be the written product of a systematic study of a significant problem. It identifies the problem, states the major assumptions, explains the significance of the undertaking, sets forth the sources for and methods of gathering information, analyze the data, and offers a conclusion or recommendation. The finished product evidences originality, critical and independent thinking, appropriate organization and format, and thorough documentation. The work should be associated with engineering research or innovation. No more than 3 units may be awarded for a topic directly related to a topic studied of CE 299. A public presentation is required.

### Plan B

Master's Project (3 or 6 units) Approval by the faculty thesis advisor and by a second faculty or an expert in the area of study is required. A Master's Project should be a significant undertaking appropriate to the engineering profession. It evidences originality and independent thinking, appropriate form and organization, and rationale. It is described and summarized in a written report that includes a discussion of the project's significance, objectives, methodology and a conclusion or recommendation. The work should be associated with practical engineering applications. The report must comply with University standards for format and will be filed in the University Library. No more than 3 units may be awarded for a topic directly related to a topic studied for CE 299. A public presentation is required.

### Plan C

Directed Study with Comprehensive Exam (3 units). Approval of one faculty member is required for Directed Study. The comprehensive examination is administered by a committee of three faculty members. A written report and a public presentation are required on the directed study. The format of the comprehensive examination can be written, oral, or both.

- With advisor approval. Students pursuing an emphasis in Environmental Engineering, Water Resource Engineering or Transportation Engineering must take ENGR 203. Students pursuing an emphasis in Structural Engineering must take ENGR 201 or ENGR 202.
- Elective courses (including CE 299) selected with prior approval of the student's faculty advisor in the area of interest. In addition to 200-level courses, these may also include the technical electives (but not the required courses) from the civil engineering undergraduate curriculum. Not more than 3 units of CE 299 may be taken without prior approval of the Graduate Coordinator.
- Total required units for degree is 30. Variable units are listed due to variable culminating requirement units. If 3 units of culminating requirement are selected, 6 units of electives are required, and vice versa.

## Specialization Courses

Units required: 15 – a minimum of 12 units must be taken from one of the following five areas of specialization. Up to 3 units can be satisfied by 200 level coursework (not including CE 299) outside the chosen area of specialization.

| Code                             | Title   | Units |
|----------------------------------|---|-------|
| <b>Environmental Engineering</b> |   |       |
| CE 232                           | Groundwater Hydrology                                 |       |
| CE 251                           | Environmental Quality Processes I                     |       |
| CE 252                           | Environmental Quality Processes II                    |       |
| CE 253                           | Environmental Quality Processes III                   |       |
| CE 254                           | Water Quality Management                              |       |
| CE 255                           | Transport of Chemicals in Soil Systems                |       |
| CE 281                           | Systems Analysis of Resources Development             |       |
| <b>Geotechnical Engineering</b>  |   |       |
| CE 270                           | Advanced Soil Mechanics and Foundation Engineering I  |       |
| CE 271                           | Advanced Soil Mechanics and Foundation Engineering II |       |
| CE 272                           | Geotechnical Modeling                                 |       |
| CE 273                           | Ground Modification Engineering                       |       |

CE 274 Soil Dynamics and Earthquake Engineering

CE 275 Geosynthetics

#### **Structural Engineering**

CE 260 Matrix Structural Analysis

CE 261 Finite Element Analysis

CE 262 Nonlinear Structural Analysis

CE 263 Advanced Steel Design

CE 264 Advanced Design in Reinforced Concrete

CE 266 Dynamics and Earthquake Response of Structures

CE 267 Structural Systems for Buildings

CE 268 Pre-stressed Concrete Bridge Design

#### **Transportation Engineering**

CE 241 Analysis and Control of Traffic Systems

CE 242 Transportation Planning

CE 243 Traffic Flow Theory

CE 244 Advanced Transportation Facility Design

CE 245 Pavement Design

CE 275 Geosynthetics

#### **Water Resources Engineering**

CE 230 Water Resources Planning

CE 231 Hydrometeorology

CE 232 Groundwater Hydrology

CE 234 Advanced Engineering Hydraulics

CE 235 Hydrologic Modeling

CE 281 Systems Analysis of Resources Development