

# Civil Engineering (M.S.C.E.)

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## About The Program:

The M.S.C.E. program is designed to provide students with the opportunity to develop a greater technical competency in the general area of Civil and Environmental Engineering. Students are motivated to grow intellectually through the continued search for and use of knowledge, and are provided with the catalyst to become active, articulate, and socially aware individuals. Graduates of the program are key contributors to the civil engineering and environmental engineering professions.

**Career Options:** Graduates with the M.S.C.E. are employed by various engineering companies as well as government agencies in design, analysis, and applications. Typical examples are water treatment facilities and regulatory agencies engaged in environmental regulation and pollution control; companies involved in construction project management; and those involved in structural design and analysis of buildings, bridges, and other structures. Students who complete an M.S.C.E. with a thesis are prepared to enter a doctoral program.

**Prerequisites for Admission:** Completion of junior year of a bachelor's degree program in Civil Engineering or Environmental Engineering

## Areas of Specialization:

For each of the two areas of specialization, research includes:

- Civil Engineering Systems — three major branches of civil engineering: construction engineering, structural engineering, and transportation engineering.
- Environmental Engineering — the fundamentals and applications of water resources engineering, pollution in natural systems (water and air), and engineered treatment and remediation systems.

For the M.S.C.E. program, students also choose between three tracks:

1. The Thesis Track is intended for students pursuing advanced research and includes 24 credits of didactic coursework, 3 credits of Project ([CEE 9995](#)), and 3 credits of Thesis ([CEE 9996](#)).
2. The Project Track introduces students to applied research and includes 27 credits of didactic coursework and 3 credits of Project ([CEE 9995](#)).
3. The Coursework Track provides students with an advanced engineering background for their future in the engineering profession through 30 credits of didactic coursework.

In the first term, the student and the CEE Graduate Program Director establish a graduate Plan of Study that outlines all required courses and the sequence for the student to follow. This form is used to track the student's progress as the various benchmarks in the program are completed. Once established, any revisions to the Plan of Study require approval in advance. However, if considering whether to change one's track, the student should note that:

- "Thesis" credits ([CEE 9996](#)) can only be applied toward the Thesis M.S.C.E. Track and cannot be applied to either the Project or Coursework Tracks.

- "Project" credits ([CEE 9995](#)) can be applied toward the Thesis and Project M.S.C.E. Tracks but cannot be used for the Coursework Track.
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## Requirements of Programs:

- **Total Credit Hours:** 30
- **Culminating Events:**

### *Thesis Track:*

The culminating events in the Thesis Track are typically undertaken during the last two successive terms of study. Successful completion requires the following:

#### **Thesis Proposal — [CEE 9995](#) Project (3 credits)**

Under the guidance of the advisor, the student conducts independent research on an applied engineering topic of current interest and registers for [CEE 9995](#). This work includes the research and preliminary results that form the basis of an extended study that the student plans to carry on in [CEE 9996](#) Thesis in the following term. The student submits a research report as her/his Thesis Proposal to a committee consisting of three or more faculty members, including the faculty advisor, and presents her/his proposal in an open College-wide seminar, which is scheduled and posted at least 10 business days in advance of the presentation date.

Immediately following the presentation, the student's advisory committee questions the student about the details and strategy of the proposed research. The committee then accepts, accepts with revisions, or rejects the proposal.

The student must pass the Thesis Proposal before registering for [CEE 9996](#). If the student fails Thesis Proposal, s/he may either re-register for [CEE 9995](#) (1 credit) in the next regular term and repeat the entire proposal process or consider switching to the Project or Coursework Track. *NOTE: A second failure of Thesis Proposal results in automatic dismissal from the University.* If switching to another track, the Plan of Study form requires updating and appropriate approvals.

#### **Thesis Defense — [CEE 9996](#) Thesis (3 credits)**

The student should register for [CEE 9996](#) in the term that s/he plans to defend the thesis. The thesis document should be prepared in a format compliant with University standards.

(See [Graduate School Policy 02.26.12.02](#).) Two weeks prior to the thesis defense, the student provides the committee with a copy of the completed thesis and posts an announcement of the defense, which is to take place during a regular academic term (i.e., not scheduled during study days, final exams, or the breaks between terms). If the student is to graduate in the same term as the thesis defense is held, then the defense should take place at least 30 days prior to the end of the term.

The thesis defense is an open College seminar in which the student presents the concepts and results of her/his research. Immediately following the defense, the thesis committee convenes to closely examine the student's research and decide to accept the thesis as provided, accept the thesis with revisions, or not accept the thesis. If the thesis is accepted, a letter grade for [CEE 9996](#) is assigned. If the thesis is accepted with revisions, then the student must submit the revised thesis within 30 days and with the approval of the Thesis Committee. If the thesis is not accepted, but the committee decides to not fail the student, an "R" grade is assigned to [CEE 9996](#). In the following term, the student registers for one credit of [ENGR 9991](#) Directed

Research until s/he is again prepared to attempt the defense. The defense procedures described above are then carried out again in the term that the student is prepared to defend the thesis.

*Project Track:*

The culminating event for the Project Track is [CEE 9995](#) Project. This entails a one-term research activity done under the supervision of a full-time faculty advisor on an applied engineering topic of interest. Near the end of the term, the student prepares a report of her/his findings and presents the study in an open departmental seminar. Both the seminar and the written report are used to determine the student's grade for [CEE 9995](#). The grade is determined jointly by the advisor and another designated grader selected by the Graduate Program Director.

*Coursework Track:*

No culminating event is warranted for the Coursework Track.

## Required Courses (Thesis Track)

### Core Courses

*Select three from the following:*

**Bridge Design** – The course covers bridge design in structural steel and reinforced concrete; application of AASHTO bridge design specifications; and analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches.

**Transportation Engineering Materials** – Topics include physical properties of asphalt, aggregates, portland cement, portland cement concrete, and their combinations; advanced techniques in material characterization in the lab and the field; material variability, sampling, and statistical techniques; and the impact of these properties on their characterization of the design, construction, rehabilitation, and management of transportation facilities, including portland cement concrete pavements with steel reinforcement; construction methodologies, recycling, and energy consideration; and application of the state-of-the-art computer software packages.

**Pavement Management and Traffic Systems Management** – The course covers development of management methods for analysis, planning, design, construction, maintenance, and rehabilitation of pavements and traffic systems. The objective functions include creation of more efficient use of existing facilities through improved management and operation of vehicles and roadway.

**Structural Dynamics** – This design course addresses developments in theory and practice of earthquake engineering. It familiarizes students with new techniques of analysis and seismic design. Students learn advanced concepts in applied mathematics, especially structural dynamics and application of seismic building and bridge codes. Familiarity with differential equations, matrix methods of analysis, non-linear equations, eigenvalue solutions, and finite elements modeling are required. Students are instructed to learn and apply new software for dynamic analysis. Laboratory work includes the study of experimental models such as for bridge piers (frames, walls, and hammerhead columns) using an MTS machine for applying dynamic loads.

**Foundation Engineering** – Principles of foundation engineering and design. Topics include soil stress distributions, bearing capacity of shallow (footings, mats) and deep foundations (driven piles, drilled shafts), tolerable settlements, construction techniques, and field quality control.

**Earth Retaining Systems** – Principles related to design of earth retaining systems and stability of earth slopes. Topics include lateral earth pressure theory, temporary and permanent retaining structures, in-situ reinforcement, and braced excavations. Shear strength of cohesive and granular soils and slope stability analysis using limited equilibrium, design charts and numerical methods.

### **Electives (15 Credits Worth)**

#### **Non-Didactic Courses**

**Project** - A project is assigned with the approval of the Civil and Environmental Engineering Graduate Committee and conducted under the supervision of a graduate faculty advisor. An oral presentation in an open seminar and a written report are required to complete the independent project. Projects related to industrial applications are encouraged. For non-thesis students only.

**Thesis** – Master's thesis. May be taken twice.

### **Required Courses (Project Track)**

#### **Core Courses**

*Select three from the following:*

**Bridge Design** – The course covers bridge design in structural steel and reinforced concrete; application of AASHTO bridge design specifications; and analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches.

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## **Electives (18 Credits Worth)**

### **Non-Didactic Courses**

**Project** - A project is assigned with the approval of the Civil and Environmental Engineering Graduate Committee and conducted under the supervision of a graduate faculty advisor. An oral presentation in an open seminar and a written report are required to complete the independent project. Projects related to industrial applications are encouraged. For non-thesis students only.

## **Required Courses (Coursework Track)**

### **Core Courses**

*Select three from the following:*

**Bridge Design** – The course covers bridge design in structural steel and reinforced concrete; application of AASHTO bridge design specifications; and analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches.

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## Electives (21 Credits Worth)

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### Courses:

Click [HERE](#) for more information on the courses below.

- Probability and Statistics in Engineering
- Probability Statistics in Engineering
- Special Topics
- Transportation Systems Management
- Transportation Engineering
- Structural Design of Pavements
- Bridge Design
- Transportation Engineering Materials
- Intelligent Transportation Systems
- Airport Engineering
- Pavement Management and Traffic Systems Management
- Introduction to Geosynthetics
- Pavement Rehabilitation and Maintenance
- Construction Administration
- Engineering Project Management
- Construction Financial Management
- Construction Equipment Management
- Geotechnical Engineering
- Structural CADD Systems
- Structural Dynamics
- Behavior and Design of Steel Structures
- Structural Mechanics
- Behavior and Design of Masonry Structures
- Behavior and Design of Reinforced Concrete Structures
- Earthquake Engineering and Seismic Design
- Life Cycle Assessment and Carbon Footprinting
- Engineering Hydrology
- Fate of Pollutants in Subsurface Environments
- Contaminant Dynamics in Urban Streams
- Environmental Hydrology
- Urban Streams and Stormwater Management
- Physical Principles of Environmental Systems
- Chemical Principles of Environmental Systems
- Mathematical Modeling
- Air Pollution Control
- Weather Monitoring and Forecasting
- Solid Wastes Engineering
- Environmental Chemistry
- Environmental Organic Chemistry
- Chemistry for Environmentally Sustainable Engineering
- Sustainable Development and Industrial Ecology
- Sustainability Aspects of Water Supply and Wastewater Treatment
- Membrane Separation in Wastewater Treatment
- Biological Principles of Environmental Systems
- Environmental Biotechnology

- Advanced Biological Wastewater Treatment
- Aquatic Toxicology in Environmental Engineering
- Environmental Engineering
- Advanced Soil Mechanics
- Foundation Engineering
- Earth Retaining Systems
- Geotechnical Earthquake Engineering
- Advanced Project Management
- Advanced Physical/Chemical Treatment Processes
- Advanced Chemical Principles of Environmental Systems
- Computer Modeling of Environmental Transport
- Water and Wastewater Systems Design
- Directed Research