CIVIL AND INFRASTRUCTURE ENGINEERING, MS

Banner Code: VS-MS-CEIE

Academic Advising
Phone: 703-993-1675
Email: ceiegrad@gmu.edu
Website: civil.gmu.edu/graduate/master-of-science

This MS is designed for students who have completed a bachelor’s degree in civil engineering, although students with related undergraduate degrees may be considered for provisional admission. The MS educates students in the theory and practice of civil engineering science and design, with a technical concentration. The master’s degree is increasingly expected for high level practice in civil engineering, and prepares graduates to practice in civil engineering for: federal, state, or local government; engineering design firms; construction firms; public utilities; non-governmental organizations; and local and regional planning firms, among others. The MS degree serves as a foundation for subsequent study in a doctoral program in civil engineering, as well as for graduate studies in architecture, law, business, economics, finance, and public policy and administration.

Full-time students typically complete the degree in one and a half, to two years.

Admissions & Policies

Admissions
To be considered for admission to the program, a candidate must:

- Satisfy general University and Volgenau School requirements for admission to a graduate program,
- Have earned a baccalaureate degree in engineering or a related science,
- Provide two letters of reference, submitted by former professors or supervisors,
- Provide a goals statement and professional résumé.

Acceptance to the degree program is based on an assessment of the applicant’s capacity to pursue graduate studies successfully. Consideration is given to the undergraduate record, any previous graduate work, professional work experience, and reference letters. Students with minor admission deficiencies may be provisionally admitted subject to completing an articulation program. Prescribed courses taken in the articulation program are not creditable toward the MS degree.

Requirements

Degree Requirements
Total credits: 30

All MS students must develop a faculty-approved plan of study with a minimum of 30 graduate credits. These credits include two core courses (CEIE 601 Infrastructure Modeling and CEIE 605 Risk and Uncertainty in Civil Engineering), specific requirements of a concentration declared by the student, and seminar requirement (CEIE 795 Civil and Infrastructure Engineering Seminar).

Plan of Study
Students are responsible for developing and receiving advisor approval on a plan of study no later than the end of their second semester of study. Courses taken without prior approval by the faculty advisor may not be accepted for credit toward the degree. No more than three courses used for credit toward the MS may be cross-listed as undergraduate courses. None may repeat material completed as part of the student’s previous studies. Most MS courses are offered on a three-semester rotation.

Core Courses
All MS students must complete the following two core courses within the first 12 credit hours of their MS studies. These courses provide a common background for understanding the breadth and complexity of civil and infrastructure engineering and for analyzing and solving engineering problems.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 601</td>
<td>Infrastructure Modeling</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 605</td>
<td>Risk and Uncertainty in Civil Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

Concentration in Construction Project Management (CPM)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select at least three from the following five construction project management core courses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEIE 571</td>
<td>Construction Administration !</td>
<td>1</td>
</tr>
<tr>
<td>CEIE 572</td>
<td>Building Information Modeling !</td>
<td>1</td>
</tr>
<tr>
<td>CEIE 573</td>
<td>Legal Aspects of the Construction Process</td>
<td></td>
</tr>
<tr>
<td>CEIE 575</td>
<td>Design for Constructability</td>
<td></td>
</tr>
<tr>
<td>CEIE 576</td>
<td>Construction Cost Estimating</td>
<td></td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

1 Cross-listed as undergraduate course

Electives
The remaining elective credits depend on whether the student is pursuing research credits or not.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select one from the following options (also outlined in the Notes section below):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option 1: Thesis:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEIE 799</td>
<td>Master’s Thesis (6 credits)</td>
<td></td>
</tr>
<tr>
<td>At least 9 credits of electives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option 2: Project:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEIE 798</td>
<td>Research Project in Civil Engineering (3 credits)</td>
<td></td>
</tr>
<tr>
<td>At least 12 credits of electives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option 3: All Coursework:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
At least 15 credits of electives

Total Credits 15

A list of approved electives for the construction project management concentration is provided below. Note that the remaining construction project management core courses can also be selected as electives.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 524</td>
<td>Introduction to Bridge Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 525</td>
<td>Structural Evaluation and Rehabilitation</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 531</td>
<td>Earth Retaining Structures and Slope Stability</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 532</td>
<td>Foundation Design</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 607</td>
<td>Public Infrastructure Management and Finance</td>
<td>3</td>
</tr>
<tr>
<td>GBUS 510</td>
<td>Engineering Marketing and Financial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 636</td>
<td>Sources of Geotechnical Data</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 679</td>
<td>Special Topics in Construction Management</td>
<td>3</td>
</tr>
<tr>
<td>GGS 553</td>
<td>Geographic Information Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

1) Cross-listed as undergraduate course

Concentration in Environmental and Water Resources Engineering (EWRE)

Select at least three from the following five environmental and water resources engineering core courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 641</td>
<td>Water Resources Engineering I: Principles and Practice</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 657</td>
<td>Environmental Engineering Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 658</td>
<td>Water Quality</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 742</td>
<td>Water Resources Engineering II: Water Resource Systems</td>
<td>3</td>
</tr>
<tr>
<td>COMM 637</td>
<td>Risk Communication</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 9

Electives

The remaining elective credits depend on whether the student is pursuing research credits or not.

Select one from the following options (also outlined in the Notes section below):

Option 1: Thesis:

CEIE 799 Master’s Thesis (6 credits)

At least 9 credits of electives

Option 2: Project:

CEIE 798 Research Project in Civil Engineering (3 credits)

At least 12 credits of electives

Option 3: All Coursework:

At least 15 credits of electives

Total Credits 15

A list of approved electives for the environmental and water resources engineering concentration is provided below. Note that the remaining environmental and water resources engineering core courses can also be selected as electives.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 540</td>
<td>Water Supply and Distribution</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 542</td>
<td>Open Channel Flow</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 550</td>
<td>Environmental Engineering Systems</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 553</td>
<td>Water and Wastewater Treatment Processes</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 607</td>
<td>Public Infrastructure Management and Finance</td>
<td>3</td>
</tr>
<tr>
<td>or GBUS 510</td>
<td>Engineering Marketing and Financial Analysis</td>
<td></td>
</tr>
<tr>
<td>CEIE 634</td>
<td>Groundwater and Geoenvironmental Design</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 642</td>
<td>Flood Hazards Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 643</td>
<td>Coastal Flood Hazards</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 649</td>
<td>Special Topics in Water Resources Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 659</td>
<td>Hazardous Waste</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 664</td>
<td>Transportation Engineering and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 683</td>
<td>Water and Wastewater Systems Security</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 627</td>
<td>Aquatic Environmental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 651</td>
<td>Environmental Chemistry of Organic Substances</td>
<td>3</td>
</tr>
<tr>
<td>CLIM 714</td>
<td>Land-Climate Interactions</td>
<td>3</td>
</tr>
<tr>
<td>CSI 501</td>
<td>Introduction to Scientific Programming</td>
<td>3</td>
</tr>
<tr>
<td>CSI 690</td>
<td>Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>CSI 720</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>CSI 721</td>
<td>Computational Fluid Dynamics I</td>
<td>3</td>
</tr>
<tr>
<td>EVPP 524</td>
<td>Introduction to Environmental and Resource Economics</td>
<td>3</td>
</tr>
<tr>
<td>EVPP 670</td>
<td>Environmental Law</td>
<td>3</td>
</tr>
<tr>
<td>GGS 553</td>
<td>Geographic Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>GGS 656</td>
<td>The Hydrosphere</td>
<td>3</td>
</tr>
<tr>
<td>GGS 671</td>
<td>Algorithms and Modeling in GIS</td>
<td>3</td>
</tr>
<tr>
<td>GGS 787</td>
<td>Scientific Data Mining for Geoinformatics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 554</td>
<td>Applied Statistics I</td>
<td>3</td>
</tr>
</tbody>
</table>

1) Cross-listed as undergraduate courses

Concentration in Geotechnical Engineering (GEOE)

Select at least three from the following five geotechnical engineering core courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 531</td>
<td>Earth Retaining Structures and Slope Stability</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 634</td>
<td>Groundwater and Geoenvironmental Design</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 635</td>
<td>Advanced Soil Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 636</td>
<td>Sources of Geotechnical Data</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 638</td>
<td>Advanced Foundation Design</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 9
Electives
The remaining elective credits depend on whether the student is pursuing research credits or not.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Select one from the following options (also outlined in the Notes section below):</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option 1: Thesis:</td>
<td></td>
</tr>
<tr>
<td>CEIE 799</td>
<td>Master’s Thesis (6 credits)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At least 9 credits of electives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option 2: Project:</td>
<td></td>
</tr>
<tr>
<td>CEIE 798</td>
<td>Research Project in Civil Engineering (3 credits)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At least 12 credits of electives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option 3: All Coursework:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At least 15 credits of electives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td>15</td>
</tr>
</tbody>
</table>

A list of approved electives for the geotechnical engineering concentration is provided below. Note that the remaining geotechnical engineering core courses can also be selected as electives.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 524</td>
<td>Introduction to Bridge Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 532</td>
<td>Foundation Design</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 535</td>
<td>Engineering Geology</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 573</td>
<td>Legal Aspects of the Construction Process</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 575</td>
<td>Design for Constructability</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 607</td>
<td>Public Infrastructure Management and Finance</td>
<td>3</td>
</tr>
<tr>
<td>or GBUS 510</td>
<td>Engineering Marketing and Financial Analysis</td>
<td></td>
</tr>
<tr>
<td>CEIE 639</td>
<td>Special Topics in Geotechnical Engineering</td>
<td>1-3</td>
</tr>
<tr>
<td>CEIE 659</td>
<td>Hazardous Waste</td>
<td>3</td>
</tr>
<tr>
<td>GGS 553</td>
<td>Geographic Information Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

1 Cross-listed as undergraduate courses

Concentration in Structural Engineering (STRE)

Select at least three of the following five structural engineering core courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 526</td>
<td>Advanced Steel Design</td>
<td></td>
</tr>
<tr>
<td>CEIE 527</td>
<td>Pre-stressed Concrete</td>
<td></td>
</tr>
<tr>
<td>CEIE 611</td>
<td>Advanced Structural Analysis</td>
<td></td>
</tr>
<tr>
<td>CEIE 612</td>
<td>Structural Mechanics</td>
<td></td>
</tr>
<tr>
<td>CEIE 613</td>
<td>Structural Dynamics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td>9</td>
</tr>
</tbody>
</table>

Electives
The remaining elective credits depend on whether the student is pursuing research credits or not.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Select one from the following options (also outlined in the Notes section below):</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option 1: Thesis:</td>
<td></td>
</tr>
<tr>
<td>CEIE 799</td>
<td>Master’s Thesis (6 credits)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At least 9 credits of electives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option 2: Project:</td>
<td></td>
</tr>
<tr>
<td>CEIE 798</td>
<td>Research Project in Civil Engineering (3 credits)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At least 12 credits of electives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option 3: All Coursework:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At least 15 credits of electives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td>15</td>
</tr>
</tbody>
</table>

Concentration in Transportation Engineering (TRNE)

Select at least three of the following five transportation engineering core courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 662</td>
<td>Travel Demand Modeling</td>
<td></td>
</tr>
<tr>
<td>CEIE 663</td>
<td>Intelligent Transportation Systems</td>
<td></td>
</tr>
<tr>
<td>CEIE 664</td>
<td>Transportation Engineering and the Environment</td>
<td></td>
</tr>
<tr>
<td>CEIE 767</td>
<td>Traffic Engineering Modeling and Analysis</td>
<td></td>
</tr>
<tr>
<td>STAT 554</td>
<td>Applied Statistics I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td>9</td>
</tr>
</tbody>
</table>

Electives
The remaining elective credits depend on whether the student is pursuing research credits or not.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Select one from the following options (also outlined in the Notes section below):</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option 1: Thesis:</td>
<td></td>
</tr>
<tr>
<td>CEIE 799</td>
<td>Master’s Thesis (6 credits)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At least 9 credits of electives</td>
<td></td>
</tr>
</tbody>
</table>
30 credit hours required for the MS degree. The MS thesis should reflect a significant, independent research effort that advances engineering science, and is worthy of publication. The work is conducted under the guidance of a faculty thesis advisor, and the final written thesis and oral defense are defended before a three-member faculty committee. In addition, students must make a satisfactory presentation of the thesis in the CEIE graduate seminar. The thesis is recommended for those students who wish to develop and document their research skills, or contemplate subsequent enrollment in a PhD program. Students are advised of the university’s continuous registration requirement for thesis and dissertation research credits. Upon first enrolling in CEIE 799 Master’s Thesis, the student must continue registration for each fall and spring semester until the thesis is successfully completed. CEIE 799 Master’s Thesis credits count toward the 30 credit hours required for the MS degree.

A list of approved electives for the transportation engineering concentration is provided below. Note that the remaining transportation engineering core courses can also be selected as electives.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 560</td>
<td>Public Transportation Systems</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 561</td>
<td>Traffic Engineering ¹</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 562</td>
<td>Urban Transportation Planning ¹</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 607</td>
<td>Public Infrastructure Management and Finance Engineering Marketing and Financial Analysis or GBUS 510</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 665</td>
<td>Travel Survey Methods and Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 667</td>
<td>Multi-modal Transportation Systems</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 668</td>
<td>Transportation Economics</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 669</td>
<td>Special Topics in Transportation Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 762</td>
<td>Network Models for Transportation Planning</td>
<td>3</td>
</tr>
<tr>
<td>CEIE 763</td>
<td>Discrete Choice Analysis in Transportation</td>
<td>3</td>
</tr>
<tr>
<td>CS 504</td>
<td>Principles of Data Management and Mining</td>
<td>3</td>
</tr>
<tr>
<td>GGS 553</td>
<td>Geographic Information Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

¹ Cross-listed as undergraduate courses

Note:
Electives outside of the chosen concentration can only be taken or substituted with the approval of the faculty advisor.

Project or Thesis Option
As part of the plan of study, students may elect to pursue research credits.

Research Project
Students complete CEIE 798 Research Project in Civil Engineering, during which they prepare and present a scholarly paper. The scholarly paper is a technical report on an independent study, laboratory or computer experimentation, or literature search on a current civil and infrastructure engineering topic selected under the guidance of a faculty advisor. CEIE 798 Research Project in Civil Engineering credits count toward the 30 credit hours required for the MS degree.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIE 798</td>
<td>Research Project in Civil Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Master’s Thesis
Students complete CEIE 799 Master’s Thesis which counts toward the 30 credit hours required for the MS degree. The MS thesis should reflect
courses. The courses selected for this purpose must be approved by the academic advisor.

**Degree Requirements**

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student’s final undergraduate semester, students must complete a Bachelor's/Accelerated Master’s Transition form that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master’s degree is conferred.