

CIVIL AND INFRASTRUCTURE ENGINEERING, MS

Banner Code: VS-MS-CEIE

Academic Advising

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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.

CEIE 601	Infrastructure Modeling	3
CEIE 605	Risk and Uncertainty in Civil Engineering	3
Total Credits		6

Concentration in Construction Project Management (CPM)

Select at least three from the following five construction project management core courses: 9

CEIE 571	Construction Administration ¹	
CEIE 572	Building Information Modeling ¹	
CEIE 573	Legal Aspects of the Construction Process	
CEIE 575	Design for Constructability	
CEIE 576	Construction Cost Estimating	
Total Credits		9

¹ Cross-listed as undergraduate course

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): 15

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

CEIE 524	Introduction to Bridge Engineering	3
CEIE 525	Structural Evaluation and Rehabilitation	3
CEIE 531	Earth Retaining Structures and Slope Stability	3
CEIE 532	Foundation Design ¹	3
CEIE 607	Public Infrastructure Management and Finance	3
GBUS 510	Engineering Marketing and Financial Analysis	3
CEIE 636	Sources of Geotechnical Data	3
CEIE 679	Special Topics in Construction Management	3
GG5 553	Geographic Information Systems	3

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: 9

CEIE 641	Water Resources Engineering I: Principles and Practice	
CEIE 657	Environmental Engineering Microbiology	
CEIE 658	Water Quality	
CEIE 742	Water Resources Engineering II: Water Resource Systems	
COMM 637	Risk Communication	
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): 15

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.

CEIE 540	Water Supply and Distribution ¹	3
CEIE 542	Open Channel Flow ¹	3

CEIE 550	Environmental Engineering Systems ¹	3
CEIE 553	Water and Wastewater Treatment Processes ¹	3
CEIE 607	Public Infrastructure Management and Finance	3
or GBUS 510	Engineering Marketing and Financial Analysis	
CEIE 634	Groundwater and Geoenvironmental Design	3
CEIE 642	Flood Hazards Engineering	3
CEIE 643	Coastal Flood Hazards	3
CEIE 649	Special Topics in Water Resources Engineering	3
CEIE 659	Hazardous Waste	3
CEIE 664	Transportation Engineering and the Environment	3
CEIE 683	Water and Wastewater Systems Security	3
CHEM 627	Aquatic Environmental Chemistry	3
CHEM 651	Environmental Chemistry of Organic Substances	3
CLIM 714	Land-Climate Interactions	3
CSI 501	Introduction to Scientific Programming	3
CSI 690	Numerical Methods	3
CSI 720	Fluid Mechanics	3
CSI 721	Computational Fluid Dynamics I	3
EVPP 524	Introduction to Environmental and Resource Economics	3
EVPP 670	Environmental Law	3
GG5 553	Geographic Information Systems	3
GG5 656	The Hydrosphere	3
GG5 671	Algorithms and Modeling in GIS	3
GG5 787	Scientific Data Mining for Geoinformatics	3
STAT 554	Applied Statistics I	3

¹ Cross-listed as undergraduate courses

Concentration in Geotechnical Engineering (GEOE)

Select at least three from the following five geotechnical engineering core courses: 9

CEIE 531	Earth Retaining Structures and Slope Stability	
CEIE 634	Groundwater and Geoenvironmental Design	
CEIE 635	Advanced Soil Mechanics	
CEIE 636	Sources of Geotechnical Data	
CEIE 638	Advanced Foundation Design	
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): 15

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)	
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At least 12 credits of electives

Option 3: All Coursework:

At least 15 credits of electives

Total Credits		15
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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.

CEIE 524	Introduction to Bridge Engineering	3
CEIE 532	Foundation Design ¹	3
CEIE 535	Engineering Geology ¹	3
CEIE 573	Legal Aspects of the Construction Process	3
CEIE 575	Design for Constructability	3
CEIE 607	Public Infrastructure Management and Finance	3
or GBUS 510	Engineering Marketing and Financial Analysis	
CEIE 639	Special Topics in Geotechnical Engineering	1-3
CEIE 659	Hazardous Waste	3
GG5 553	Geographic Information Systems	3

¹ Cross-listed as undergraduate courses**Concentration in Structural Engineering (STRE)**

Select at least three of the following five structural engineering core courses: 9

CEIE 526	Advanced Steel Design	
CEIE 527	Pre-stressed Concrete	
CEIE 611	Advanced Structural Analysis	
CEIE 612	Structural Mechanics	
CEIE 613	Structural Dynamics	
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): 15

Option 1: Thesis:

CEIE 799	Master's Thesis (6 credits)	
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At least 9 credits of electives

Option 2: Project:

CEIE 798	Research Project in Civil Engineering (3 credits)	
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At least 12 credits of electives

Option 3: All Coursework:

At least 15 credits of electives

Total Credits		15
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A list of approved electives for the structural engineering concentration is provided below. Note that the remaining structural engineering core courses can also be selected as electives.

CEIE 512	Structural Steel Design ¹	3
CEIE 513	Reinforced Concrete Design ¹	3
CEIE 524	Introduction to Bridge Engineering	3
CEIE 525	Structural Evaluation and Rehabilitation	3
CEIE 532	Foundation Design ¹	3
CEIE 575	Design for Constructability	3
CEIE 607	Public Infrastructure Management and Finance	3
or GBUS 510	Engineering Marketing and Financial Analysis	
CEIE 619	Special Topics in Structural Engineering	3
CEIE 620	Intelligent Structural Systems	3
CEIE 623	Advanced Reinforced Concrete Design	3
CSI 690	Numerical Methods	3
CSI 742	The Mathematics of the Finite Element Method	3

¹ Cross-listed as undergraduate courses**Concentration in Transportation Engineering (TRNE)**

Select at least three of the following five transportation engineering core courses: 9

CEIE 662	Travel Demand Modeling	
CEIE 663	Intelligent Transportation Systems	
CEIE 664	Transportation Engineering and the Environment	
CEIE 767	Traffic Engineering Modeling and Analysis	
STAT 554	Applied Statistics I	
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): 15

Option 1: Thesis:

CEIE 799	Master's Thesis (6 credits)	
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At least 9 credits of electives

Option 2: Project:

CEIE 798	Research Project in Civil Engineering (3 credits)	
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At least 12 credits of electives

Option 3: All Coursework:

At least 15 credits of electives

Total Credits		15
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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.

CEIE 560	Public Transportation Systems	3
CEIE 561	Traffic Engineering ¹	3

CEIE 562	Urban Transportation Planning ¹	3
CEIE 607	Public Infrastructure Management and Finance	3
or GBUS 510	Engineering Marketing and Financial Analysis	
CEIE 665	Travel Survey Methods and Data Analysis	3
CEIE 667	Multi-modal Transportation Systems	3
CEIE 668	Transportation Economics	3
CEIE 669	Special Topics in Transportation Engineering	3
CEIE 762	Network Models for Transportation Planning	3
CEIE 763	Discrete Choice Analysis in Transportation	3
CS 504	Principles of Data Management and Mining	3
GGIS 553	Geographic Information Systems	3

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.

CEIE 798	Research Project in Civil Engineering	3
Total Credits		3

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 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.

CEIE 799	Master's Thesis (must complete 6 credits)	1-6
Total Credits		1-6

Seminar Requirement

All degree candidates must attend a minimum of five graduate seminars approved by the CEIE Department for the degree program. Students must enroll in CEIE 795 Civil and Infrastructure Engineering Seminar each semester (fall and spring) for the duration of their MS studies until they receive a satisfactory (S) grade. This course is used to verify the seminar attendance requirement and is repeatable.

CEIE 795	Civil and Infrastructure Engineering Seminar	0
Total Credits		0

Accelerated Master's

Civil and Infrastructure Engineering, BS/ Civil and Infrastructure Engineering, Accelerated MS

Overview

Highly-qualified students in the Civil and Infrastructure Engineering, BS have the option of obtaining an accelerated Civil and Infrastructure Engineering, MS.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees. For policies governing all graduate degrees, see AP.6 Graduate Policies.

Admission Requirements

Students in the Civil and Infrastructure Engineering, BS program may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30. All other criteria for admission are identical to criteria for admission into the Civil and Infrastructure Engineering, MS program.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for both the BS and MS programs. Students register for 6 credits of overlapping graduate level courses in place of undergraduate technical elective 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.