

**The University Senate of Michigan Technological University
Proposal 7-21**

(Voting Units: Academic)

Establishment of a New Graduate Certificate in Structural Engineering: Bridge Analysis and Design

Submitted by: Department of Civil and Environmental Engineering

1. Proposal Date:

May 15, 2020

2. Proposing Contacts and Department:

- Dr. Theresa M. Ahlborn, Department of Civil and Environmental Engineering, tess@mtu.edu
- Dr. William M. Bulleit, Department of Civil and Environmental Engineering, wmbullei@mtu.edu
- Dr. Qingli Dai, Department of Civil and Environmental Engineering, qingdai@mtu.edu
- Dr. Daniel M. Dowden, Department of Civil and Environmental Engineering, dmdowden@mtu.edu
- Dr. Stephen M. Morse, Department of Civil and Environmental Engineering, smmorse@mtu.edu
- Dr. R. Andrew Swartz, Department of Civil and Environmental Engineering, raswartz@mtu.edu

3. Sponsor Department Approvals: May 29, 2020

4. General Description and Characteristics of Program:

4.1 General Description of Certificate

The structures faculty in the department of Civil and Environmental Engineering within the College of Engineering at Michigan Tech proposes a nine credit Certificate named Structural Engineering: Bridge Analysis and Design. In addition to practicing structural engineers, individuals with an engineering background with an interest in structural analysis, will find the skills covered in this Certificate to be of use.

The proposed certificate provides individuals with the ability to analyze and design bridge structures. Analysis methods taught as part of this certificate go significantly beyond those at the undergraduate level.

4.2 Catalog Description

This certificate includes the necessary courses needed to analyze and design bridge structures. Modern, advanced structural analysis tools and techniques are utilized to analyze bridge structures for static and dynamic loading conditions. Provisions of the AASHTO LRFD Bridge Design Specification are introduced and used the design bridge structures

5. Rationale for Certificate:

The skills gained here will be to utilize advanced techniques and evaluate the design and construction of bridges of many materials types. Skills learned as part of this certificate are very useful and necessary for career advancement of structural engineers in the technical track at large and small engineering firms and agencies that focus on design, analysis, construction and operations of bridges and support structures.

This certificate will be offered primarily online. Graduate students who want this stackable certificate that would count towards a full MS degree would benefit from this certificate. Also benefiting from this certificate would be working professionals, particularly those already holding undergraduate engineering degrees, who want to expand their skills to evaluate and design bridge structures. The online versions of these courses are already components of an existing online MSCE degree offering, thus they are currently online, or are planned to be online within the next two years. This program draws a significant number of MTU alumni and other students. Offering these courses as part of a certificate will increase these numbers to include students seeking only certificates as well. In addition, the certificate can attract full-time working professionals who do not find an MS degree necessary to achieve their goals.

6. Related Programs:

University of Central Florida

Structural engineering graduate certificate

12 credit hours

https://catalog.ucf.edu/preview_program.php?catoid=4&poid=1334&returnto=239

University of Kentucky

Structural engineering graduate certificate

9 credit hours

<https://www.engr.uky.edu/research-faculty/departments/civil-engineering/students/graduate-program/graduate-certificate>

The George Washington University

Structural engineering graduate certificates (4 options)

12 credit hours

<https://www.cee.seas.gwu.edu/structural-engineering-graduate-certificate-program>

The Citadel

Graduate certificate in structural engineering

12 credit hours

<https://www.citadel.edu/root/cee-graduate-programs/structural-engineering>

University of Louisville

Online graduate certificate in structural engineering

12 credit hours

<http://louisville.edu/online/programs/certificate-programs/structural-engineering>

University of Alabama at Birmingham

Structural engineering, graduate certificate

15 credit hours

<https://www.uab.edu/degrees/graduate/structural-engineering-gc>

The University of Kansas

Graduate certificate in structural design

12 credit hours

<https://catalog.ku.edu/engineering/civil-environmental-architectural-engineering/certificate-structural-design/>

7. Projected Enrollments:

The primary market for this certificate is expected to be online students who are currently working as engineers and are looking to enhance their career prospects. Also, students who are currently enrolled in the Civil Engineering online professional M.S. program are expected to enroll in this certificate program in order to add value to their work as they progress. Additional students are expected to enroll as certificate-seeking students, perhaps converting to degree-seeking roles after completion of one (or more) certificate(s).

The courses that are part of this certificate already exist and are taught on ground. Some of these courses have also been developed for online, asynchronous learning with the remaining courses to be developed for online by the Spring of 2022.

Semester	On-campus Enrollment	On-line Enrollment
Fall 2021	12	20
Fall 2022	14	24

Fall 2023	16	28
Fall 2024	20	32

8. Scheduling Plans:

No change in the regular scheduling of the existing courses is anticipated. The Departments delivering the online courses have agreed to fit them into their regular scheduling plans. Courses will be available online throughout the academic year and during summer semester.

- 9. Curriculum Design:** The certificate is designed to be completed in 3 semesters. Online students that have other, full-time employment obligations tend to want to take a single graduate-level course at a time.

Required Coursework: 3 credits

CEE5261: Bridge Design and Construction (3 cr., Spring)

Elective Coursework: choose 6 credits from the following

CEE5212: Prestressed Concrete Design (3 cr., Fall)

CEE5213: Concrete and Masonry Building Design (3 cr., Fall, Summer)

CEE5223: Steel Design II (3 cr., Spring, Summer)

10. Course Descriptions:

CEE 5261: Bridge Design and Construction (3 cr.)

Introduction to design and behavior of short and medium span bridges. Topics include aesthetics, preliminary design and layout, design of prestresses and plate girders bridges, deck design, foundation design. Project may alternate between structural steel and prestressed concrete member design.

CEE 5212: Prestressed Concrete Design (3 cr.)

Theory of prestressed and post-tensioned members. Covers analysis and design of prestressed concrete beams, slabs, box girders, and bridge girders by elastic and ultimate strength methods. Precast and cast-in-place system construction techniques will be included.

CEE 5213: Concrete and Masonry Building Systems (3 cr.)

Design of reinforced concrete two-way slabs and reinforced masonry systems for buildings. Includes design of bearing walls, shear walls, lintels, pilasters, slender columns, torsional beams and connections. A design project may be included during the semester.

CEE 5223: Steel Design II (3 cr.)

Additional topics in steel design including beam-columns, floor vibrations, diaphragms, buckling behavior of thin elements, torsional buckling, and beam and column bracing. Includes an introduction to cold-formed steel design.

11. Model Schedule Demonstrating Completion Time

The certificate is designed to be completed in 3 semesters.

Summer Semester

CEE5213: Concrete and Masonry Building Systems

-or-

CEE5223: Steel Design II

Fall Semester

CEE5212: Prestressed Concrete Design

Spring Semester (Certificate “Capstone”)

CEE5261: Bridge Design and Construction

12. Library and other Learning Resources

No library or other learning resources are required at this time.

13. Faculty Resumes

The following faculty will be supporting the program.

- Dr. Theresa M. Ahlborn, Department of Civil and Environmental Engineering,
 - <https://www.mtu.edu/cee/people/faculty-staff/faculty/ahlborn/>
- Dr. William M. Bulleit, Department of Civil and Environmental Engineering,
 - <https://www.mtu.edu/cee/people/faculty-staff/faculty/bulleit/>
- Dr. Qingli Dai, Department of Civil and Environmental Engineering,
 - <https://www.mtu.edu/cee/people/faculty-staff/faculty/dai/>
- Dr. Daniel M. Dowden, Department of Civil and Environmental Engineering,
 - <https://www.mtu.edu/cee/people/faculty-staff/faculty/dowden/>
- Dr. Stephen M. Morse, Department of Civil and Environmental Engineering,
 - <https://www.mtu.edu/cee/people/faculty-staff/faculty/morse-s/>
- Dr. R. Andrew Swartz, Department of Civil and Environmental Engineering,
 - <https://www.mtu.edu/cee/people/faculty-staff/faculty/swartz/>

14. Equipment

No additional equipment will be required.

15. Program Costs

Initial costs for offering the certificate will not incur additional costs, but as enrollment grows additional instructional resources will be needed.

16. Space

There are no new space requirements.

17. Policies, Regulations, and Rules

Not applicable

18. Accreditation Requirements

The proposed certificate will not seek additional accreditation.

19. Planned Implementation Date

Spring 2021

20. Assessment

The learning objective of the Certificate is:

1. Apply advanced engineering skills necessary for the design, analysis, construction, and inspection of small- and medium-span bridges.

21. Approval Process

Departmental Graduate Committee: May 15, 2020

Department: May 29, 2020

College of Engineering: June 2, 2020

Provost's Office and Deans' Council: June 10, 2020

Graduate School: June 23, 2020

Approved by the Senate:

Approved by the President: