Institutional Effectiveness Report
2021-22

Program: Civil and Environmental Engineering MS

College and Department: College of Engineering – Civil Engineering

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Mission: The mission of the civil engineering program is to offer the strong academic content necessary to produce well-educated graduates who become innovative and productive members of society. Graduates will possess both the problem-solving skills and the fundamentals of critical thinking and analysis that are crucial for success within the framework of the civil and environmental engineering profession.

Program Goals

PG 1: MS graduates will have the technical competence to be successful in the chosen sub-discipline of civil engineering professional practice or research.

PG 2: MS graduates will have the skills to undertake technically sound analysis independently and present their work at professional meetings or publish their work in scholarly journals.

PG 3: MS graduates will have the technical competence to successfully undertake further advanced study at the doctoral level in civil engineering or a related area, and pursue lifelong learning through professional education.

Student Learning Outcomes

SLO 1: MS graduates will demonstrate clear understanding of the chosen sub-discipline of civil engineering covered in course material in the graduate program.

SLO 2: MS graduates will apply advanced methods in the development of solutions in the chosen sub-discipline of civil engineering.

SLO 3: MS graduates will demonstrate the ability to conduct professional presentations or write scholarly manuscripts worthy of publication in peer reviewed journals.

Assessment Methods

1. *Alumni Surveys:* Approximately every 5 years alumni are given a set of questionnaires to examine (1) the appropriateness and relevance of the curriculum structure to their activities after graduation, (2) the extent to which they acquire needed skills for job performance and the degree of engagement in professionally-related learning experience, and (3) whether the curriculum objectives and outcomes are met. The metric that has been established is that at least eighty percent of alumni respondents “agree” or “strongly agree” that the program provided them with adequate preparation. A lesser percentage and response on individual questions that constitute less than fifty percent combined “agree or strongly agree” would generate a concern, which would require a review and actions by department Graduate Affairs committee. The survey statements are as follows:

a. The CEE MS degree has provided me with skills to be successful in civil engineering professional practice.

b. The CEE MS degree has made me aware of the present day professional practice in my area of study in civil engineering.

c. The CEE MS degree has provided me with the necessary skills to present work at professional meetings or publish work in scholarly journals.

d. The CEE MS degree has provided me with skills to independently undertake technically sound analysis.

e. The CEE MS degree has provided me with the technical competence needed to successfully undertake further advanced study at the doctoral level in civil engineering or a related area.

f. The CEE MS degree has provided me with the technical competence to pursue lifelong learning through professional education.

g. Would you recommend the TTU CEE MS degree program to other potential candidates in future?

The first six statements were framed as multiple choice (no opinion, strongly disagree, disagree, agree and strongly.

2. *Thesis and oral defense rubric***:** CEE MS students are required to undertake thesis research or a project independently under the direction of a CEE faculty advisor and the student's graduate advisory committee. Students through this experience learn to manage a significant research or project effort, acquire the technical knowledge and skills required for its successful completion, learn to pose the appropriate questions whose answers lead to the advancement of their research or project, and also learn to have meaningful periodic interaction with their advisory committee.

   Communication skills are critical to achieving scholarly accomplishments; that is, they are critical to proper technical paper writing and its presentation at conferences, or publication in peer reviewed journals. Hence, at the onset of his/her research or project, a graduate student has to present a proposal on his/her proposed research or project to his/her graduate advisory committee for approval. In addition to judging the intellectual merit of the proposal, the advisory committee also evaluates the oral communication skills of the student and provides feedback to the student soon thereafter through a standardized form adopted by the CEE Department.

3. *Grades for Core Courses:* CEE MS students are required to complete sub-discipline courses and electives that provide both an in-depth and broad understanding of civil engineering to students.

4. *Publications and Presentations:* A critical element of the process for facilitating a students' development in independent thinking is the requirement that each student work on a research project of real-world significance to the Civil Engineering discipline and to present their work at a peer-reviewed conference and/or publish it in a peer-reviewed journal.

Results

SLO 1 - demonstrate clear understanding of the chosen sub-discipline of civil engineering covered in course material in the graduate program.

Summary of Grades and Five-Year Average of Course Enrollment (when offered) in Core MS CEE Courses

Water Resources and Environmental Engineering

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2017-18	2018-19	2019-20	2020-21	2021-22	
CEE 6520 – Open-Channel Hydraulics	4.00 (3)	4.00 (6)	4.00 (5)	N/A (0)	4.00 (2)	4.0
CEE 6610 – Applied Environmental Chemistry	N/A (0)	3.57 (7)	N/A (0)	4.00 (7)	4.00 (4)	6.0

Structural Engineering and Structural Mechanics

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2017-18	2018-19	2019-20	2020-21	2021-22	
CEE 6350 – Finite Element Analysis	3.00 (7)	3.60 (4)	3.33 (6)	3.57 (8)	3.60 (5)	6.0
CEE 6930 – Theory of Elasticity	3.33 (6)	3.09 (6)	3.10 (5)	3.50 (6)	3.75 (4)	5.4

Transportation Engineering

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2017-18	2018-19	2019-20	2020-21	2021-22	
CEE 6410 – Traffic Control Systems	N/A (0)	N/A (0)	N/A (0)	N/A (0)	3.75 (4)	4.0
CEE 6470 – Transportation Demand Analysis	3.00 (2)	3.33 (3)	4.00 (2)	3.00 (2)	3.50 (6)	3.0

Civil Engineering Materials

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2017-18	2018-19	2019-20	2020-21	2021-22	
CEE 5190 – Advanced Mechanics of Materials	4.00 (1)	4.00 (2)	4.00 (2)	4.00 (1)	4.00 (4)	2.0
CEE 6300 – Multiscale Analysis of Concrete	4.00 (3)	3.75 (7)	4.00 (5)	4.00 (4)	N/A (0)	4.8

Geotechnical Engineering

Course	Average Grades by academic year (Number enrolled)					Average number of students
	2017-18	2018-19	2019-20	2020-21	2021-22	
CEE 5810/6900 – Foundation Engineering	4.00 (1)	N/A (0)	N/A (0)	4.00 (6)	4.00 (1)	2.7
CEE 6800 – Advanced Soil Mechanics	N/A (0)	3.40 (5)	N/A (0)	N/A (0)	3.67 (6)	5.5
CEE 6820 – Seepage and Slope Stability	3.80 (5)	N/A (0)	3.50 (6)	N/A (0)	N/A (0)	5.5

SLO 2 - apply advanced methods in the development of solutions in the chosen sub-discipline of civil engineering.

Assessments of MS Proposal Presentations

Assessed by	Academic Year	Number of Students Evaluated	Number of Evaluations	Average Score[1]	
				Content	***Response to Questions and Comments***
Committee Members	2017-2018	6	16	3.42	3.17
	2018-2019	6	16	3.03	2.95
	2019-2020	3	5	3.00	3.50
	2020-2021	3	9	3.22	3.44
	2021-2022	4	8	3.34	3.25
Other Faculty	2017-2018	0	0	N/A	N/A
	2018-2019	0	0	N/A	N/A
	2019-2020	2	2	3.50	3.00
	2020-2021	0	0	N/A	N/A
	2021-2022	0	0	N/A	N/A

[1] Assessment scale: 1 = Not Acceptable, 2 = Below Expectations, 3 = Meets Expectations, 4 = Above Expectations

Assessments of MS Thesis Defense Presentations

Assessed by	Academic Year	Number of Students Evaluated	Number of Evaluations	Average Score[1]	
				Content	***Response to Questions and Comments***
Committee Members	2017-2018	4	8	3.50	3.63
	2018-2019	7	15	3.26	3.33
	2019-2020	5	15	3.57	3.20
	2020-2021	7	15	3.55	3.64
	2021-2022	10	23	3.48	3.17
Other Faculty	2017-2018	2	2	4.00	4.00
	2018-2019	2	2	4.00	3.50
	2019-2020	3	3	4.00	4.00
	2020-2021	1	1	4.00	4.00
	2021-2022	0	0	N/A	N/A

[1] Assessment scale: 1 = Not Acceptable, 2 = Below Expectations, 3 = Meets Expectations, 4 = Above Expectations

SLO 3 - demonstrate the ability to conduct professional presentations or write scholarly manuscripts worthy of publication in peer reviewed journals.

Assessments of MS Proposal Presentations

Assessed by	Academic Year	Number of Students Evaluated	Number of Evaluations	Average Score[1]		
				Visual Aids	***Presenter Preparation***	***Presentation Mechanics***
Committee Members	2017-2018	6	16	3.36	3.36	3.39
	2018-2019	6	16	3.00	3.11	3.14
	2019-2020	3	5	3.67	3.33	3.67
	2020-2021	3	9	3.33	3.44	3.33
	2021-2022	4	8	3.42	3.67	3.42
Other Faculty	2017-2018	0	0	N/A	N/A	N/A
	2018-2019	0	0	N/A	N/A	N/A
	2019-2020	2	2	3.50	3.00	3.00
	2020-2021	0	0	N/A	N/A	N/A
	2021-2022	0	0	N/A	N/A	N/A

[1] Assessment scale: 1 = Not Acceptable, 2 = Below Expectations, 3 = Meets Expectations, 4 = Above Expectations

Assessments of MS Thesis Defense Presentations

Assessed by	Academic Year	Number of Students Evaluated	Number of Evaluations	Average Score[1]		
				Visual Aids	***Presenter Preparation***	***Presentation Mechanics***
Committee Members	2017-2018	4	8	3.50	3.75	3.25
	2018-2019	7	15	3.55	3.88	3.60
	2019-2020	5	15	3.40	3.53	3.30
	2020-2021	7	15	3.60	3.67	3.60
	2021-2022	10	23	3.52	3.52	3.44
Other Faculty	2017-2018	2	2	3.50	4.00	4.00
	2018-2019	2	2	4.00	4.00	3.50
	2019-2020	3	3	3.67	3.67	4.00
	2020-2021	1	1	4.00	4.00	3.00
	2021-2022	0	0	N/A	N/A	N/A

[1] Assessment scale: 1 = Not Acceptable, 2 = Below Expectations, 3 = Meets Expectations, 4 = Above Expectations

Modifications for Improvement:

For SLO 1, no issues have been identified that warranted investigation. Relevant courses will continue to be reviewed as pertinent to the individual sub-discipline areas.

For SLO 2 and 3, only one data point fell slightly below the 3.0 threshold (2.95) – this occurred during academic year 2018-19 MS Proposal "Response to Questions and Comments". Subsequent academic years do not indicate any issues. Upon closer examination of this particular data set, it is revealed that one student had low marks compared to the rest, pulling the average down. In addition, this data set is for the MS Proposal – the purpose of the oral evaluation here is to identify any issues that a student may have so these can be addressed prior to the actual MS Defense. The student who received low marks on the MS Proposal later received all marks above the 3.0 threshold during the MS Defense, indicating that the process for student assessment and improvement is working.

It is noted that the number of students evaluated (for MS Defense) in some years has been lower than the actual number of students defending. Furthermore, since all MS students are required to have at least 3 committee members, the total number of evaluations conducted should be at least 3 times the number of students. However, this is often not the case, indicating that not all committee members are completing the survey. While surveys are available electronically through Qualtrics due to many presentations being held virtually due to COVID, this has also presented the inability to ensure all forms are completed after the particular meeting. A QRC image has been generated and all students moving forward in AY2022-2023 and beyond have been asked to include this QRC at the end of their respective presentation. It is anticipated that this will prompt feedback immediately after a presentation, regardless of whether being attended in person or virtually.

The Department of Civil and Environmental Engineering is in the process of preparing for a State of Tennessee MS Program Review during the academic year 2022-2023. Over the next year, the additional assessment tools, such as alumni surveys, will be utilized. Data will be presented in next year's report.

Appendices

1. Curriculum Map

Appendix 1: Curriculum Maps

Civil Engineering, MS (Thesis): Mapping of the Graduate Curriculum and Student Learning Objectives

Course	Title	Student Outcomes		
		SLO 1: Sub-discipline course knowledge	SLO 2: Advanced methods in sub-discipline	SLO3: Communication Skills
Core Sub-Discipline Courses	6-9 credits minimum in subdiscipline	X	X	
Program of Study Courses	15-18 credits of elective courses approved by student's advisory committee	X	X	
CEE 6910	Graduate Seminar (1 credit)			X
CEE 6990	Research and Thesis (6 credits total)		X	X

Civil Engineering, MS (Non-Thesis): Mapping of the Graduate Curriculum and Student Learning Objectives

Course	Title	Student Outcomes		
		SLO 1: Sub-discipline course knowledge	SLO 2: Advanced methods in sub-discipline	SLO3: Communication Skills
Core Sub-Discipline Courses	6-9 credits minimum in subdiscipline	X	X	
Program of Study Courses	21-24 credits of elective courses approved by student's advisory committee	X	X	
CEE 6910	Graduate Seminar (1 credit)			X
CEE 6980	Directed Studies Project Work (3 credits)		X	X