

Lyles College of Engineering
Department of Civil and Geomatics Engineering
Master of Science in Civil Engineering
STUDENT OUTCOME ASSESSMENT PLAN

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Mission of the MSCE Program:

The mission of the MSCE Program at CSU Fresno is to educate engineers who, entrusted by society, will create a sustainable world and enhance the quality of life during the 21st century as planners, designers, constructors, and operators of the built environment. The basic tenant of their formation is the instilling of the rectitude of intention that as professionals, using the principles of mathematics and the natural sciences, will use economically the materials and forces of nature for the progressive well being of society in the following activities: creating, improving, and protecting the environment; planning, designing, and building facilities and structures for community living, industry, and transportation.

Program Goals:

The Goals of the MSCE program are to prepare the MSCE students:

- to have a better understand, beyond the undergraduate level, of the scientific principles involved in the analysis of structures, water supply and water treatment facilities, and soil structures.
- to know the methodologies for the design of the built infrastructure and know how to map and measure it.
- to know advanced techniques of analysis, including mathematical analysis and modeling, numerical techniques, and know the use of professional software for the analysis and design in civil and geomatics engineering.
- to have excellent communication skills in writing, oral, graphical, and public speaking.

Educational Objectives:

Students graduating from the MSCE program will:

1. be able to understand the scientific principles and to know the modern professional techniques in the analysis of structures, water supply and water treatment facilities, and soil structures,
2. be able to design structures, water supply and water treatment facilities, and soil structures,
3. know the latest procedures for environmental and soil protection and remediation,
4. know the scientific principles and techniques for measuring and mapping the earth and the built infrastructure,
5. Be abreast of regulations, codes, and specifications in the planning, analysis, measuring, mapping, and design of the built infrastructure,

6. Be proficient in solving problems in engineering analysis and design through the use of mathematical analysis, differential equations, finite elements, finite differences, or least square errors,
7. be proficient in the use of computer software for analysis, design, measuring, and mapping of the built infrastructure,
8. be proficient in writing in general, but especially writing technical documents, research reports, and proposals,
9. be proficient in oral and public presentations in front of technical and non-technical audiences,

Educational Objectives										
At the completion of the MSCE, the students will:										
	be able to understand the scientific principles and to know the modern professional techniques in the analysis of structures, water supply and water treatment facilities, and soil structures	be able to design structures, water supply and water treatment facilities, and soil structures	know the latest procedures for environmental and soil protection and remediation	know the scientific principles and techniques for measuring and mapping the earth and the built infrastructure	be abreast of regulations, codes, and specifications in the planning, analysis, measuring, mapping, and design of the built infrastructure	be proficient in solving problems in engineering analysis and design through the use of mathematical analysis, differential equations, finite elements, finite differences, or least squared errors	be proficient in the use of computer software for analysis, design, measuring, and mapping of the built infrastructure	be proficient in writing in general, but especially writing technical documents, research reports, and proposals	be proficient in oral and public presentations in front of technical and non-technical audiences	be able to function effectively in interdisciplinary teams
Program Goals										
The Goals of the MSCE Program are to develop:										
an understanding of the scientific principles in the analysis of structures, water supply and water treatment facilities, and soil structures.	X		X		X	X	X			X
knowledge of the methodologies for the design of the built infrastructure and know how to map and measure it.	X	X	X	X	X	X	X			X
knowledge of advanced techniques of analysis, including mathematical analysis and modeling, numerical techniques, and know the use of professional software for the analysis and design in civil and geomatics engineering.	X			X		X	X			
excellent skills in communication; written, oral, graphical, and public speaking.								X	X	X

FIG. 1 Relationship between Program Goals and Educational Objectives

course	Educational Objective										
	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7	Objective 8	Objective 9	Objective 10	
CE 205	I					A	A				
CE 206					A						
CE 210	A *							A	A	A	
CE 220		A			A	I	A	A			
CE 223	A	A			A	I	A	A			
CE 225	A					A	A	R			
CE 230	A				A	A					
CE 232		A			A						
CE 233		A			A						
CE 235	A					A	A				
CE 236		A			A		A				
CE 237	A					R	A				
CE 245	A	A			A	R	A				
CE 240	A					A	A				
CE 246A		A		A	A	R					
CE 246B		A		A	A	R					
CE 247			A		A			A	A	A	
CE 251				R	A		I	A	A	A	
CE 261				A	R	R	A	R	R	R	
CE 271				A		R	R	R			
CE 280				I	I			R			
CE 283				R	R	I	A	R	R		
CE 285						A	A	R	R		
CE 286					R	A	A	R	R	I	
CE 290	}	outcomes vary depending on the topic selected									
CE 298	*										
CE 299	*										

Notes: I = Introduce
R = Reinforce
A= Advance
Several courses are continuation of corresponding undergraduate courses where the material has been already introduced
* Contents and emphasis depend on topic selected by student

FIG. 2 Relationship between Educational Objectives and MSCE Courses

Assessment

The assessment of student outcomes is achieved through formative instruments to measure students' progress while going through the program and with summative instruments to measure the students' level of achievement at the end of the program and after graduation by using alumni surveys. The assessment activities include:

Direct Measures:

1. **Students' grades in specific MSCE courses, (*formative*)**
2. **Students' performance in writing and in oral presentations in CE 210, (*formative*)**
3. **Students' performance in the culminating experience (*summative*)**

Indirect Measures:

1. **Exit Surveys (*summative*)**
2. **Alumni Surveys (*summative*)**

Students' grades in specific MSCE courses.-The matrix shown in FIG. 2 relates the educational objectives with the courses throughout the MSCE curriculum. The MSCE curriculum currently includes four clearly defined areas of specialization, namely: environmental/water resources, geotechnical, geomatics, and structural engineering. Students graduating with the MSCE degree will have a level of preparation that is unique to the individual area of concentration and thus not all MSCE students will take all the assessment courses. The following table indicates which courses are used for assessment in the various specializations. The assessment activity is conducted each time the particular course is taught. Since all these courses are offered either, once a year or once every three semesters, the aggregate of student results is used for assessment.

Table 1. Course to be used for formative assessment; by specialization

Course	Area of Specialization			
	Environmental & Water Resources	Geotechnical	Geomatics	Structural
CE 206	X			
CE 220		X		
CE 223		X		
CE 232				X
CE 233				X
CE 246A	X			
CE 251			X	
CE 261			X	

Students' performance in writing and in oral presentations .-The course CE 210 *Research Methods* has to be completed satisfactorily by all MSCE students to be advanced to candidacy. The course has a strong component related to communication skills, in writing, graphical, and oral presentations. Among the several objectives of the course, the two main objectives are to prepare the MSCE students to undertake the culminating experience in the form of masters project or thesis, and to develop their communication skills. Students in this course are graded for the general performance in the course and graded separately for their writing competency. A student may pass the course satisfactorily but not the writing component. In that case the student is allowed to pursue the completion of the writing requirements independently from the course and in collaboration with his/her graduate advisor as indicated in the CE 210 syllabus. The overall grade of all the students in the class and the average grade of the class in the writing component are used for assessment purposes. The rubrics to assess the writing component are given in the syllabus of the 210 class. Assessment is conducted each time the course CE 210 is taught (at least once a year)

Students' performance in the culminating experience.-Although the MSCE program offers three plans to complete the program, namely: (A) thesis, (B) project, or (C) comprehensive exam, the graduate faculty is of the opinion that options A and B should be encouraged. Option C would be allowed only in special circumstances in which a particular student has time constraints (e.g. full-time job) that makes rather difficult for him to pursue independent research beyond the course work.

All students following plans (A) and (B) are required to make a final oral presentation/defense of their independent project or thesis work and submit a final report (Thesis or Project Report). Both the oral presentation and final report are used for a general assessment of the educational objectives. The educational objectives and assessment rubrics are shown in Appendix A.

Exit Surveys.-All students graduating from the MSCE program complete an exit survey. The survey is administered to the graduating students as they complete they program and that may occur either at the end of fall or spring semesters. For students completing a thesis or project in the summer semester, the survey is administered in the spring immediately presiding the graduating summer. The Exit survey is shown in the following figure.

MSCE Program
Graduating Student Feedback

Date _____ Graduation: Spring [] Fall [] Summer [] Year: _____

Under which plan did you complete the MSCE Thesis [] Project [] Comp. Exam []

Did you work off campus while pursuing your MSCE ? Full-time [] Part-time []
 No []

Do you have a full-time job offer? Yes [] No [] N/A []

If you had a job offer, what is the starting salary (voluntary) ? [_____]

What was the best thing you remember about the MSCE Program?

What is the worst thing you remember about the MSCE Program?

Based on your experience through the MSCE program, provide your assessment as how the program fulfills its goals as follows:
 (Use a numerical rating from 1 through 4, where 1.0 = inadequately and 4.0 = excellently)

Goal	Scale 1.0 through 4.0
Did the MSCE program help you to better understand, beyond the undergraduate level, of the scientific principles involved in the analysis of structures, water supply and water treatment facilities, and soil structures.	[]
Did the MSCE program help you to know the methodologies for the design of the built infrastructure or know how to map and measure it	[]
Did the MSCE program help you to know advanced techniques of analysis, including mathematical analysis and modeling, numerical techniques, and know the use of professional software for the analysis and design in civil and geomatics engineering (as applicable in your area)	[]
Did the MSCE program help you to have excellent communication skills in writing, oral, graphical, and public speaking	[]

Alumni Surveys .- Alumni surveys are solicited from MSCE alumni on a regular basis but they are compiled and analyzed at the end of the academic year every two years. The survey instrument is shown on pages 8 and 9.

Timeline.-Assessment activities will be conducted in a regular basis and rather frequently in an initial stage. As the student enrollment increases and the number of graduates increase, thus increasing the number of culminating experience presentations and exit interviews to be conducted, the frequency may be adjusted to a less frequent basis accordingly and in consultation of the Department Chair, Graduate Coordinator and Graduate Faculty. The initial timeline is shows is given below.

Table 2. Assessment time table and action plan

Assessment Activity	How Often	Who	How	
Student Grades in selected MSCE courses	After each time the particular course is taught	Course instructor provides summary to Graduate Coordinator	Graduate coordinator compiles information and summarizes it every year	Graduate coordinator compiles and summarizes information. Course of action is suggested by Graduate coordinator and Graduate Faculty and decided by the majority in the graduate faculty.
Student performance in oral presentation and writing in CE 210	After each time the course is taught	Course instructor provides summary of results to Graduate Coordinator	Graduate coordinator compiles information and summarizes it every two years	
Student performance in culminating experience	After each student presentation	Advisor provides summary of results to Graduate Coordinator	Graduate coordinator compiles information and prepares a summary every two years	
Exit Surveys	At graduation of each student	Advisor conducts interview	Graduate coordinator compiles results and prepares a summary every two years	
Alumni Surveys	Continuous solicitation from alumni	Graduate coordinator requests surveys	Graduate coordinator compiles information every two years	

**Alumni Survey
MSCE Program
Lyles College of Engineering**

1. When did you complete your MSCE degree?
(month, year) _____

2. Current job title: _____
Current Salary (optional) _____
Name and Address (optional) _____

3. Current employer: _____

4. In what field do you work?
____ Industry
____ Government
____ Private Practice/consulting
____ Education
____ Construction
____ Other: _____

5. Indicate your present employment status:
____ Employed full-time
____ Full-time graduate student
____ Temporarily not employed
Reason: _____
____ Working in another field
Reason: _____
Do you intend to return to your field?
___ Yes ___ No ___ Not sure
____ Other, please explain:

6. Please rank your professional success level:
____ Very successful
____ Successful
____ Average
____ Unsuccessful
Please explain briefly: _____

7. As you compare yourself to other beginning professionals in your field, how do you rate the quality of your educational preparation through the MSCE program?

____ Far higher than average
____ Higher than average
____ Average
____ Lower than average
____ Far lower than average

8. Using the following scale, please rate the following items relative to your education in the MSCE program

	weak --> strong			
	1	2	3	4
Overall quality of your MSCE education				
Support, assistance, and general help from the Civil Engr. Office				
Support, assistance and general help you received from faculty in the MSCE program				
How confident and prepared you felt in handling professional tasks when you completed the MSCE				
How confident and prepared you feel in handling professional tasks now				

9. Using the following scale, please indicate the degree to which your MSCE education provided you with the ability to:

content, specific lab or field experience, specific instructional equipment, etc. Please explain.

weak --> strong

1 2 3 4

understand, beyond the undergraduate level, the scientific principles involved in the analysis of structures, water supply and water treatment facilities, and soil structures				
know the methodologies for design of the built infrastructure and to know how to map and measure it (as applicable)				
Know advanced techniques of analysis, including mathematical analysis and modeling, numerical techniques, and know the use of professional software for the analysis and design in civil and geomatics engineering				
Have excellent communication skills in writing, oral, graphical, and public speaking				

13. To follow up on question 14, please identify the areas in your program of study that contributed **MOST** to your professional development.

10. Do you think that any aspects of the MSCE program at CSU-Fresno should be modified?

___ yes ___ no

If yes, explain:

11. What changes do you foresee in your field in the next ten years? How might the MSCE program address these changes?

12. Please identify the areas in your MSCE program of study that contributed **LEAST** to your professional development. Such areas might include a specific course or specific course

Appendix A

Educational Objectives and Rubrics to assess student performance in the culminating experience

Educational Objectives 1 and 4 (as applicable for the individual student)

Score of 5: Strong

The student's knowledge of the subject area is demonstrated with clear, unambiguous, and concise definitions.

The student can precisely provide mathematical and conceptual models of the subject area.

The student has a strong knowledge of the principles that are the basis of the subject area.

The student has a complete historical perspective of the development of the statements, principles, and modeling of the subject area.

Score of 4: Good

The student's knowledge of the subject area is demonstrated with clear, unambiguous, and concise definitions.

The student can precisely provide mathematical and conceptual models of the subject area.

The student has knowledge of the basic principles that are the basis of the subject area.

The student has an idea of the historical perspective of the development of the statements, principles, and modeling of the subject area.

Score of 3: Adequate

The student's knowledge of the subject area is demonstrated with definitions that are clear and unambiguous, but they may not be concise.

The student can provide a conceptual model of the subject area but may have difficulty expressing it mathematically.

The student has an idea of the basic principles that are the basis of the subject area.

The student has an incomplete historical perspective of the development of the statements, principles, and modeling of the subject area.

Score of 2: Weak

The student has difficulty in providing clear, unambiguous, and concise definitions in the subject area.

The student cannot provide a conceptual or mathematical model of the subject area.

The student does not know the basic principles that are the basis of the subject area.

The student does not know the historical perspective of the development of the statements, principles, and modeling of the subject area.

Score of 1: Incompetent

The student cannot provide clear, unambiguous, and concise definitions in the subject area.

The student cannot provide a conceptual or mathematical model of the subject area.

The student does not know the basic principles that are the basis of the subject area.

The student has no idea of the historical perspective of the development of the statements, principles, and modeling of the subject area.

Educational Objectives 2, 6, and 7 (as applicable for the individual student)

Score of 5: Strong

The student has a strong background in traditional and current analysis and design procedures.

The student is very knowledgeable of the codes, specifications and regulations associated with the design in a particular specialty area.

The student is very proficient in state-of-the-art, professional analysis and design computer software.

The student can deliver a complete design in a specific area with confidence and without requiring guidance or supervision.

Score of 4: Good

The student has a background in traditional or current analysis and design procedures.

The student knows which codes, specifications and regulations govern the design in a particular specialty area.

The student knows how to use state-of-the-art, professional analysis and design computer software.

The student can deliver a complete design in a specific area with confidence and with some guidance or supervision.

Score of 3: Adequate

The student knows about traditional or current analysis and design procedures.

The student knows about most of the codes, specifications and regulations that govern the design in a particular specialty area.

The student could use state-of-the-art, professional analysis and design computer software after some orientation or guidance.

The student can deliver most of the design in a specific area with some guidance or supervision.

Score of 2: Weak

The student knows about traditional but not necessarily current analysis and design procedures.

The student could guess what codes, specifications and regulations may govern the design in a particular specialty area but is not familiar with them

The student could use state-of-the-art, professional analysis and design computer software after considerable orientation or guidance.

The student can deliver up to about half of the design required in a specific area with some guidance or supervision.

Score of 1: Incompetent

The student does not know about traditional or current analysis and design procedures.

The student could not even guess what codes, specifications and regulations may govern the design in a particular specialty.

The student would not know where to start in using state-of-the-art, professional analysis and design computer software.

The student cannot complete any design task in a specific engineering area.

Educational Objective 3

Score of 5: Strong

The student has a complete knowledge and understanding of the environmental issues associated with engineering design in his/her area of study.

The student has a complete knowledge and understanding of the environmental regulations and enforcing agencies associated with engineering design in his/her area of study.

Score of 4: Good

The student has knowledge and understanding of the environmental issues associated with engineering design in his/her area of study.

The student knows most of the environmental regulations and enforcing agencies associated with engineering design in his/her area of study.

Score of 3: Adequate

The student has knowledge and understanding of the most important environmental issues associated with engineering design in his/her area of study.

The student knows most of the environmental regulations and enforcing agencies associated with engineering design in his/her area of study.

Score of 2: Weak

The student has knowledge of some of the environmental issues associated with engineering design in his/her area of study.

The student knows some of the environmental regulations and enforcing agencies associated with engineering design in his/her area of study.

Score of 1: Incompetent

The student does not know the environmental issues associated with engineering design in his/her area of study.

The student does not know the environmental regulations and enforcing agencies associated with engineering design in his/her area of study.

Educational Objective 5

Score of 5: Strong

The student has a complete knowledge and understanding of all codes, regulations, and specifications that are applicable in the subject area.

The student has a clear understanding of the professional, ethical, and legal implications associated with the implementation, or lack thereof of, the codes, regulations, and specifications.

Score of 4: Good

The student has knowledge and understanding of all codes, regulations, and specifications that are applicable in the subject area.

The student has an understanding of the professional, ethical, and legal implications associated with the implementation, or lack thereof of, the codes, regulations, and specifications.

Score of 3: Adequate

The student knows about the codes, regulations, and specifications that are applicable in the subject area.

The student is aware of the professional, ethical, and legal implications associated with the implementation, or lack thereof of, the codes, regulations, and specifications.

Score of 2: Weak

The student knows that some codes, regulations, or specifications may be applicable in the subject area.

The student suspects that there are professional, ethical, and legal implications associated with the implementation, or lack thereof of, the codes, regulations, and specifications.

Score of 1: Incompetent

The student does not know what codes, regulations, or specifications may be applicable in the subject area.

The student is not aware of the professional, ethical, and legal implications associated with the implementation, or lack thereof of, the codes, regulations, and specifications.

Educational Objective 8

Rubric for Graduate Writing

Criteria	Excellent (4)	Good (3)	Acceptable (2)	Unacceptable (1)
Content	Balanced presentation of relevant information that shows a thoughtful, in-depth analysis of main topic	Information provides support for a central argument and displays evidence of a basic analysis of main topic	Information supports a central purpose at times. Analysis is basic. Reader gains few insights.	Central argument is not clear. Analysis is vague. Reader is confused or misinformed.
Organization	Ideas arranged logically to support main argument. Ideas flow from one to another and are clearly linked together.	Ideas arranged logically to support main argument. Ideas usually but not always, linked together.	In general, writing is arranged logically, although occasionally ideas fail to make sense together. Some clarity of writers' intend.	Writing is not logically organized. Frequently ideas fail to make sense together. Hard to identify a line of reasoning.
Sentence Structure	Sentences are well structured and varied in length. Sentences flow smoothly from one to another.	Sentences are well structured as there is some variety in length. Sentence flow is generally but not always present.	Some sentences are awkwardly constructed so that reader is occasionally distracted.	Mistakes in sentence structure and major distraction to the reader.
Grammar	Writing is free or almost free of errors.	Occasional errors.	Writing has many errors, and reader is distracted by them.	So many errors that meaning is obscured. Reader is confused and stops reading.
References	Primarily peer-reviewed professional journals.	Although most of the references are peer-reviewed, a few are questionable (e.g., popular magazines, trade books, etc.)	Most of the references are from sources that are not peer-reviewed.	There are no professionally reliable sources. Reader seriously doubts the value of the material.

Educational Objective 9

Oral Presentations

Evaluation of Oral Presentation	
Date: _____	
Title: _____	
Presenter: _____	
Title of Presentation (0 to 3 points)	_____
Introduction (0 to 3 points)	_____
Outline of Presentation (0 to 4 points)	_____
Voice	
Clear (0 to 5 points)	_____
Loud (0 to 5 points)	_____
Delivery	
Enthusiastic (0 to 5 points)	_____
Eye contact with audience (0 to 5 points)	_____
Audiovisual Materials	
Quantity (0 to 5 points)	_____
Quality (0 to 5 points)	_____
Organization of Presentation	
Logical progression (0 to 10 points)	_____
Contents	
Completeness (0 to 15 points)	_____
Technically correct (0 to 20 points)	_____
Timing	
Effective use of time (0 to 5 points)	_____
Addressing of Questions (0 to 5 points)	_____
Comments:	
	SCORE _____ points
	Maximum: 100 points