



Lyles College of Engineering

Designing and Building the Future

Department of Civil and Geomatics Engineering

Master of Science in Civil Engineering, and
Water Resources and Environmental Engineering Option

STUDENT OUTCOME ASSESSMENT PLAN

2021-2022

Prepared by

William Wright
(Assessment Coordinator)

and

The Faculty of Civil and Geomatics Engineering

June 22, 2021

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Mission Statements, Goals, and Objectives

Mission of the MSCE Program and WREE Option

The mission of the Master of Science in Civil Engineering (MSCE) Program and the Program's option in Water Resources and Environmental Engineering (WREE) 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, analysts, designers, constructors, and operators of the built environment. The basic tenet of their formation is the instilling of the professional rectitude of intention. As professionals, using the principles of mathematics and the natural sciences, they 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.

Our program is designed for students who wish to gain technical depth and educational experience geared toward professional practice and advanced study, through creative instruction and research.

Goals of the University of California at Fresno

Student who graduate from California State University, Fresno will demonstrate the importance of discovery, diversity, and distinction by:

- developing a foundational, broad and integrative knowledge of the humanities, the arts, the sciences, and social sciences, and their integration with their major field of study. Students will consolidate learning from different fields and explore the concepts and questions that bridge those essential areas of learning. Graduate students will articulate the significance, implications and challenges within their field in a societal and global context. In fields in which interdisciplinarity is fundamental, graduate students will further draw from the perspectives of other domains of inquiry/practice so as to assess a problem better and offer solutions to it.
- acquiring specialized knowledge as identified by program learning outcomes in their major field. Students will demonstrate expertise in a specialized area of study, including integration of ideas, methods, theory and practice. Graduate students will demonstrate further mastery of the field's theories, research methods, and approaches to inquiry. They will also show the ability to assess major contributions to the field, as well as expand on those contributions through empirical research or aesthetic exploration.
- improving intellectual skills including critical thinking, effective oral and written communication, information literacy and quantitative reasoning. Students will demonstrate fluency via application of these skills to everyday problems and complex challenges. Graduate students will hone these skills further, demonstrating coherent arguments, analysis, insight, creativity, and acumen as they address local, regional, and global issues in their respective fields of study.
- applying knowledge by integrating theory, practice, and problem solving to address real world issues using both individual and team approaches. Students will apply their knowledge in a project, paper, exhibit, performance, or other appropriate demonstration that links knowledge and skills acquired at the university with those from other areas of their lives. Graduate students will integrate knowledge and skills from coursework, practicum, and research to address critical issues in their field and demonstrate advanced application of knowledge through a culminating experience that validates, challenges, and/or expands the profession's body of knowledge.
- exemplifying equity, ethics, and engagement. Students will form and effectively communicate their own evidence-based and reasoned views on public issues, interact with others to address social, environmental and economic challenges, apply knowledge of diversity and cultural competencies to promote equity and social justice in the classroom and the community, value the complexity of ethical decision making in a diverse society, acknowledge the importance of standards in academic and professional integrity, and demonstrate honesty, tolerance, and civility in social and academic interactions. Building upon this at the graduate level, students will apply these values in the creation of scholarly and/or aesthetic works that enrich the human experience.

Goals of the MSCE Program and WREE Option

The overall goal of the MSCE program and the WREE Option is to prepare students for professional practice and advanced study beyond the master's degree. Upon completion of the graduate program of study in Civil Engineering, the competent student will successfully attain the knowledge and skills necessary to:

- Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship.
- Describe and explain, beyond the undergraduate level, the scientific principles involved in the planning, analysis and design of the built environment, or in the mapping and measurement of it.
- Evaluate and employ advanced concepts and methodologies for the design of the built infrastructure or for mapping and measuring it.
- Evaluate and employ advanced techniques of analysis, including mathematical analysis and modeling, numerical techniques, and professional software for analysis and design in civil or geomatics engineering.
- Exhibit excellent communication skills.

MSCE and WREE Student Learning Outcomes

Students graduating from the MSCE Program and WREE Option will (according to their area of concentration) be able to:

1. Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship.
2. Describe, explain, and employ beyond the undergraduate level scientific principles and modern professional techniques used in the planning, analysis, management and/or design of:
 - a. buildings, bridges, and other structures, and/ or
 - b. transportation systems, transportation planning, and traffic operations, and/ or
 - c. water supply, flood management, water treatment, and environmental protection/ remediation facilities, and/ or
 - d. soil engineering, retaining walls, foundations, tunnels, and other geotechnical structures, and/or
 - e. measuring and mapping the earth and the built infrastructure.
3. Identify major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained.
4. Solve problems using advanced methods of engineering analysis and design through the use of mathematical analysis including but not limited to geospatial analysis, differential equations, finite elements, finite differences, least square errors, machine learning, optimization, or other numerical methods.
5. Use modern computer software for the analysis, design, operation, and/or measuring and mapping of the built infrastructure.
6. Exhibit excellence in written and graphical communication, including technical documents, research reports, research papers, proposals, and presentations.
7. Exhibit excellence in oral communication, including public presentations to technical and non-technical audiences.

Relationship between Program Goals and Student Learning Outcomes

The relationship between the MSCE Program and WREE Option goals and student learning outcomes are summarized in Table 1. Some program goals are represented in one or a few learning outcomes, while the others have been articulated in several outcomes. For example, the first program goal, student embracement of professional ethics, personal responsibility, and environmental stewardship, is represented by Learning Outcome 1 and considered to have been achieved only to the degree that Outcome 1 has been achieved. In contrast, several learning outcomes are used to assess how well the second program goal is achieved.

Table 1. Relationship between Program Goals and Student Learning Outcomes.

	Student Learning Outcomes:						
	Students graduating from the MSCE program will (according to their area of concentration) be able to:						
	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7
<p>Program Goals: The overall goal of the MSCE program and the WREE Option is to prepare students for professional practice and advanced study beyond the master's degree. Upon completion of the graduate program of study in Civil Engineering, the competent student will successfully attain the knowledge and skills necessary to:</p>	Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship	Describe, explain, and employ beyond the undergraduate level scientific principles and modern professional techniques used in the planning, analysis, management and/or design of: (a) buildings, bridges, and other structures, and/ or (b) transportation systems, transportation planning, and traffic operations, and/ or (c) water supply, flood management, water treatment, and environmental protection/ remediation facilities, and/ or (d) soil engineering, retaining walls, foundations, tunnels, and other geotechnical structures, and/or measuring and mapping the earth and the built infrastructure.	Identify major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained.	Solve problems using advanced methods of engineering analysis and design through the use of mathematical analysis including but not limited to geospatial analysis, differential equations, finite elements, finite differences, least square errors, machine learning, optimization, or other numerical methods.	Use modern computer software for the analysis, design, operation, and or measuring and mapping of the built infrastructure.	Exhibit excellence in written and graphical communication, including technical documents, research reports, research papers, proposals, and presentations.	Exhibit excellence in oral communication, including public presentations to technical and non-technical audiences.
Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship.	X						
Describe and explain, beyond the undergraduate level, the scientific principles involved in the planning, analysis and design of the built environment, or in the mapping and measurement of it.		X	X	X	X		
Evaluate and employ advanced concepts and methodologies for the design of the built infrastructure or for mapping and measuring it.		X		X	X		
Evaluate and employ advanced techniques of analysis, including mathematical analysis and modeling, numerical techniques, and professional software for analysis and design in civil or geomatics engineering.		X		X	X		
Exhibit excellent communication skills.						X	X

Relationship between Program Courses and Learning Outcomes

The relationship between MSCE Program and WREE Option courses and student learning outcomes are summarized in Table 2. WREE option courses are identified by grey highlight and recent additions by light blue highlight. Information on whether the learning outcome was introduced, developed, or mastered in the course is indicated by the letters I, D, and M, respectively. Just a few learning outcomes are associated with some courses (e.g., CE 232 or 233) while several outcomes are covered in other courses (e.g., CE 223).

Table 2. Relationship between program courses and student learning outcomes.

Course	Assessment Instrument	Student Learning Outcomes						
		Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7
CE 205 Comp in Engr Analysis	√		I		M	M		
CE 206 Engr Env Impact	√	M		M				
CE 210 Research Methods in Civ Engr		Outcomes depend on topic selected by student and/or instructor					M	M
CE 220 Adv Found Engr	√		M	M	I	M		
CE 223 Adv Soil Mechanics	√		M	M	I	M	M	
CE 225 Num Methds Geot Engr			M	M	M	M	M	
CE 230 Adv Theory Structures			M		M	I		
CE 232 Prestressed Conc Desgn	√		M	M				
CE 233 Adv Beh & Des Steel Struct	√		M	M				
CE 234 Theory of Plates and Shells			M		M			
CE 235 Finite Elmt Anal		I	M		M	I	D	D
CE 236 Reinf Masonry Ther & Desgn			M	M	M			
CE 237 Dynamics of Struct			M		M	I		
CE 238 Stability of Structures			M		M	I		
CE 239 Adv Reinf Conc Theory			M	M	M		M	M
CE 240 Intro to Urban & Indust. Water	√		M			M		
CE 241 Groundwater Engr	√	D	M		M	M		
CE 243 Surface Water Engr		D	M		M	M		
CE 244 Water Res Syst Optimization		D	M		M	M		
CE 246 Cont. Fate & Transport Engr.		D	M		M	M		D
CE 247 Water Treatment Processes		D	M	M	D			
CE 248 Wastewater Treat & Reuse		D	M	M	D			
CE 249 Solid Waste Engr		D	M	M			M	M
CE 250. Transportation System Design	√	D	M		D	M	D	D
CE 251 Adv Boundary Law	√	M	D	M		I	M	M
CE 261 Geoprocessing	√		M	D	D	M	D	D
CE 271 Geod Syst Optim			M		D	D	D	
CE 275. Satellite Surveying			M		D	D	D	
CE 276 GPS Theory & Appl			M		M	M		
CE 280 Geom Engr Seminar		Outcomes depend on topic selected by student and/or instructor					D	
CE 283 Digit Remote Sens			D	D	I	M	D	D
CE 285 Adv Analyt Photogram					M	M	D	D
CE 286 Geogr Info Syst Desgn				D	M	M	D	D
CE 290 Independent Study		Outcomes depend on topic selected by student and/or instructor					M	
CE 291T Topics in Engr		Outcomes depend on topic selected by student and/or instructor						
CE 298 Project		Outcomes depend on topic selected by student and/or instructor					M	M
CE 299 Thesis		Outcomes depend on topic selected by student and/or instructor					M	M

Notes: I = Introduced; D = Developed; M = Mastered

Several courses are continuation of corresponding undergraduate courses where the material has already been introduced.

Courses with blue shading are part of the Water Resources and Environmental Engineering option.

Courses with yellow shading were added during in the latest revision to the program SOAP.

Assessment Methods

Assessment of student learning 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. Both direct and indirect measures are used. Direct measures are defined here as first-hand objective assessments of student learning. These are typically implemented by program faculty. Indirect measures are subjective assessments of student learning that are typically reported by the student or a third-party. The assessment activities are summarized then discussed as follows:

Direct Measures:

1. Students' scores on specific questions in specific courses (*formative*)
2. Students' communication skills in CE 210 (*formative*)
3. Students' performance in the culminating experience (*summative*)

Indirect Measures:

1. Student Exit Surveys (*summative*)
 - a. Administered by MSCE Program
 - b. Administered by Office of Institutional Effectiveness (when available)
2. Alumni Surveys (*summative*)
3. *Planned:* Employer Surveys (*summative*)

Students' scores on specific questions in specific courses.

Statistical analysis of student scores on one or more exam or assignment question(s) in a specific course are used to assess Outcomes 1 through 5 (ethics and technical knowledge and skills). The same or similar questions from prior assessments are used when possible. The MSCE curriculum includes four areas of specialization within civil engineering, namely: environmental/ water resources, geotechnical, geomatics, structural, and transportation. The environmental/ water resources area is available as a formal option. Graduating students will have a level of preparation that is unique to the individual area of concentration and thus not all students will take all the courses that are designated as assessment instruments.

Students' communication skills in CE 210 Research Methods.

Every three years communication skills of students enrolled in CE 210 Research Methods are used in program assessment. The primary objectives of CE 210 are to prepare the students to undertake the culminating experience in the form of master's project or thesis, and to develop their research and communication skills. Students in this course are graded for the general performance in the course and graded separately for their writing and oral presentation competency. The communication skills component of CE 210 in writing and oral presentations is strong and the overall performance of students is used for assessment purposes. The rubric used to assess the writing component can be found in Appendix A. Skill in graphical communication is not currently assessed in either written reports or in presentations, however, the grading rubrics could be expanded to include this important skill. The potential to assess additional learning outcomes in CE 210 exist, and Outcome 1 may be a good candidate. Outcomes 2-5 are advanced knowledge and therefore not relevant in this second semester course.

Program Requirements Satisfied in CE 210

Graduate Writing Requirement (GWR): The writing component of CE 210 is the primary instrument used to assess the GWR. Achieving a passing score of 87.5% is required to pass CE 210. If a passing grade on the writing component is not achieved, students who have a passing grade on the sum total of other course requirements will receive an "Incomplete" and must pursue the completion of the writing requirements independently from the course and in collaboration with his/ her graduate advisor. Students have two semesters to resolve incomplete work to avoid a failing grade in the course (and a high likelihood of disqualification from the graduate program based on low GPA).

Qualifying Exam: Students must pass CE 210 with a minimum grade of ‘B’ to meet the program qualifying exam requirement.

Achieving these two requirements demonstrates that the student has sufficient communication and technical proficiency to continue in the program, and both must be satisfied for a student to be eligible for Advancement to Candidacy.

Students’ performance in the culminating experience

Every three years culminating experiences of graduating students are used in program assessment. The MSCE Program and WREE option offer three culminating experience plans to complete the program, namely: (A) CE 299 Thesis, (B) CE 298 Project, or (C) Comprehensive Exam.

All new students begin in Plan C and have the option to change to Plan A or B if an advisor agrees to supervise their work. All students following plans (A) and (B) are required to make a final oral presentation/defense of their project or thesis work and submit a final report. Students who select Plan C (Comprehensive Exam) are not required to make a final oral presentation/defense of their work.

The program-based rubrics used to evaluate and score master’s projects can be found in Appendix B. Currently only Outcomes 7 and 8 are assessed, based on the total score from Rubric I (written report) and Rubric II (oral presentation), respectively. As was the case for CE 210, skill in graphical communication is not currently assessed in culminating experience written reports or presentations and the grading rubrics could be modified to include this skill. Parts of Rubrics I and II have the potential to be used as assessment tools for Outcomes 1 through 6. A separate set of rubrics may be developed in the future for CE 299. Consideration is also being given to using the comprehensive exam as a means for assessing technical objectives.

Graduate Core Competency Assessment

The MSCE program assessed campus Graduate Core Competencies 1 and 2 in Spring 2021 based on CE 298 and CE 299 culminating experiences. Inclusion of comprehensive exams will be discussed by department faculty.

Program Standards

A uniform standard of 75% for numeric scores has been adopted across all learning outcomes except for the GWR (87.5%). The merits and drawbacks of using a single value (75%) will be reviewed over time.

Student Retention & Residence Time

Consideration is being given to tracking student retention statistics and the average time to complete their degree.

Exit Surveys

Every three years graduating students are asked to complete a program exit survey (on a voluntary basis). The exit survey is shown in Figure 1. In addition to the program-administered exit survey, the campus Office of Institutional Effectiveness collects data from graduating students and, when data specific to our program can be identified, the data is requested for use in assessment.

Alumni and Employer Surveys

An alumni survey (prior graduates of the MSCE Program and WREE Option who have been working at least one year but not more than five years was implemented in 2017 and current plans are to repeat the survey every 5 years. The survey instrument is shown in Figure 2. A survey for employers of program graduates is desired but implementation is pending permission to access alumni and employer databases on campus. Consideration is being given to the possibility of assessing the percentage of students who obtain professional licenses (from the State Board or NCEES) and who go on to earn doctorate degrees.

Outcomes & Methods Matrix

The relationship between MSCE Program and WREE Option goals and the instruments used to measure student learning outcomes are summarized in Table 3. Shaded areas represent potential measurement instruments that are not currently used. All five program goals are assessed using the program exit interview and alumni survey, four goals are assessed using questions in specific courses, one program goal is assessed using the CE 210 Research Methods course. Measurement of additional goals via CE 210, CE 298, CE 299 and the comprehensive exam are being considered. Assessment using an employer survey is planned for the future.

Table 3. Relationship between program goals and instruments used to measure student learning outcomes.

	Outcome Measurement Instrument					
	1	2	3	4	5	6
<p>Program Goals: The overall goal of the MSCE program is to prepare MSCE students for professional practice and advanced study beyond the Master of Science degree. Upon completion of the graduate program of study in Civil Engineering, the competent student will successfully attain the knowledge and skills necessary to:</p>	CE 210 Research Methods	Questions in specific courses	Culminating Experience (Project or Thesis)	Program Exit Survey	Alumni Survey	Employer Survey (future)
Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship.	X *	X	X *	X	X	X
Describe and explain, beyond the undergraduate level, the scientific principles involved in the planning, mapping, analysis, and/or design of the built environment.		X	X	X	X	X
Evaluate and employ advanced concepts and methodologies for the design of the built infrastructure or for mapping and measuring it.		X	X	X	X	X
Evaluate and employ advanced techniques of analysis, including mathematical analysis and modeling, numerical techniques, and professional software for analysis and/or design in civil or geomatics engineering.		X	X	X	X	X
Exhibit excellent communication skills.	X		X	X	X	X

* Degree of attainment of this goal will vary by student depending on the activity topic selected by the student.

Shading represents instruments that might be implemented in the future.

Timeline for Implementation of Assessment Methods

Timelines for implementation of assessment activities are summarized below. A schedule for implementation of assessment instruments is provided in Table 4. A schedule for implementing questions in specific courses is provided in Table 5. An overall action plan is presented in Table 6. Prior to AY 2014-15 most instruments were utilized annually. The frequency of was reduced in AY 2015-16 and in AY 2017-18 based on recommendations from the campus director of assessment. AY 2019-20 assessment activities were suspended following the outbreak of the COVID-19 pandemic and an annual assessment report for AY 2019-20 was not prepared. Tables 4 and 5 have been updated to reflect the event.

Table 4. Schedule for assessment activities.

Instrument	Academic Year and Outcomes to be Assessed					
	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Instrument 1 – CE 210 Research Methods	--	--	n/a	6, 7	--	--
Instrument 2 – Questions in specific courses ¹	4, 5	1, 2	n/a	3, 4	5, 1	2, 3
Instrument 3 – Culminating Experience	6, 7	--	n/a	--	6, 7	--
Instrument 4 – Program Exit Survey	--	1 thru 7	n/a	--	--	1 thru 7
Instrument 5 – Alumni Survey	--	--	n/a	--	--	1 thru 7
Instrument 6 – Employer Survey	--	--	n/a	--	--	--

¹ The courses are indicated in Table 5.

Courses used for outcomes assessment in the various specializations within the program are shown in Table 5, along with an implementation schedule. Outcomes 1 - 6 are rotated in pairs each year (identified with a check mark). Outcomes assessed in past years are identified by dark background fill in the box.

Table 5. Schedule for formative assessment via mean student scores on specific questions in specific courses.

Course	Area of Specialization ¹						Learning Outcome Implementation Schedule									
	Environmental & Water Resources	Geotechnical	Geomatics	Structures	Transportation	2017-18		2018-19		2020-21		2021-22				
						Taught? ²	Outcome ⁴	Taught? ²	Outcome ⁴	Taught? ²	Outcome ⁴	Taught? ²	Outcome ⁴			
						4	5	1	2	3	4	5	1			
CE 205 Comp in Engr Analysis		X	X	X		X	√	√	X		√			√		
CE 206 Engr Env Impact	X														√	
CE 210 Research Methods	See Note 3					X			X			X				
CE 220 Adv Found Engr		X		X			√	√	X		√	√	X	√	√	
CE 223 Adv Soil Mechanics		X					√	√			√	√		√	√	
CE 232 Prestressed Conc				X		X					√					
CE 233 Adv Beh & Des Steel Struct				X		X	√			√	√		√			
CE 240 Intro. Urban & Indust. Water Syst.	X						√		X	√	√		X		√	
CE 241 Groundwater Engr.	X						√	√	X	√	√			√		√
CE 250 Transportation System Design					X						√		X		√	√
CE 251 Adv Boundary Law			X					√		√	√			√	√	√
CE 261 Geoprocessing			X				√	√			√	√		√	√	√

¹ Students can specialize in one technical area or take courses in multiple areas.

² A blank box indicates that the course was not offered during the academic year indicated.

³ Area depends on topic selected by student.

⁴ Course Learning Outcomes are identified with a check mark; outcomes that were assessed are shown by dark background solid fill.

Table 6. Assessment time table and action plan.

Assessment Activity	How Often	Who	How	
Student scores on problems in selected MSCE/ WREE courses	In accordance with Table 5	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	In accordance with Table 5	Course instructor provides summary of results to Graduate Coordinator	Graduate coordinator compiles information and summarizes it every year	
Student performance in culminating experience	In accordance with Table 4	Advisor provides summary of results to Graduate Coordinator	Graduate coordinator compiles information and prepares a summary every year	
Exit Surveys	In accordance with Table 4	Graduate coordinator asks graduating students to complete the form and return it to the Dept. Administrative Assistant anonymously.	Graduate coordinator compiles results and prepares a summary every year.	
Alumni and Employer Surveys	In accordance with Table 4	Graduate coordinator requests surveys	Graduate coordinator compiles information every two years	

Evaluation, Curriculum Adjustment, and Reporting (Closing the Loop)

The MSCE Program/ WREE Option SOAP is reviewed annually by the department faculty and modifications are made when warranted. Assessment data is collected on a continuous basis throughout the academic year. Data analysis, evaluation, and reporting is conducted on an annual basis, after the conclusion of the spring semester. Summary results are reported to the department faculty and chair, college dean, and campus Office of Institutional Effectiveness. Findings that suggest that there may be a need for curriculum adjustment are brought to the attention of graduate faculty for discussion and resolution.

Program Review and Action Plan

The MSCE Program underwent program review in AY 2018-19 and a 5-year action plan was developed and approved by campus in the Fall of 2019. Implementation was delayed one semester due to the COVID-19 outbreak in spring 2020. In the Fall of 2020, an Action Plan Implementation Decision Tool was developed to score each action in terms of importance, urgency and “doability.” The sum of these scores was used to establish the order in which the actions would be considered by the department. The items and discussion of progress made will be included in annual assessment reports beginning with the AY 2020-21 report.

MSCE Program & WREE Option
Graduating Student Feedback

Today's Date _____ Graduation Year: _____ Spring Fall Summer

Which program did you complete? (check one) MSCE WREE

What area of concentration(s), if any? (check one or more) Geomatics Geotech. Structural
 Water/ Env. Transport.

Which culminating experience plan did you complete? Thesis Project Comp. Ex

Were you employed while pursuing your degree? No Yes, -----> Full-time
-----> Part-time On-campus Off-campus

Do you have a full-time job offer following graduation? No N/A Yes ----->
--> Is the nature of your employment or employment offer civil engineering?" No Yes

--> What is the starting salary (voluntary) ? [_____]

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

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

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

Learning Outcomes (as applicable to your area)	Scale 1.0 to 4.0
Did the MSCE program help you to understand and embrace principles of professional ethics, personal responsibility, and environmental stewardship?	[]
Did the MSCE program help you better understand and employ, beyond the undergraduate level, the scientific principles and modern professional techniques used in the planning, analysis, management and/ or design of the built environment, including: <ul style="list-style-type: none"> • buildings, bridges, and other structures; and/ or transportation systems, transportation planning, and traffic operations; and/ or • water supply, flood management, water treatment, and environmental protection/ remediation facilities; and/ or • soil engineering, retaining walls, foundations, tunnels, & other geotechnical structures; and/or • measuring and mapping the earth and the built infrastructure? 	[]
Did the MSCE program help you learn major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained?	[]
Did the MSCE program help you learn how to solve problems using advanced methods of engineering analysis and design through the use of mathematical analysis including but not limited to geospatial analysis, differential equations, finite elements, finite differences, least square errors, machine learning, optimization, or other numerical methods?	[]
Did the MSCE program help you learn how to use modern computer software for analysis, design, operation and/or measuring or mapping of the built infrastructure?	[]
Did the MSCE program help you to exhibit excellence in communication, specifically: <ul style="list-style-type: none"> • written and graphical communication, including technical documents, research reports, research papers, proposals and presentations? • oral communication, including public presentations to technical and non-technical audiences 	[]

Figure 1. MSCE Program and WREE Option Student Exit Survey form.

MSCE Program Alumni Survey

Q1 When did you complete your master's degree in Civil Engineering at Fresno State?

- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- Not completed

Q2 Are employed in the US?

- Yes
- No

Q3 Please provide the following information:

Name of your employer
Your current job title

Q4 In what field are you working?

- Private Practice/Consulting/Industry/Construction
- Government
- Self Employed
- Education
- Other, please specify _____

Q5 What is your current salary?

- Less than \$50,000
- \$51,000 - \$80,000
- \$81,000 or more
- I don't wish to answer

Q6 As you compare yourself to other beginning professionals in your field, how do you rate the quality of your educational preparation through Fresno State's Civil Engineering program?

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

Q6 How confident and prepared do you feel in handling professional tasks now?

- A great deal
- A lot
- A moderate amount
- A little
- Not at all

Q7 Please identify the areas in your master program of study that contributed LEAST to your professional development. Such areas might include a specific course or specific course content, specific lab or field experience, specific instructional equipment, etc.

Figure 2. MSCE Program proposed Alumni Survey form (Page 1 of 3).

Q8 On a scale of 1 to 5 (1 is lowest and 5 is highest), please rate the degree of attainment of each of the MS program's learning outcomes (LOs) upon graduation and the importance of each as you relate them to your career success after graduation at Fresno State. If you are not able to answer, please mark N/A (Not Applicable).

	Degree of Attainment						Importance					
	1	2	3	4	5	N/A	1	2	3	4	5	N/A
1) Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2) Describe, explain, and employ the scientific principles and modern professional techniques used in the analysis and/or design of (as applicable):												
a. buildings, bridges, and other structures												
b. transportation systems, transportation planning, and traffic operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. water supply, flood management, water treatment, and environmental protection/ remediation facilities												
d. soil engineering, retaining walls, foundations, tunnels, and other geotechnical structures												
e. measuring and mapping the earth and the built infrastructure												
3) Identify major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4) Solve problems in engineering analysis and design through the use of mathematical analysis, differential equations, finite elements, finite differences, least square errors, or other numerical methods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5) Use modern computer software for the analysis and design or measuring and mapping of the built infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6) Exhibit excellence in written and graphical communication, including technical documents, research reports, proposals, and presentations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) Exhibit excellence in oral communication, including public presentations to technical and non-technical audiences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9 What is your overall satisfaction with your MS education at Fresno State?</p>

- Extremely satisfied
- Somewhat satisfied
- Neither satisfied nor dissatisfied
- Somewhat dissatisfied
- Extremely dissatisfied

Q10 OPTIONAL: How would you rate the support, assistance, and general help you received from faculty in the master's program?

- Excellent
- Good
- Average
- Poor
- Unacceptable

Q12 OPTIONAL: What changes do you foresee in your field in the next ten years? How might the master program address these changes?

Figure 2. MSCE Program proposed Alumni Survey form (Page 2 of 3).

Q13 May we contact you in the future?

- Yes
- No

Display This Question:

If May we contact you in the future? Yes Is Selected

Q40 Preferred method of contact:

- Phone
- Email
- Mail
- Other, please specify: _____

Display This Question:

If Preferred method of contact: Phone, please provide your phone number with your area code: Is Selected

Q41 Please provide your phone number with area code:

Display This Question:

If Preferred method of contact: Email Is Selected

Q42 Please enter your email address:

Display This Question:

If Preferred method of contact: Mail Is Selected

Q43 Please provide your complete mailing address (street number, city, state, zip):

Q44 If you are not yet a member of the Lyles College of Engineering (LCOE) Alumni society and would like to join, please contact the LCOE alumni chapter at this link:

Thank you for your time. GO 'DOGS!!!

Figure 2.b. MSCE Program proposed Alumni Survey form (Page 3 of 3)

Appendix A Graduate Writing Rubrics in CE 210 Research Methods

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' intent.	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.

Graduate Oral Presentation Rubrics in CE 210 Research Methods

See CE 298 Project Grading Rubrics, Part II Rubric (Project Oral Presentation) in Appendix B.

Appendix B CE 298 Project Grading Rubrics

**Lyles College of Engineering
MSCE Program**

**CE 298 Project
Grading Rubrics**

Rationale

Similarly to the thesis, the work performed in the CE 298 Project option must show evidence of originality, organization, clarity of purpose, critical analysis, accuracy, completeness, and quality of writing consisting with the standards appropriate for publication in the scholarly journals of the field. Additional insight on the nature of the project can be found in California's Title 5 (Education Code) as follows:

A project is a significant undertaking appropriate to the fine and applied arts or to professional fields.

It evidences:

1. originality and independent thinking
2. appropriate form and organization, and
3. a rationale.

It is described and summarized in a written abstract that includes the project's:

1. significance
2. objectives
3. methodology and
4. a conclusion or recommendation.

An oral defense of the project shall be required.

Although the Final Project Report does not have to comply with the datelines and format requirements of the thesis option, it is highly recommended that the format and deadlines are followed as guidelines in the preparation and submittal of the Final Project Report. The following content and organization guidelines for projects have been approved by the University Graduate Committee (11/9/10):

- | | |
|---|---|
| 1. Title Page | 6. Introductory Statement |
| 2. Personal Responsibility Statement ¹ | 7. Literature Review |
| 3. Signature Page | 8. Data Collection/Analysis/Project Documents |
| 4. Table of Contents | 9. Conclusions/Recommendations |
| 5. Abstract | 10. References |
| 11. Appendixes | |

The project option is completed when the graduate advisor submits the final grade for the project and the student has successfully made an oral presentation summarizing the importance, approach, and findings of his/her research project. It is required that this final oral presentation be made before all interested faculty and students and be appropriately announced by the student (e.g., via e-mail, flyers, or other effective advertisement) ahead of time.

¹ The following statement shall be included at the center of the Personal Responsibility Page (*scheduled to be implemented beginning in AY 2012-13*):

“Personal Responsibility Statement:

I have completed this work under the direction of my faculty advisor _____ (*add name*) and all results presented are my original work, or otherwise explicitly acknowledged in writing within this report. The conclusions and recommendations therein are based on my best assessment of the obtained or experimentally developed evidence.

Signed _____”

Grading

The grade in the CE 298 Project option is thus calculated based on the following two parts:

Part I.-Nature, merit, quality, completeness of the work performed and correctness, quality, clarity, and organization of the written report.

See attached Rubrics: **Points: 160**

Part II.-Clarity, correctness, completeness, and effectiveness of oral presentation.

See Oral Presentation Rubrics: **Points: 100**

Total Points: 260

Grade Scale:	A:	> 240
	B:	> 214 ≤ 240
	C:	> 202 ≤ 214
	D:	≥ 170 ≤ 202
	F:	< 170

Part I Rubric (Project Content and Written Report)

Student's name _____

Abstract

(10)

- a. project/problem statement _____ out of 3 points
- b. A brief statement of the merit of the study _____ out of 2 points
- c. A brief summary of results and conclusion _____ out of 3 points
- d. 3-5 Key Words _____ out of 2 points

Introduction

(30)

- e. format/grammar _____ out of 5 points
- f. Description of the importance of the project _____ out of 5 points
- g. Literature Review, including:
 - i. pertinent background knowledge and technology _____ out of 5 points
 - ii. similar works done by others _____ out of 3 point
 - iii. reference citations _____ out of 2 points
- h. Project statement and objectives _____ out of 5 point
- i. Tasks and hypothesis _____ out of 5 points

Data Acquisition

(30)

- j. format/grammar _____ out of 5 points
- k. List of data types, names and meanings and sources _____ out of 5 points
- l. list of the names of equipment, software and parameters _____ out of 3 points
- m. data acquisition procedures _____ out of 6 points
- n. evaluation of the quality of each type of data _____ out of 6 points
- o. lists of any uncertain or unexpected factors _____ out of 5 points

Results and Discussion

(50)

- p. format/grammar _____ out of 5 points
- q. logic of content _____ out of 5 points
- r. proper tables and figures, including:
 - i. proper figures and tables with captions _____ out of 10 points
 - ii. consistent format of the tables and figures _____ out of 5 points
- s. interpretation and inclusion of all data, tables and figures _____ out of 15 points
- t. discussion of the uncertainty and reliability of the data _____ out of 5 points
- u. final results _____ out of 5 points

Conclusion

(30)

- v. format/grammar _____ out of 5 points
- w. summary of project results and findings _____ out of 15 points
- x. the impact of results on the project's objective _____ out of 5 points
- y. recommendation for future study _____ out of 5 points

References

(5)

- z. follows ASCE Journal Paper format _____ out of 5 points

Acknowledgement, Appendices, Electronic Documents

(5)

- aa. acknowledgements (funding, contributors) _____ out of 2 points
- bb. Appendix(es) and electronic attachments _____ out of 3 points

Part I Score _____ out of 160 points or _____ %

Part II Rubric (Project Oral Presentation)

Student's name _____

Delivery

- Was the presenter enthusiastic about the presentation
1 through 5 (5 = best) []
- Was the voice clear, audible, and understandable
1 through 5 (5 = best) []
- Did the presenter use proper terminology and grammar
1 through 5 (5 = best) []
- Did the presenter introduced her/himself and the topic concisely
1 through 5 (5 = best) []
- Was there an outline of the presentation given at the beginning
1 through 5 (5 = best) []
- Did the presenter summarize the presentation at the end
1 through 5 (5 = best) []
- Did the presenter allow for questions at the appropriate time
1 through 5 (5 = best) []
- Was time allotted used appropriately
1 through 5 (5 = best) []

Delivery Subtotal (out of 40): _____

Content

- Were the objectives of the research topics clearly presented?
1 through 10 (10 = best) []
- Was the State-of-the-Art presented factually, quantitatively, precisely?
1 through 10 (10 = best) []
- Were the Research Needs presented clearly as a natural continuation of the State-of-the-Art?
1 through 10 (10 = best) []
- Was the Methodology presented clearly and convincingly?
1 through 10 (10 = best) []
- Was the analysis presented clearly and quantitatively as appropriate
1 through 10 (10 = best) []
- Were the conclusion presented succinctly, and clearly supported by the data and analysis
1 through 10 (10 = best) []

Content Subtotal (out of 60): _____

Part II Score _____ out of 100 points or _____ %