CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

Office of Academic Programs

Date: May 22, 2017

To: David Speak
Chair, Academic Senate

Copy: Francelina Neto
Larisa Preiser-Houy
Valerie Otto
Julie Shen

Via: Sylvia Alva, Ph.D.
Provost and Vice-President for Academic Affairs

From: Soraya M. Coley, Ph.D.
President

Subject: **Response to Senate Reports on Programs for Semester calendar**

Provost' to President:

The Academic Senate recommended approval of the following new and revised Academic Programs and Options for the Semester-based schedule of operations:

AS-2693-167-AP	Multiple Subject Credential (Revisioned)
AS-2694-167-AP	Single Subject Credential (Revisioned)
AS-2695-167-AP	Civil Engineering, M.S. – Environmental and Water Resources Engineering Option
AS-2696-167-AP	Civil Engineering, M.S. – Geotechnical Engineering Option
AS-2697-167-AP	Civil Engineering, M.S. – Transportation Engineering Option
AS-2698-167-AP	Civil Engineering, M.S. – Structural Engineering Option
AS-2699-167-AP	Preliminary Education Specialist Credential, Moderate/Severe Disabilities
AS-2675-167-AP	Fashion Merchandise Minor

The Senate and curriculum authorities at various levels have studied these proposals and judged them worthy. I concur with this verdict and recommend their approval.

President to Academic Senate:

I concur with Provost Alva's judgment. I request that the staff in Academic Affairs officially record these as approved and that they appear in the lists of programs in the catalog, PeopleSoft, and other databases and published lists as necessary for the campus move to semester-based operations.

Recommendation

See attached

California State Polytechnic University, Pomona

Academic Senate Report

AS-2696-167-AP

Civil Engineering, M.S. – Geotechnical Engineering Option (New)

Academic Senate Action:

Adopted: April 5, 2017

Final Disposition:

Transmitted to President: April 10, 2017

RECOMMENDATION:

The Academic Senate recommends approval of the Civil Engineering, M.S. - Geotechnical Engineering Option as part of the semester conversion process (See attached program proposal).

Program Proposal

Master of Science in Civil Engineering (MSCE)
Geotechnical Engineering Option

Title of the proposed option
Geotechnical Engineering Option

Title of the degree major program under which the option will be offered
Civil Engineering, Master of Science in Civil Engineering (MSCE)

Program total units
30

Description of Option
The Civil Engineering Department at Cal Poly Pomona (CPP) proposes to convert an existing Master of Science in Civil Engineering (MSCE) program consisting of emphasis areas into a revised Master of Science in Civil Engineering (MSCE) program consisting of options. The proposed option name for geotechnical engineering shall be MSCE Geotechnical Engineering Option. This includes converted courses, revised courses, and new courses as summarized in the Curriculum Sheets. This Program will offer a specialized program of advanced coursework in geotechnical analysis and design, and give students in-depth technical knowledge related to the field of Geotechnical Engineering.

This proposal contains the Curriculum Sheets for the MSCE Geotechnical Engineering Option, the Roadmap, the 2-Year Course Schedule, the Course Catalog Descriptions, and the Assessment Plan.

List options or emphases already existing under the degree major program for which the option is proposed.
Environmental and Water Resources Engineering emphasis
Geotechnical Engineering emphasis
Structural Engineering emphasis
Transportation Engineering emphasis

State the aims of the proposed option
The College of Engineering has offered a Master of Science in Engineering (MSE) degree for nearly forty years. Initially, this program included specialty tracks in the various engineering disciplines, including civil engineering. In the late 1990s, the College developed a strategic plan to spin off the more successful specialty tracks into separate degree programs, including the

Master of Science in Electrical Engineering (MSEE), the Master of Science in Mechanical Engineering (MSME), and others. The Master of Science in Structural Engineering (MSSE) program was developed in this context, and began in 2001. The program catered primarily to working professional engineers, with classes offered mostly in the evening. Given the continued success of the MSSE program and with an increasing demand for civil engineers to hold a master's degree in order to advance in their professional career, the Civil Engineering Department obtained approval on July 27, 2006 to change the name of its MS program from MSSE to MSCE. At that time the MSSE program was converted into an emphasis in the MSCE program, concurrently with the addition of the Geotechnical Engineering and Transportation Engineering Emphases to the program. Later in 2015, in response to demand from current students as well as the industry, the Environmental and Water Resources Emphasis was added to the MSCE program. Since then, enrollment has significantly grown and between all emphases, more than 150 students are currently enrolled in the program.

The complexity of contemporary engineering problems faced globally by society requires technical specialization in the different civil engineering technical areas. Furthermore, in response to the societal needs, the American Society of Civil Engineering (ASCE) created the Raise the Bar Strategic Initiative to advance the profession and the public welfare by actively supporting the national movement to raise educational requirements for licensure of future professional engineers. This initiative includes the increase of the in-depth level of technical training fulfilled with additional 30 credits of graduate or upper level undergraduate courses in engineering and professional practice topics. The recommendations are presented at http://www.asce.org/raise_the_bar/. The conversion of the MSCE emphases to MSCE options will allow the Civil Engineering Department to provide more concentrated in-depth technical experience for the students enrolled in the option, while including the multidisciplinary and broader professional experience in the technical electives offered in the option's curriculum. The proposal to convert the existing emphasis to an option is aligned to the goals of ASCE's Body of Knowledge for the 21st Century (http://www.asce.org/civil_engineering_body_of_knowledge/).

The conversion from the Geotechnical Engineering Emphasis to a Geotechnical Engineering Option will offer the opportunity to specify in the MSCE degree the area of technical expertise for each student. This will help the department recruit well-qualified students and will also enhance the opportunities for our graduates to be employed in the geotechnical engineering field. An added benefit of converting the emphasis into an option is that it will be possible to track student enrollment and track student progress towards graduation. Student tracking will facilitate student advising and streamline course offerings.

List courses by subject area, catalog number, title, and units of credit as well as the total units to be required under the proposed option
Refer to the Curriculum Sheets included in this proposal.

Justify the need for the proposed option.
Local industries have looked to the Civil Engineering Department for graduates to fill internships, part-time and full-time positions in geotechnical engineering. Our graduates are well sought after by both private companies and public agencies for employment. The industry trend

in the area of geotechnical engineering is that a Master's Degree is the minimum requirement for employment even at an entry level position. By converting the Geotechnical Engineering Emphasis to a Geotechnical Engineering Option, the graduates' degree will identify the area of expertise which will open opportunities for them in sectors that would otherwise not be accessible.

In addition, the enhancement of our existing MSCE program by converting the Geotechnical Engineering Emphasis into a Geotechnical Engineering Option is an essential part of the department's strategic plan to ensure continued success and professional growth of our graduates and ensure lifelong learning and development of our alumni.

The proposed changes in the MSCE program will allow the Civil Engineering Department to continue supporting and expanding the MSCE Program and will facilitate the recruitment of well-qualified faculty in geotechnical engineering.

List new courses to be developed. You will need to submit separate course proposals for each new course.
Refer to the curriculum sheets included in this proposal.

List all present faculty members with rank, appointment status, highest degree earned, date and field of highest degree, and professional experience, who would teach in the proposed option.

1. **Dragos Andrei**, Professor; full-time; Ph.D. (2003) in Civil Engineering with an emphasis in Pavement Engineering; He is a licensed Civil Engineer in the State of California and a licensed Professional Engineer in the State of Texas. He has expertise in Pavement Engineering, Building Materials, Infrastructure Sustainability and Asset Management.

2. **Jinsung Cho,** Assistant Professor; full-time; Ph.D. (2012) in Civil Engineering with an emphasis in Construction Engineering and Management; He has expertise in Construction Engineering and Management, as well as in Geotechnical Engineering.

3. **Mehrad Kamalzare**, Assistant Professor; full-time; Ph.D. (2013) in Civil Engineering with an emphasis in Geotechnical Engineering; He is a licensed Civil Engineer in the State of Connecticut. He has expertise in Geotechnical Engineering, as well as in Soil Dynamics, Embankment Dams, and Deep Foundations.

4. **Lisa Y. Wang**, Professor; full-time; Ph.D. (1997) in Civil Engineering with an emphasis in Structural Engineering; She is a licensed Civil Engineer in the State of California. She has expertise in Structural and Earthquake Engineering, Liquid-Structure Interaction, and Soil-Structure interaction. She also had a M.S, Degree in Geotechnical Engineering.

5. **Man-chu Ronald Yeung**, Professor, Interim Associate Dean for the College of Engineering; full-time; Ph.D. (1991) in Civil Engineering with an emphasis in

Geotechnical Engineering; He is a licensed Civil Engineer in the State of California. He has expertise in Geotechnical Engineering, Rock Mechanics, and Tunneling.

Describe instructional resources (faculty, space, equipment, library volumes, etc.) needed to implement and sustain the proposed option.

The resources currently utilized to run the MSCE Geotechnical Engineering Emphasis (faculty, classrooms, computer labs, library resources, geotechnical engineering laboratory with tri-axial testing capabilities) would be adequate to run the Geotechnical Engineering Option. Because the MSCE courses are offered in evening, the needed resources do not interfere with those required to properly run the B.S. Civil Engineering Program.

List additional resources needed including specific resource, cost, and source of funding.

No additional resources are needed to properly run the proposed Geotechnical Engineering Option.

CURRICULUM SHEET

Program Name : MSCE – Geotechnical Engineering Option				
Total Units: 30				
Required Major Core Courses – Units: 3-9 (CE 5020 is common core course for all MSCE students; culminating experience is satisfied by CE 6970, CE 6950, or CE 6960)				
Course Number	**Title**	**Units (lec/lab)**	**Revisioned/ Converted**	**GE Area Double Count (Y/N)**
CE 5020	Applied Probability Concepts in Civil Engineering	3	Converted	N
CE 6950	Master's Project	3	Converted	N
or CE 6960	Master's Thesis	3 (6 units required)	Converted	N
or CE 6970	Comprehensive Examination	0	Revisioned	N
Required Option Core Courses – Units: 12				
Course Number	**Title**	**Units (lec/lab)**	**Revisioned/ Converted**	**GE Area Double Count (Y/N)**
GSC 4150/L	Engineering Geology II/Laboratory	2/1	Converted	N
CE 5400	Advanced Soil Mechanics I	3	Converted	N
CE 5401	Advanced Soil Mechanics II	3	Converted	N
CE 5431	Subsurface Investigation and Characterization	2	Converted	N
CE 5431L	Subsurface Investigation and Characterization Lab	1	Revisioned	N
Option Elective Courses – Units: 9-15 (Up to 3 units of approved 4000-level courses)				
Course Number	**Title**	**Units (lec/lab)**	**Revisioned/ Converted**	**GE Area Double Count (Y/N)**
CE 5430	Advanced Foundation Engineering	3	Converted	N
CE 5440	Earth Retaining Structures	3	Converted	N
CE 5451	Pavement Design and Construction	3	Revisioned	N
CE 5460	Rock mechanics	3	Converted	N
CE 5470	Slope Stability and Earth Dams	3	Converted	N
CE 5480	Geotechnical Earthquake Engineering	3	Converted	N
CE 5491	Street Maintenance, Rehabilitation and Management	3	Revisioned	N
CE 5990	Special topics for Graduate Students	3	Converted	N
CE 4400	Foundation and Retaining Wall Design	3	Converted	N

Civil Engineering Department
Geotechnical Engineering Option
Curriculum Year: 2018-2019

Your department has developed this road plan, taking into account prerequisites and schedule restrictions.
You should pay attention to these concerns when deviating from this plan.

	Fall	Units	Spring	Units	Comment
Year 1	**CE 5020** Applied Probability Concepts in Civil Engineering	3	**CE 5401** Advanced Soil Mechanics II	3	*The three columns in a semester refer to the three possible culminating experiences: Master's Thesis, Master's Project, or Comprehensive Exam, respectively*
	CE 5400 Advanced Soil Mechanics I	3	**CE XXXX Option Elective**	3	
	CE 5431/5431L Subsurface Investigation & Characterization/Lab	3			
	Total Units	**9**	**Total Units**	**6**	
			Total Units for Year	**15**	

	Fall	Units	Spring	Units	Comment
Year 2	**GSC 4150/L** Engineering Geology II/Lab	3	**CE XXXX** Option Elective	3	*The three columns in a semester refer to the three possible culminating experiences: Master's Thesis, Master's Project, or Comprehensive Exam, respectively*
	CE XXXX Option Elective	3	**CE 6960** Master's Thesis / **CE 6950** Master's Project / **CE XXXX** Option Elective	3	
	CE 6960 Master's Thesis / **CE XXXX** Option Elective / **CE XXXX** Option Elective	3	**CE 6970** Compr. Exam	0	
	Total Units	**9**	**Total Units**	**6**	
			Total Units for Year	**15**	

Total Units on Plan	**30**
Option/Core Units	**21/18/15**
Option Support Units	**9/12/15**
General Education Units	**0**
Unrestricted Elective Units	**0**

CE Projected Two-Year Course Schedule

Please refer to BroncoDirect for the current academic quarter course schedule

Course	Academic Year 2018-19			Academic Year 2019-2020		
	Fall	Spring	Summer	Fall	Spring	Summer
CE 5020	X			X		
CE 5400	X			X		
CE 5401		X			X	
CE 5430					X	
CE 5431	X			X		
CE 5431 L	X			X		
CE 5440		X				
CE 5451					X	
CE 5460				X		
CE 5470	X					
CE 5480		X				
CE 5491		X				
CE 5990						
CE 6950	X	X		X	X	
CE 6960	X	X		X	X	
CE 4400	X	X		X	X	

California State Polytechnic University, Pomona
Civil Engineering Department
Graduate Program Assessment Plan (Semesters)

November 30, 2016

The Master of Science in Civil Engineering (MSCE) program at Cal Poly Pomona builds upon an undergraduate education and facilitates more advanced studies in one of the branches of civil engineering. The program consists of 30 semester units. Currently, there are four emphases under the MSCE program: Environmental and Water Resources Engineering, Geotechnical Engineering, Structural Engineering, and Transportation Engineering. They will be converted into options.

This Assessment Plan describes the meaning of the MSCE degree, including the program educational objectives and student outcomes. It also details the process of assessing and improving the level of performance in achieving these objectives and outcomes and upholding the quality and integrity of the degree.

Meaning of the MSCE Degree

The MSCE degree provides students with advanced knowledge and understanding of civil engineering principles and practices, which they apply to solve civil engineering problems. It enables the graduate to articulate the significant challenges confronting the field utilizing a solid foundation of advanced courses. Through a careful selection of challenging projects, students propose creative approaches to solving contemporary civil engineering problems. These project experiences distinguish the MSCE graduate by providing them with the analysis and design background necessary to tackle complex civil engineering projects using state-of-the-art methods. Graduates with the MSCE degree are expected to attain certain Program Educational Objectives (PEOs) within a few years of graduation and demonstrate certain Student Outcomes (SOs) at the time of graduation. These PEOs and SOs are given below:

Program Educational Objectives

Program Educational Objectives are broad statements that describe what MSCE graduates are expected to attain within a few years of graduation. Graduates of the MSCE program will be able to:

1. Apply advanced technical knowledge to analyze and design civil engineering projects.
2. Demonstrate professional-level communication, teamwork, leadership, and lifelong learning skills.
3. Demonstrate a high level of individual, professional, and social responsibility.

Student Outcomes

Student Outcomes are the knowledge, skills, and values MSCE graduates are expected to demonstrate at the time of graduation. Graduates of the MSCE program will have:

1. An ability to design and conduct experiments, as well as to analyze, interpret, and explain data.
2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
3. An ability to identify, formulate, analyze and solve engineering problems.
4. An ability to plan, compose, and integrate the verbal, written, virtual, and graphical communication of a project to technical and non-technical audiences.
5. An ability to evaluate the design of a complex system or process, or evaluate the validity of newly created knowledge or technologies in a traditional or emerging advanced specialized technical area appropriate to civil engineering.

Table 1 shows the relationship between the PEOs and SOs.

Table 1: Relationship between Program Educational Objectives and Student Outcomes

Program Educational Objectives	Student Outcomes				
	SO1	SO2	SO3	SO4	SO5
PEO1	X	X	X		X
PEO2			X	X	X
PEO3		X			X

Mapping of Student Outcomes to Required and Elective Courses

The five SOs listed above (SO1 to SO5) and the required courses and elective courses aimed at providing students with practice and mastery of these outcomes are mapped for the Geotechnical Engineering option, as shown in Table 2.

Table 2 Course-to-Student Outcome Map: MSCE Geotechnical Engineering Option

Course No.	Course Title	Required/ Elective	SO1	SO2	SO3	SO4	SO5
CE 5020	Applied Probability Concepts in Civil Engineering	Required	P	P	P	P	P
CE 5400	Advanced Soil Mechanics I	Required	P	P			
CE 5401	Advanced Soil Mechanics II	Required	P	P			
CE 5431/5431L	Subsurface Investigation and Charact. / Lab	Required	P	P		P	
GSC 4150/L	Engineering Geology II	Required	P				P
CE 6950	Master's Project	Required	M	M	M	M	M
CE 6960	Master's Thesis	Required	M	M	M	M	M
CE 6970	Comprehensive Examination	Required	M	M	M	M	M
CE 4400	Foundation and Retaining Wall Design	Elective	P	P			P
CE 5430	Advanced Foundation Engineering	Elective	P	P			P
CE 5440	Earth Retaining Structures	Elective	P	P			P
CE 5451	Pavement Design & Construction	Elective	P	P	P	P	
CE 5460	Rock Mechanics	Elective	P	P			P
CE 5470	Slope Stability and Earth Dams	Elective	P	P			P
CE 5480	Geotechnical Earthquake Engineering	Elective	P	P			P
CE 5491	Street Maintenance, Rehabilitation and Management	Elective	P	P	P	P	

P: Practice; M: Master

Assessment Plan

The level of achievement of the PEOs and SOs will be assessed through collecting and analyzing data from courses and other means. Assessment data in the form of direct and indirect measures will be collected. Examples of direct measure data include:

A. Performance on embedded final exam problems
B. Quality of Master's Project reports and Master's Theses
C. Performance on oral presentations of Master's Projects and Theses
D. Performance on Comprehensive Exam in how students retain knowledge gained in course work and their ability to use this knowledge over a long period of time.
E. Performance on Comprehensive Exam in how students synthetize knowledge gained through the Master's program course work.
F. Quality of written term papers and course project reports
G. Performance on oral presentations of written term papers and design project reports

Examples of indirect measure data include:

H. Results of exit survey of graduating students
I. Results of survey of graduates
J. Results of survey of employers of graduates

The Civil Engineering Department Graduate Committee will analyze collected assessment data, discuss the analysis results, and develop and implement an action plan to improve the program.

A general assessment plan schedule is given in Table 3 to show the schedule of assessment data collection and action plan discussion and development for each SO. Table 3 also shows the kinds of data to be collected (identified by the letters in the list of data above). The courses from which data will be collected in each semester will be determined from the actual course offerings for the semester.

The PEOs will be assessed by collecting data (Data G. and H. listed above) once every three years or twice per ABET accreditation cycle, starting in 2018-19.

Table 3 Assessment Plan Schedule

	F 18	S 19	F 19	S 20	F 20	S 21	F 21
SO1	**C (Data A. to C.)**	**D**	**C (Data A. to C., and F.)**	**D**	**C (Data A. to C.)**	**D**	
SO2	**C (Data A. to E.)**	**D**	**C (Data A. to F.)**	**D**	**C (Data A. to E.)**	**D**	
SO3		**C (Data B. and C.)**	**D**	**C (Data B., C. and F.)**	**D**	**C (Data B. and C.)**	**D**
SO4		**C (Data B. and C.)**	**D**	**C (Data B., C. and F.)**	**D**	**C (Data B. and C.)**	**D**
SO5		**C (Data B. and C.)**	**D**	**C (Data B., C. and F.)**	**D**	**C (Data B. and C.)**	**D**

C: Collection of direct or indirect data identified by letter(s) in data list

D: Discussion of data analysis results and development of action plan to improve program

COURSE NUMBER	UNITS	COURSE TITLE	COURSE DESCRIPTION
CE 4400	3	Foundation and Retaining Wall Design	Analysis and design of spread footing foundations and cantilever retaining walls considering both geotechnical and structural aspects.
CE 5020	3	Applied Probability Concepts	Modeling uncertainty in civil engineering projects. Numerical and graphical data analysis. Common probability distributions. Hypothesis testing and confidence intervals. Regression analysis and curve fitting. Monte Carlo simulations. Reliability and reliability based design. Elements of decision theory.

CE 5400	3	Advanced Soil Mechanics I	Soil as an engineering material. Stresses in soil and elastic responses to loading. Groundwater and seepage in soil; consolidation, secondary compression, and soil improvement methods to control settlement. Use of finite element seepage analysis.
CE 5401	3	Advanced Soil Mechanics II	Shear strength of soils. Theories of lateral earth pressure. Use of numerical analysis software.
CE 5431	2	Subsurface Investigation and Characterization	Methods and techniques of investigating subsurface soil, rock, and groundwater conditions. Obtaining samples, in-situ and laboratory testing to determine engineering properties. Geophysical methods. Interpretation of field and laboratory results to develop engineering parameters for design.
CE 5431L	1	Subsurface Investigation and Characterization Laboratory	Laboratory methods for characterizing soil strength, compressibility, and hydraulic conductivity. Interpretation of results.
CE 5430	3	Advanced Foundation Engineering	Analysis and design of mat foundations. Analysis and design of deep foundations to resist both vertical and lateral loads. Soil-structure interaction.
CE 5440	3	Earth Retaining Structures	Lateral earth pressure. Analysis and design of retaining walls. Analysis and design of mechanically stabilized earth. Analysis and design of sheet pile walls both freestanding and anchored. Analysis and design of braced excavations and tiebacks
CE 5451	3	Pavement Design and Construction	Structural design of pavement structures and construction techniques. Traffic loading. Design methods for flexible and rigid pavements. Stresses and strains in pavement structures. Laboratory testing of pavement materials and mechanistic-empirical design. Highway construction and quality assurance.
CE 5460	3	Rock Mechanics	Properties of intact rock and discontinuities. Rock mass strength and deformability. In-situ rock stresses and their measurement. Groundwater flow in rock. Rock mass classification systems. Numerical methods. Analysis and design of rock slopes, tunnels, underground excavations, and rock foundations. Rock fall analysis and mitigation. Case histories in rock engineering.
CE 5470	3	Slope Stability and Earth Dams	General slope stability concepts. Soil strength and groundwater conditions. Slope stability analysis

			methods. Stability charts. Field investigation and instrumentation for landslide problems. Uncertainties in slope stability analysis and quantitative risk analysis. Slope stabilization methods. Earth dam analysis and design.
CE 5480	3	Geotechnical Earthquake Engineering	Introduction to seismology and earthquakes. Seismic hazard analysis. Wave propagation. Dynamic soil properties. Ground response analysis, local site effects, and design ground motions. Soil liquefaction. Seismic slope stability analysis. Seismic design of retaining walls. Remediation of seismic hazards.
CE 5491	3	Street Maintenance, Rehabilitation and Management	Street maintenance strategies including preservation and recycling. Pavement management principles, case studies and applications.
CE 5990	1-3	Special Topics for Graduate Students	Selected topics comprising new or experimental courses not otherwise offered. Each offering identified in the current schedule and on the student's transcript.
CE 6900	1	Research Methods	Emphasis on how to do applied research in civil engineering. It covers the entire research process including: 1) identifying research problems or issues, 2) formulating strategies for solving problems, 3) writing proposals, 4) developing plans and schedules, 5) conducting research, and 6) writing papers and reports. It also discusses strategies and methodologies effective in each phase of the research process.
CE 6950	2-3	Master's Project	Individual and independent work based on the project proposal, plan and scheduled approved by advisor. Regular meetings and discussions with advisor.
CE 6960	2-6	Master's Thesis	Individual and independent research work based on the project proposal, plan and scheduled approved by advisor. Regular meetings and discussions with advisor.
CE 6970	0	Comprehensive Examination	Comprehensive examination in partial fulfillment of Master's degree.