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-2698-167-AP

Civil Engineering, M.S. – Structural Engineering Option

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. – Structural Engineering Option as part of the semester conversion process (see attached program proposal).

Program Proposal
Master of Science in Civil Engineering (MSCE)
Structural Engineering Option

Title of the proposed option
Structural 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 structural engineering shall be MSCE Structural 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 structural analysis and design, and give students in-depth technical knowledge related to the field of Structural Engineering.

This proposal contains the Curriculum Sheets for the MSCE Structural 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 evenings. 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 a more concentrated in-depth technical experience for the students enrolled in each of the options, 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 Structural Engineering Emphasis to a Structural 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 structural 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 structural engineering. Our graduates are well sought after by both private companies and public agencies for employment. The industry trend in the area of structural engineering is that a Master's Degree is the minimum requirement for employment even at an entry level position. By converting the Structural Engineering Emphasis

to a Structural 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 Structural Engineering Emphasis into a Structural 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 structural 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. **Hany J. Farran**, Professor Emeritus; Faculty Early Retirement Program (FERP); Ph.D. (1981) in Structural Engineering with an emphasis in Computer Methods in Structural Engineering; He is a licensed Civil Engineer in the State of California and in the State of West Virginia. He has expertise in Structural Engineering, Bridge Engineering, Aerospace Structures, and in the Finite Element Method.

3. **Mikhail Gershfeld**, Professional Practice Professor (Lecturer D); full-time; M. Engineering. (1982) with an emphasis in Structural Engineering; He is a licensed Structural Engineer in the State of California. He has expertise in Structural Engineering, as well as in design of wood structures.

4. **Giuseppe Lomiento**, Assistant Professor; full-time; Ph.D. (2006) in Structural Engineering; He is a licensed Civil Engineer in Italy and EIT in California. He has expertise in Structural Engineering, as well as in Structural Health Monitoring, and seismic isolation and energy dissipation systems.

5. **Felipe J. Perez**, Associate Professor; full-time; Ph.D. (2004) in Civil Engineering with an emphasis in Structural Engineering; He is a licensed Civil Engineer in the State of California. He has expertise in Structural Engineering and in concrete post-tensioned earthquake resisting systems.

6. **Yasser Salem**, Professor and Associate Chair of the Civil Engineering Department; full-time; Ph.D. (2006) in Civil Engineering with an emphasis in Structural Engineering; He is a licensed Structural Engineer in the State of California. He has expertise in seismic rehabilitation of heavy industrial structures, and the design of heavy petrochemical refinery, power plants, and parking structures.

7. **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.

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 Structural Engineering Emphasis (faculty, classrooms, computer labs, library resources) would be adequate to run the Structural Engineering Option. Because the MSCE courses are offered in the 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 Structural Engineering Option.

CURRICULUM SHEET

Program Name : MSCE – Structural 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: 18				
Course Number	**Title**	**Units (lec/lab)**	**Revisioned/ Converted**	**GE Area Double Count (Y/N)**
CE 6500	Advanced Engineering Mathematics	3	Converted	N
CE 6510	Structural Dynamics	3	Converted	N
CE 6520	Finite Element Analysis	3	Converted	N
CE 6530	Advanced Steel Design	3	Converted	N
CE 6540	Advanced Reinforced Concrete Design	3	Converted	N
CE 6550	Seismic Design of Structures	3	Converted	N
Option Elective Courses – Units: 3-9 (Up to 3 units of approved 4000-level courses)				
Course Number	**Title**	**Units (lec/lab)**	**Revisioned/ Converted**	**GE Area Double Count (Y/N)**
CE 5500	Stability of Structures	3	Converted	N
CE 5510	Theory of Plates and Shells	3	Converted	N
CE 5520	Prestressed Concrete Design	3	Converted	N
CE 5530	Advanced Timber Design	3	Converted	N
CE 5541	Advanced Structural Analysis	3	Revisioned	N
CE 5561	Light Gage Steel Design	3	Revisioned	N
CE 5480	Geotechnical Earthquake Engineering	3	Converted	N
CE 5990	Special topics for Graduate Students	3	Converted	N

Civil Engineering Department
Structural 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 6520** Finite Element Analysis	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 6500 Advanced Engineering Mathematics	3	**CE 6530** Advanced Steel Design	3	
	CE 6510 Structural Dynamics	3			
	Total Units	**9**	**Total Units**	**6**	
			Total Units for Year	**15**	

	Fall	Units	Spring	Units	Comment
Year 2	**CE 6540** Advanced Reinforced Concrete Design	3	**CE 6550** Seismic Design of structures	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	**27/24/21**
Option Support Units	**3/6/9**
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 5480		X				
CE 5500				X		
CE 5510		X				
CE 5520		X				
CE 5530		X				
CE 5541					X	
CE 5561						
CE 6500	X			X		
CE 6510		X			X	
CE 6520	X			X		
CE 6530		X			X	
CE 6540	X			X		
CE 6550		X			X	
CE 6900	X			X		
CE 6910	X	X		X	X	
CE 6950	X	X		X	X	
CE 6960	X	X		X	X	
CE 6990						

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

December 2, 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 Structural Engineering option, as shown in Table 2.

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

Course No.	Course Title	Required/ Elective	SO1	SO2	SO3	SO 4	SO 5
CE 6500	Advanced Engineering Math	Required			P		
CE 6510	Structural Dynamics	Required		P	P	P	
CE 6520	Finite Element Analysis	Required		P	P		
CE 6530	Advanced Steel Design	Required		P	P	P	P
CE 6540	Advanced Reinforced Concrete Design	Required		P	P	P	P
CE 6550	Seismic Design of Structures	Required		P	P	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 5020	Applied Probability Concepts in Civil Engineering	Required	P	P	P	P	P

CE 5500	Stability of Structures	Elective			P		
CE 5510	Theory of Plates and Shells	Elective			P		
CE 5520	Prestressed Concrete Design	Elective		P	P	P	
CE 5530	Advanced Timber Design	Elective		P	P	P	
CE 5541	Advanced Structural Analysis	Elective		P	P	P	P
CE 5561	Light Gage Steel Design	Elective		P	P	P	P
CE 5480	Geotechnical Earthquake Engineering	Elective	P	P			P

P: Practice; M: Master

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 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 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 5500	3	Stability of Structures	Stability of beam columns; elastic and inelastic buckling of straight columns; torsional buckling of bars; lateral buckling of beams; local buckling of plate elements; stability of frames.
CE 5510	3	Theory of Plates and Shells	Analysis of plates and shells; bending of thin plates. Fourier solution of simply supported rectangular plates; plates of various shapes and boundaries; plates subject to bending and in-plane membrane type forces; plates on elastic foundations, cylindrical shells, finite difference methods; finite element methods; SAP-2000 and its application to plates and shell-type structures.
CE 5520	3	Prestressed Concrete Design	Design of prestressed concrete structures. Methods of pre-stressing. Pretensioning and post-tensioning techniques. Properties of concrete and prestressing steels. Design for flexure, shear, camber and deflections. Design considerations on anchorage/bonding of cables/wire and prestress losses.
CE 5530	3	Advanced Timber Design	Design of non-residential and multi-family timber structures using sawn lumber and engineered wood structural elements. Analysis and design of dowel and heavy timber connections, high-load diaphragms, perforated and FTAO shear walls, and shear wall tie downs. Analysis of rigid diaphragms, diaphragms with openings and re-entrant corners.
CE 5541	3	Advanced Structural Analysis	Basic concepts of geometric and material nonlinearities in structural analysis, numerical approaches for nonlinear problems, static and dynamic analysis of nonlinear structures. 3 lectures/problem-solving
CE 5561	3	Light Gage Steel Design	Design of light gage steel structures, including effects of local stability.
CE 5590A	1-3	Special Topics for Graduate Students Activity	Selected topics comprising new or experimental courses not otherwise offered. Each offering

			identified in the current schedule and on the student's transcript.
CE 6500	3	Advanced Engineering Mathematics	Matrices, eigenvalue problems, differential equations, partial differential equations, Fourier series and Fourier transforms.
CE 6510	3	Structural Dynamics	The free and forced vibration response of single and discrete-parameter multi-degree-of-freedom systems. Duhamel's integral. Response spectra. Evaluation of seismic deformations and forces in structures by linear response history analysis. Linearization of the equations of motion. Dynamic analysis of structures under ground motion. Effects of inelastic behavior. Free and forced vibration of distributed-parameter systems.
CE 6520	3	Introduction to Finite Element Analysis	Theory and application of finite element analysis, topics covered in this course are focused on the structural engineering aspects of the FEM, which are: 1D elements, bars and beams; 2D elements, plates and shells; 3D elements, isoparametric elements; static and dynamic analysis; linear and nonlinear analysis; modeling issues and considerations; and commercial software usage.
CE 6530	3	Advanced Steel Design	Structural analysis and design of steel structures under static and earthquake loads. Ductility requirement on seismic design. Behavior and design of steel elements for global and local buckling. Plastic analysis and its application. Design code provisions for special moment resisting, braced, and eccentric braced frames. Design of composite beams. Design of connections. Load and resistance factor design (LRFD).
CE 6540	3	Advanced Reinforced Concrete Design	Advanced design of building frame structures. Nonlinear analysis and design, including confinement, ductility, and moment redistribution. Design for torsion. Strut-and-tie modeling. Design of slender columns and two-way slabs.
CE 6550	3	Seismic Design of Structures	Introduction to fundamental concepts in seismic design of structures. Characterization of earthquakes for design. Time-history analysis. Response spectral analysis. Seismic performance of various structural systems. Basis for code design procedures. Force- and displacement-based design.
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.
CE 6990	0	Master's Degree Continuation	Continued work on a Master's Project or Thesis after a student has completed the number of required units of CE 6950 or CE 6960. This course permits such students to remain in residency during the graduation quarter.