PROGRAM REVIEW
ENGINEERING COURSES
(ENGR 1, 9)

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Final Report

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1 Overview

a) Description of Program

The Pre-Engineering Program at El Camino College consists of those courses required for engineering students by many, if not most, of our transfer institutions. These courses include Math 190, 191, 220 (the calculus sequence), 270, 210, Phys 1a, 1b, 1c, 1d, Ch 1a, 1b, CS 1, 2, 3, as well as Engr 1 and Engr 9. It is, of necessity, multidisciplinary. In order for our engineering students to benefit fully from their time at ECC, it is essential that the courses they need work in concert. The courses must be scheduled at times which don't conflict, else students will be forced to choose which of the conflicting courses is more essential. Courses must be offered often enough (and with enough sections) that they can fit into the crowded schedules of the engineering students. (Engineering is a high unit major. Students do not have much flexibility in their schedules.) Ideally this program review would be a multidisciplinary product in which we could work to coordinate our efforts on behalf of our students. Realistically, this has not happened. A request made to find faculty from outside the Math and Engineering Departments to participate, went nowhere. Both the Physics Program Review and the Computer Science Program Review follow the same cycle as the Pre-Engineering Program Review, making it unlikely to find volunteers from those departments. Thus, instead of addressing the entire program of courses taken by our engineering majors, this program review concentrates on the two engineering courses at El Camino College, which are taken by a small minority of our engineering students (currently approximately 100 students per year). These two courses are Introduction to Engineering (Engr 1), a 2 unit course and Engineering Mechanics - Statics (Engr 9), a 3 unit course.

Both of the courses in the Engineering Department may be used to satisfy the General Education Mathematics requirement for transfer to a university. However, the two courses are very different. Engineering 1, Introduction to Engineering, is an orientation to the preparation, training, practice, obligations, and ethics of the engineering profession, as well as an introduction to the various engineering disciplines such as: civil, mechanical, electrical, chemical, etc… Speakers from various fields describe opportunities and challenges in the engineering profession. Academic success strategies related to the study of engineering are emphasized. Engineering 1 has no prerequisites and is open to all students. In this course, students do very little computational work. Most of the exams are in the form of essay, short answer, or multiple-choice questions. There is only one section of Engineering 1 offered in each of the Fall and Spring semesters every year. Engineering 1 was designed to stimulate student interest in pursuing a career in Engineering. On the other hand, Engineering 9, Engineering Mechanics – Statics, is an advanced community college course. In Engineering 9, students explore forces on rigid bodies and analyze structures. Engineering 9 has both a Physics course prerequisite and a prerequisite of a Calculus II course. Students enrolled in Engineering 9 are already well into completing their lower division requirements for transfer to a university as engineering majors. There is only one section of Engineering 9 offered per year and it is offered in the Spring semester.

A student survey was conducted to find out more about the goals and backgrounds of those enrolled in the two Engineering courses. The survey questions are listed in Appendix I, along

with a tabulated summary of the results. Of the 38 students surveyed in the two classes during the Spring 2013 semester, 50% plan on a career in engineering, 21% are taking the class for transfer, 13% expressed an interest in engineering, 11% are taking the class for their major, and 5% for other reasons. From these statistics, it is apparent that most of these students are serious about majoring in engineering and later, pursuing an engineering career. Regarding the question about the highest educational degree that they plan to pursue, 26% have a Bachelor of Science as their goal, 45% plan on obtaining a Master of Science degree, 26% want a PhD, while only 3% will stop at an AS degree. So, nearly three quarters of the students are planning on earning advanced degrees. As to engineering disciplines (they could list more than one), 63% chose mechanical, 21% civil, 18% electrical, 11% aerospace and computer each, 8% chemical and environmental each, and 3% do not plan on a career in engineering. Since 23 of the students were enrolled in the Mechanics course and only 15 in the Introduction to Engineering class, it is not surprising that 63% plan on majoring in mechanical Engineering. As opposed to the general student population at El Camino, no engineering students were undecided about their educational or career goals. For the question about transfer university (they could choose more than one) CSU Long Beach was preferred by 34% of the students surveyed, 21% each for Cal Poly SLO and Pomona, 16% each for UC Irvine and USC, 8% each for UCLA and LMU, 5% for CSU Northridge, and 24% plan on transferring to a variety of other universities. Since the courses are quite different, in Engineering 1 a third of the students have completed pre-collegiate mathematics courses, a third had completed calculus, and the remaining third had completed courses in between those levels. Based on the high prerequisite for Engineering 9, all of the students had completed or were enrolled in Calculus III, while 74% had completed or were enrolled in the higher Differential Equations & Linear Algebra course. That course, Math 270, is the highest mathematics course offered at El Camino. From all of these statistics, it is clear that engineering students are quite serious and decided about their educational and career goals.

In addition to the courses offered by the Engineering Department, many of the engineering students benefit from the support service provided by MESA. Without the dedication and support of the MESA director and his staff, the engineering program at El Camino would be far less robust.

The El Camino College (ECC) Mathematics, Engineering and Science Achievement (MESA) Program was originally designed in 1999 to promote success and transfer in calculus-based disciplines for students from low income families who are also the first generation to seek university degrees. Following the guidelines of the California Community College Chancellor's Office, the MESA Program includes student-facilitated Academic Excellence Workshops (AEW), Group Study Sessions (GSS), tutoring, counseling, and a study center. For the past twelve years, there has been an increase in the number of students served and the extent of services offered. Currently, the MESA Center serves as a community for all students enrolled in calculus, physics, chemistry, biology, astronomy, geology, engineering and computer science courses; a place for individual study and research; for meetings with fellow students, tutors, instructors, and academic counselors; and for seeking transfer, scholarship, research, internship and other job opportunities. Essentially, the MESA Program develops students entering college and interested in science, engineering and mathematics (SEM) fields into strong and confident individuals that give back to the MESA community at El Camino College and the community at large.

When first conceived, the MESA Program was designed to support low income and first generation college students. However, other SEM students became aware of the excellent opportunities available and wanted to participate. Hence, participation in workshops and use of the MESA Center for studying and other socialization was opened to more SEM students in the MESA-targeted courses; while some students did not fully meet the MESA Criteria, all were a part of the El Camino SEM community striving to succeed in mathematics, engineering and science. This led to the creation of the Achievement in Science, Engineering and Mathematics (ASEM) Program to support more students majoring in mathematics, engineering or science.

MESA|ASEM Programs extend academic support, enrichment opportunities and financial resources to historically underrepresented, financially and/or educationally disadvantaged students, who intend to transfer to four-year universities in calculus-based majors. The goal of these programs is to increase the pool of SEM graduates to meet the needs of the technical workforce so much needed in our local community, the State of California and the United States.

b) Information on degrees/certificates offered

There are no degrees or certificates offered in the Pre-Engineering Program.

c) Program mission

The mission of the engineering program is to prepare students to transfer successfully to a university as engineering majors. This satisfies one component of the mission of El Camino College: to prepare students to transfer to a university.

d) Status of Previous Recommendations

The Pre-Engineering Program was created recently and no previous review of the program was conducted.

2 Analysis of Institutional Research Data

This section summarizes the data provided by El Camino College Institutional Research. The discussion is divided into four sections:

a) Course success and retention rates; grade distributions
b) Enrollment statistics (section and seat counts; fill rates)
c) Improvement rates (where applicable)
d) Recommendations (where applicable)

a) The success rate is the percentage of students who receive a C or better as a final course grade compared to all students who were enrolled at census date. The retention rate is the percentage of students who remain enrolled through the end of a course out of all students enrolled at census date. In essence, it is the percentage of students who *did not withdraw*.

Tables 1a and 1b, shown on the page 7 display a summary of the overall success and retention rates by course, year and program from academic years 2008-2009 to 2011-2012. On page 8, Table 1c shows the grade distribution for that same time period.

Other than a small dip in the academic year 2010-2011, the success rates for both Engineering 1 and the Pre-Engineering Program have steadily increased. Engineering 9 started with a success rate of 75% in 2008-2009 and then, after a two year decrease in success, has jumped to 83% in 2011-2012. Due to the small sample size, it is likely that these fluctuations are not statistically significant. Overall, the success rate is increasing for both courses and the program.

Though the retention rate for Engineering 1 has been decreasing, it is still currently at 70%, which exceeds the retention rate for the Mathematical Sciences Division as a whole. The retention rate for Engineering 9 has oscillated, but is consistently over 80%. This high retention rate for Engineering 9 is not unexpected, since students enrolled are very close to transferring and have completed several college level math and science courses.

In the academic years ending with 2009 and 2010, the most frequently earned grade was a B, while in 2011 and 2012, it was a C.

Pre-Engineering Program Success and Retention Rates Summary for Years 2008 to 2012

Pre-Engineering Student Success Rate

Academic Year	2008- 2009	2009- 2010	2010- 2011	2011- 2012
Engr 1	52%	59%	55%	61%
Engr 9	75%	72%	68%	83%
Engr Program	60%	63%	60%	71%

Table 1a

Pre-Engineering Student Retention Rate

Academic Year	2008- 2009	2009- 2010	2010- 2011	2011- 2012
Engr 1	72%	78%	77%	70%
Engr 9	82%	97%	81%	97%
Engr Program	76%	84%	78%	82%

Table 1b

Grade Distribution, Success, and Retention

Engineering Program

Preliminary Success Standard	59.7%
5 Year Success Average	62.5%
5 Year Success Minimum	56.8%

Grade Distribution

Year	Course	A	B	C	D	F	NP	Inc P	Inc NP	DR	W	Total	Success
2008	Engr 1	2	5		5	2				1	1	16	43.8%
	Total	**2**	**5**		**5**	**2**				**1**	**1**	**16**	**43.8%**
2009	Engr 1	4	15	9	5	6				9	6	54	51.9%
	Engr 9	6	13	2	2						5	28	75.0%
	Total	**10**	**28**	**11**	**7**	**6**				**9**	**11**	**82**	**59.8%**
2010	Engr 1	10	15	13	8	4				2	12	64	59.4%
	Engr 9	11	7	3	2	5					1	29	72.4%
	Total	**21**	**22**	**16**	**10**	**9**				**2**	**13**	**93**	**63.4%**
2011	Engr 1	10	8	15	11	2				5	9	60	55.0%
	Engr 9	10	10	8	4	1				3	5	41	68.3%
	Total	**20**	**18**	**23**	**15**	**3**				**8**	**14**	**101**	**60.4%**
2012	Engr 1	7	6	7	2	1					10	33	60.4%
	Engr 9	6	7	11	2	2					1	29	82.8%
	Total	**13**	**13**	**18**	**4**	**3**					**11**	**62**	**71.0%**

Table 1c

b) Enrollment Statistics (Section and Seat Counts; Fill Rates)

The following tables and graphs show that student participation in the Pre-Engineering Program had increased to over 100% during the 2010-2011 academic year, but has tapered off to 90% in 2011-2012. The high fill rate is not unexpected, since budget cuts have decreased the number of sections offered campus wide, pushing students into any open classes.

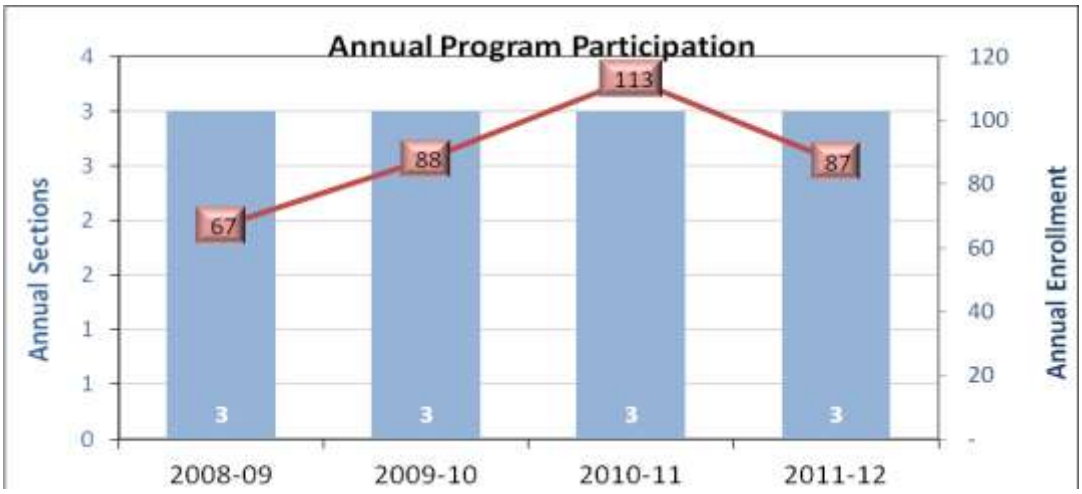
Program Participation (4-year Trend)

Engineering

Years: 2008-09 to 2011-12

Annual Enrollment

	2008-09	2009-10	2010-11	2011-12	4 Year Average
Engineering	67	88	113	87	89

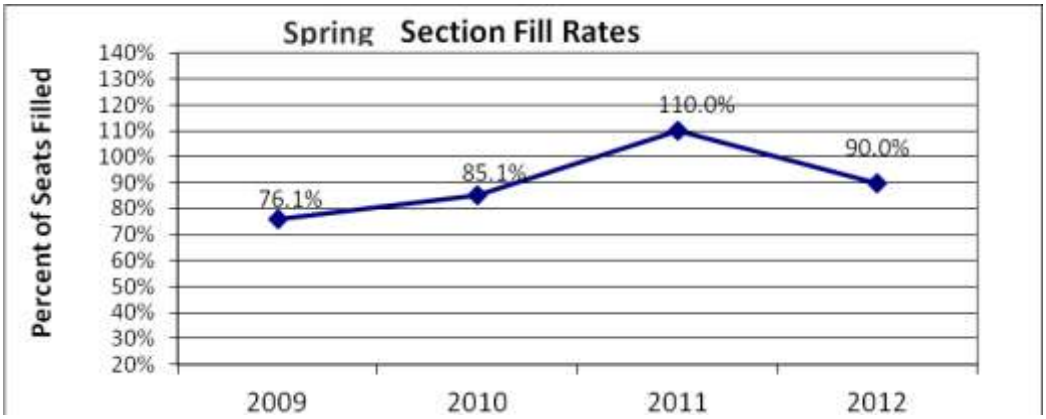


Course, Section, Seat Counts

	2008-09	2009-10	2010-11	2011-12
Sections	3	3	3	3
Seats	67	88	113	87
Students	66	88	111	86
Enrollments/Student	1.02	1.00	1.02	1.01

Course Fill Rates

Spring Term	2009	2010	2011	2012
Engineering	76.1%	85.1%	110.0%	90.0%



Enrollment by Time of Day

Spring Term	2009	2010	2011	2012
Day	54.9%	50.9%	53.2%	47.6%
Night	45.1%	49.1%	46.8%	52.4%
Weekend/Unknown	0.0%	0.0%	0.0%	0.0%

a) Improvement Rates (where applicable)

As this is the first Program Review for the Pre-Engineering Program, the improvement rate over previous reviews is not applicable.

b) Recommendations

None at this time.

3 Curriculum—Course, Content, and Articulation

a) Curriculum Course Review Timeline

There are two courses in the Pre-Engineering Program and both have been reviewed within the past five years. The Curriculum Course Review Timeline is shown below.

Six-Year Course Review Cycle Worksheet

Division: Mathematical Sciences	Department: Engineering	Faculty: Jackie Sims	Date: 5/30/2012	Semester/year of next Program Review:
Total # of Courses: 2	Courses Requiring CCC Blanket Approval: (Special Topics, CWEE, and Independent Study courses)			

Course	Last Course Review	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6	
		FA 12	SP 13	FA 13	SP 14	FA 14	SP 15	FA 15	SP 16	FA 16	SP 17	FA 17	SP 18
			P	P							P	P	
ENGR-1	2008-2009						X						
ENGR-9	2008-2009	X											

b) Specific timeline for submission of out-of-compliance courses to the College Curriculum Committee for updating and review

Neither of the courses in the Pre-Engineering Program is out of compliance for updating and review.

c) Course additions to current course offerings with explanations

The Engineering Committee is looking into the possibility of reactivating some courses, developing a new course, offering more sections of our current courses, and modifying courses to include a laboratory component. As indicated in the data in the previous section, there is a need for more Engineering courses, based on the increasing enrollment in the courses currently offered.

An analysis of data from the California Community Colleges Chancellor's Office (Appendix II) shows that the most frequently offered engineering courses in the California community colleges

are (in order of most frequently offered to less): Statics, Electric Circuits (with or without a lab component), Science of Engineering Materials, Graphics, Dynamics, and Strength of Materials (sometimes combined with Statics). The data (Appendix III) also show that over twenty California community colleges with fewer than 10,000 FTES (credit courses) offer a more comprehensive engineering program than El Camino College. If these smaller colleges can offer these courses, it is likely that if El Camino were to increase its offerings, the courses would fill. An easy place to start would be to offer Statics in both the Fall and Spring semesters.

As mentioned above, the second most commonly offered engineering content course, after Statics, is Electric Circuits. Reactivating this course would be relatively easy. The outline would need little modification. Most importantly, we already have a qualified instructor on our full time faculty. A professor with a graduate degree in electrical engineering is interested in teaching this course. It is a simple matter to fill out the appropriate paperwork to add him to the engineering faculty. In the past, this course was taught at El Camino without a laboratory component. It would better serve our students if we were able to include a lab. This would involve modifying the course outline and securing the equipment and facilities necessary for the laboratory. This is something to consider once the course (without a lab) is being offered regularly. A goal of offering this course in the Fall of 2015 does not seem unreasonable.

After a course in Electric Circuits is up and running, we can look into the possibility of adding a Materials course and possibly also a Dynamics course. Additionally a faculty member is interested in developing a course on solar energy. Although it would not satisfy any engineering transfer requirements, a few other colleges do offer such "non-standard" courses (according to data from the Chancellor's Office) and so offering such a course would not be unheard of. It is certainly worth investigating.

a) Course deletions from current course offerings with explanations

Neither of the engineering courses is being considered for deletion at this time.

b) Concerns and explanations regarding program's courses and their articulation

There are no concerns regarding articulation with either of the courses in the Pre-Engineering Program at this time.

c) Recommendations

The two most important items from this section are to reactivate the Electrical Circuits course and offer it in the Fall of 2015 and to investigate the demand for another section of Engr 9 and, if warranted, to offer Engr 9 in both the Fall and Spring semesters. The other topics discussed (adding a laboratory component to courses, developing new courses, reactivating the Engineering Materials course) should continue to be considered, but no major action needs to be taken before the next scheduled program review.

4 Student Learning Outcomes (SLOs)

a) SLOs for each course in the discipline

Both courses in the Pre-Engineering Program have a corresponding set of Student Learning Outcomes that have been approved by the committee.

The following are the Course Level SLOs for each of the two courses in the Pre-Engineering Program:

Engr 1 Student Learning Outcomes:

Upon successful completion of the course, students will:

1. Analyze the preparation, training, practice, obligations, and ethics required in the engineering profession.

2. Assess the cognitive skills and apply academic success strategies related to the study of engineering.

Engr 9 Student Learning Outcomes:

Upon successful completion of the course, students will:

1. Solve equilibrium problems in two and three dimensions using algebraic or trigonometric methods.

2. Draw diagrams and determine distributed forces, shear forces, and moments in beams.

The following are the Program Level SLOs for the Pre-Engineering Program:

Program SLO #1 (Engineering 1):

1) Students will analyze the preparation, assess the cognitive skills, and apply academic success strategies required in engineering.

Program SLO #2 (Engineering 9):

2) Students will apply principles from mathematics, physics, and chemistry to solve applied problems in engineering.

b) Alignment with Institutional Learning Outcomes (ILOs)

Since the two courses, Engr 1 and Engr 9 are so drastically different, a single Program Level SLO was created to correspond to each course. The two Course Level SLOs for Engr 1 align directly with Program Level SLO #1, while the Course Level SLOs for Engr 9 align with the broadly stated general Program Level SLO #2. Both the Program and Course SLOs align primarily with the following ILOs: I Content Knowledge and II Critical, Creative, and Analytical Thinking, though there is strong alignment with III Communication and Comprehension. This situation of Course and Program SLOs aligning with ILOs I and II is fairly common in Math and Science based programs and courses. The Engineering SLO Alignment Grid is provided on the following page.

Mathematical Sciences
Institutional (ILO), Program (PLO), and Course (SLO) Alignment

Program: Engineering	**Number of Courses: 2**	**Date Updated 1.26.13**	**Submitted by** : Jill Evensizer Ext. 5210

Institutional SLOs	I. Content Knowledge	II. Critical, Creative, and Analytical Thinking	III. Communication and Comprehension	IV. Professional and Personal Growth	V. Community and Collaboration	VI. Information and Technology Literacy
Program Rating	3	4	3	2	2	2

Program Level SLOS	**ILOs to PLOs Alignment** (Rate 1-4)					
	I	II	III	IV	V	VI
1. Students will analyze the preparation, assess the cognitive skills, and apply academic success strategies required in engineering.	4	4	3	2	2	2
2. Students will apply principles from mathematics, physics, and chemistry to solve applied problems in engineering.	4	4	3	2	2	2

Course Level SLOs	**Course to Program SLO Alignment** Mark with an X		**ILOs to Course SLOs Alignment** (Rate 1-4)					
	P1	**P2**	**I**	**II**	**III**	**IV**	**V**	**VI**
ENGR 1 Introduction to Engineering SLO #1: Analyze the preparation, training, practice, obligations, and ethics required in the engineering profession.	*X*		*3*	*4*	*3*	*3*	*2*	*3*
ENGR 1 Introduction to Engineering SLO #2: Assess the cognitive skills and apply academic success strategies related to the study of engineering.	*X*		*3*	*4*	*3*	*3*	*2*	*2*
ENGR 9 Engineering Mechanics – Statistics: SLO #1: Solve equilibrium problems in two and three dimensions using algebraic or trigonometric methods.		*X*	*3*	*4*	*2*	*2*	*2*	*2*
ENGR 9 Engineering Mechanics – Statistics: SLO #2: Draw diagrams and determine distributed forces, shear forces, and moments in beams.		*X*	*3*	*4*	*3*	*2*	*2*	*2*

c) Timeline for Course and Program Level SLO Assessments for the Engineering Program

SLO Timeline for Engineering

3 Years before Program Review for Engineering	
Spring Semester 2010	Program Level (SLO #1) Engineering 1 (SLO #4) Engineering 9 (SLO #1)
Fall Semester 2010	**** **** ****
Winter Session 2011	**** **** ****
2 Years before Program Review	
Spring Semester 2011	Program Level (SLO #2) Engineering 1 (SLO #2) Engineering 9 (SLO #1)
Fall Semester 2011	Engineering 1 (SLO #2)
Winter Session 2012	**** **** ****
1 Year before Program Review	
Spring Semester 2012	Program Level (SLO #1) Engineering 1 (SLO #1) Engineering 9 (SLO #1)
Fall Semester 2012	Engineering 1 (SLO #2)
Winter Session 2013	**** **** ****
Program Review Year	
Spring Semester 2013	Program Level (SLO #2) Engineering 1 (SLO #1) Engineering 9 (SLO #2)
Fall Semester 2013	Engineering 1 (SLO #2)

3 Years before Program Review for Engineering	
Spring Semester 2014	Program Level (SLO #1) Engineering 1 (SLO #1) Engineering 9 (SLO #1)
Fall Semester 2014	
2 Years before Program Review	
Spring Semester 2015	Program Level (SLO #2) Engineering 1 (SLO #2) Engineering 9 (SLO #2)
Fall Semester 2015	
1 Year before Program Review	
Spring Semester 2016	Program Level (SLO #1) Engineering 1 (SLO #1) Engineering 9 (SLO #1)
Fall Semester 2016	
Program Review Year	
Spring Semester 2017	Program Level (SLO #2) Engineering 1 (SLO #2) Engineering 9 (SLO #2)
Fall Semester 2017	

d) Courses with assessments

A number of complete cycles of the Course Level SLOs and Program Level SLOs (including assessment, analysis of data, and submitted report) have been conducted for both courses and the program.

e) Assessment Results

The grading rubric for all of the Course and Program Level SLOs is based on a 3 point scale (with possible scores of 0, 1, 2, 3) with 4 levels of understanding. A score of 0 corresponds to no understanding and a score of 1 corresponds to some understanding. Those two scores are associated with students being unsuccessful in acquiring that skill. A score of 2 corresponds to

most understanding, while a score of 3 corresponds to complete understanding. The scores of 2 and 3 correspond to students being successful at that SLO.

Since Engineering 1 and Engineering 9 are such vastly different courses, two separate Program Level SLOs were constructed, one for each course. Assessment data for the two Engineering courses will be discussed starting with the Spring 2010 semester.

Engr 1:

During the Spring 2010 semester, there were four SLO statements for Engr 1. That semester, SLO #4: Use basic mathematical methods to solve elementary problems in Engineering was assessed and the student success rate was only 44%. Based on discussions with the instructor for Engr 1, Bill Latto, the list of SLO statements was revised to better reflect both the skills necessary for students to succeed and the nature of the Introduction to Engineering course. The Program Level SLOs were modified and decoupled at that time, in order for them to be more appropriate for the two vastly different courses. In Spring 2011, SLO #2: Assess the cognitive skills required in the various engineering disciplines, was assessed by having students write a one page essay. The success rate was 41%. With a somewhat modified statement for SLO #2: Assess the cognitive skills and apply academic success strategies related to the study of engineering, students were assessed again in Fall 2011, with a success rate of 65%, a considerable improvement upon the success rate from Spring 2011. In Spring 2012, SLO #1: Analyze the preparation, training, practice, obligations, and ethics required in the engineering profession, was assessed. The success rate this time was 100%. In Fall 2012, SLO #2 was assessed again, this time with a 90% success rate. This was, yet again a considerable improvement from the 65% success rate in Fall 2011. In Spring 2013, SLO #1 was assessed again, with a 100% success rate, just like in Spring 2012.

Engineering 1 is a course that introduces students to the engineering profession. There is no prerequisite for this course and students are required to solve very, very few actual mathematics and engineering problems. Most of the required work consists of multiple choice exams, short answers, and some essay questions. Aside from the goal of having all 21 students enrolled in Engr 1 in Spring 2013 score 3 on this assessment, it will be very difficult to improve on a 100% success rate. However, the last time students were assessed for SLO #1 in Engr 1 was Spring 2012. At that time, 38% of the 21 students assessed earned a score of 2, while 62% earned a score of 3. Though the success rate was 100% for both semesters, the percentage of students earning a score of 3 was improved from 62% from last year to 64% this year. Since the question for the SLO was of strictly essay form, there would be little in the way of useful information regarding teaching methods to be shared with other faculty in the Mathematical Sciences Division, who are teaching more problem solving and computational courses. Also, within the Engineering Department, Bill Latto is the only instructor for this course. His methods would be of little use to Jill Evensizer in her teaching of Engineering 9, the high level statics course, which involves complicated problem solving and computation. Hopefully, the high success rate will

stimulate interest among students in pursuing further studies and a career in Engineering.

Engr 9:

Engineering 9 is offered only in the Spring semester, with just one section. During Spring 2010, there were four SLO statements for Engr 9.
That semester, SLO #1: Solve equilibrium problems in two and three dimensions using algebraic and trigonometric methods was assessed and the student success rate was 89%. Based on discussions with the instructor for Engr 9, the list of SLO statements was revised to streamline the assessment documentation process, while maintaining the integrity of assessing the students. The Program Level SLOs were modified and decoupled at that time, in order for them to be more appropriate for the two markedly different courses. In Spring 2011, the same SLO #1 was assessed with this time, a success rate of 81%. Though the success rate decreased from 89% to 81%, it was still over 80%, which is quite good for mastering a fairly difficult skill. In Spring 2012, SLO #1 was assessed, yet again with a success rate of 67%. The considerable drop off in student success can be attributed to changing the problem given from two to three dimensions. This change resulted in a much more difficult problem that was solved for the assessment. Prof. Evensizer, who taught the class, stated that part of the reason for the lower success rate was that a considerable amount of time had passed from when the topic was presented to when it was assessed on the Final Exam. In Spring 2013, SLO #2: Draw diagrams and determine distributed forces, shear forces, and moments in beams, was assessed with a 96% success rate.

Program SLOs:

Since the Program SLO that was assessed each Spring corresponds to either Engr 1 or Engr 9, the student success rates for those SLOs are identical to the corresponding Course Level SLOs for Engr 1 and Engr 9. Program SLOs are only assessed during the Spring semester.

f) Description of changes resulting from assessment of the courses

Engr 1:

Based on the 100% student success rate the last two semesters, there are no changes that are proposed to the SLO assessment instrument, rubric, or teaching methodology.

Engr 9:

For SLO #1, the only proposed change is to assess the students sooner after they have learned the skill for that SLO. Based on the 96% student success rate for SLO #2, there are no changes that are proposed to the assessment instrument, rubric, or teaching methodology for that SLO. However, if the success rate remains high in

future assessments, we will consider changing this SLO (#2) and testing a different topic.

g) Program certificate and degree SLOs and manner of assessment

The following are the Program Level SLOs for the Pre-Engineering Program:

Program SLO #1 (Engineering 1):

> Students will analyze the preparation, assess the cognitive skills, and apply academic success strategies required in engineering.

Program SLO #2 (Engineering 9):

> Students will apply principles from mathematics, physics, and chemistry to solve applied problems in engineering.

Program Level SLOs are alternately assessed only during Spring semesters. The Program Level SLO for Engineering 1 takes the form of an essay question on an exam. The Program Level SLO for Engineering 9 is assessed as a problem on a quiz, exam, or other graded material.

h) Results of the PLO assessment

Since the Program SLO that was assessed each Spring corresponds to either Engr 1 or Engr 9, the student success rates for those SLOs are identical to the corresponding Course Level SLOs for Engr 1 and Engr 9. No changes are planned in the Program Level SLO statements, assessment, or rubric at this time.

i) Program's level of SLO/assessment implementation

Since a number of cycles of all Course Level SLOs and Program Level SLOs have been completed for both courses in the program, the Pre-Engineering Program has successfully passed through the Awareness and Development levels of implementation. Based on the recent success rates of 100% for Engr 1 and 96% for Engr 9, the Pre-Engineering Program has clearly achieved the Proficiency level. The instructors on the committee are currently working on the Sustainable Continuous Quality Improvement, though success rates of either 100% and 96% will be either impossible or very difficult to improve upon.

j) Recommendations

Based on the very high student success rates for both courses, there are no recommendations for changes to the assessment instrument, rubric, or teaching methods, at this time.

5. Facilities and Equipment

a) Facilities and equipment used by the program/department

Recently, the Mathematical Sciences Division, comprised of the Mathematics, Computer Science, and Engineering Departments, moved from the old MCS (Mathematics and Computer Science) Building into the newly erected MBA (Mathematics, Business, and Allied Health) Building. There are 20 offices designated for full-time instructors and these offices are currently close to capacity. The new building contains 22 offices designated for full-time instructors, as well as 8 additional offices currently designated for part-time instructors. If needed, these offices can be converted to use by full-time instructors, however, students benefit greatly from having access to all of their instructors, full- and part-time. Given that the demand for new instructors continues due to increased enrollment, retirement, and attrition, the amount of office space will not be adequate for the long term faculty needs of the Mathematical Sciences Division. The two full-time instructors in the Engineering Department are hybrids. That is, they are qualified to teach both Engineering and Mathematics and their office is with the Mathematics Department.

b) Immediate needs

There are no immediate needs regarding facilities or equipment for the Pre-Engineering Program. The new facilities in the MBA building are designed to accommodate the needs of the Mathematical Sciences Division and consequently the programs within the department including the Pre-Engineering Program..

c) Long-range needs

Additional lecture rooms beyond those currently dedicated to the department and division will be available and will be dedicated to the entire Mathematical Sciences Division, however, since many classrooms are currently shared with other departments, there will be no net gain in available classrooms. That is, the extra dedicated classrooms will eliminate the need to share classrooms with other departments, However, there will still be a need for additional classroom space in the future, especially given the high seat fill rate and demand for courses in Engineering. Reactivating the Electrical Circuits course will not require additional facilities or equipment. If and when a laboratory component is included, lab space and equipment will need to be provided, but this is a long-term goal and is not expected to occur before the next review of this program.

d) Recommendations

The facilities and equipment for this program are shared with the entire Division of Mathematical Sciences. No new facilities or equipment are required at this time. Funding should be established to maintain all current equipment and to provide for new equipment that may be needed in the future. Developments in available equipment occur more rapidly than programs are reviewed and we must have the flexibility to obtain new equipment whose need, even existence, is currently unforeseen or unforeseeable. However, such a need is expected to be shared with the entire division and since our program is such a small part of that division, we will leave this responsibility to the larger programs.

6. Technology and Software

e) Facilities, equipment, technology, and software used by the program/department

As part of the Mathematical Sciences Division, the Pre-Engineering Program, along with many areas of the college have begun to integrate new technology into their teachings. This requires that all classrooms have computing and display technologies readily available as well as up-to-date software and maintenance to support this equipment.

f) Immediate needs

There are no immediate technology or software needs for the Pre-Engineering Program. Each classroom in the new MBA Building is designed with current computing and display technologies as well as the most up-to-date software.

g) Long-range needs

It is possible that new Engineering courses may require software capable of modeling the systems being studied. The specifics of such a consideration are beyond the scope of this current review as we have not begun to plan these courses.

h) Recommendations

As with the facilities and equipment, most of the technology and software used by the Pre-Engineering program is shared with the entire Division of Mathematical Sciences. At this time, there are no recommendations specific to the program

7. Staffing

a) Current staffing

Every Fall semester, there is only one section of Engr 1 that is offered. There are no sections of Engr 9 offered in the Fall. During every Spring semester, two sections of Engineering courses are offered; one of Engr 1 and one of Engr 9. Thus, there are a total of three sections of Engineering courses offered every year. Engineering 1 has been taught exclusively by a number of different part-time instructors, though for the past few years, it has been consistently taught by William Latto. Since its activation in 2008, Engineering 9 has been taught only by Jill Evensizer, a full-time instructor.

b) Program/department's current and long term needs

i) Program/department's current needs

The size of the engineering faculty is adequate for the current needs of the department.

The students in the program, especially those in Engr 9, would benefit greatly from free, on-campus tutoring. It is virtually impossible to find peer tutors capable of tutoring this course as students generally transfer soon after completing it. The most immediate source of tutors may be the faculty. Full-time faculty might be allowed a small amount of release time to tutor the students, though realistically, the only faculty member likely to be interested in this is the current Engr 9 instructor and we are uncertain whether an instructor can tutor his own course. Several of the part-time math faculty have backgrounds in engineering and might be interested in tutoring, perhaps in much the same way as some of the part-time faculty work in the Math Study Center. It may also be possible to hire students from local colleges to tutor, but historically, it has been difficult to find students interested in tutoring anywhere other than their own campus.

ii) Program/department's future needs

As the number of courses and sections offered by the Engineering Dept. increases, so will the need for faculty to teach them. The most immediate need, an instructor to teach the reactivated Electrical Circuits course, appears to be met. A full-time math instructor is interested in teaching this course. He does not currently have Engineering as a FSA, but appears to have all of the qualifications, so it is only a matter of filling out the appropriate paperwork.

Offering an additional section of Engr 9 and reactivating the Electric Circuits course will result in a transfer of faculty teaching assignments from Math to Engineering. This will require the hiring of either full-time or part-time math instructors. In order that this program may continue to grow, one of the next full-time math instructors hired should also have experience in engineering and the degree/coursework (and interest) necessary to teach engineering.

As the program grows, providing tutoring services to the students will be increasingly important.

c) Recommendations

When hiring math instructors, we should also list that the ability to teach engineering courses is desirable, much the same way we now do with computer science. A goal of hiring at least one hybrid instructor (math and engineering) in the next few years seems reasonable. We should investigate the possibility of including engineering tutors in the Math Study Center, possibly by hiring part-time instructors capable of tutoring engineering. The funding could come from the same source as the math tutoring. Indeed, it is possible that the tutors could tutor both math and engineering.

8. Direction and Vision

a) Internal & External Changes or Trends Impacting Program in the Next Five Years

Based on the passage of Prop. 30, there are more funds being allocated to California Community Colleges, which will hopefully result in more money for the Pre-Engineering Program. This would allow for the hiring of additional Engineering instructors to teach the newly activated Electrical Circuits and Science of Materials courses.

El Camino College is preparing to participate in a grant with Growth Sector (and some other local community colleges) with the purpose of increasing the number of (under-represented) pre-engineering students at El Camino by speeding their progress through the lower level math sequence, so that they can reach the calculus sequence and begin their preparation for engineering transfer. It is likely that enrollment in Engr 1 will be a part of their program. If this project is successful, we will have more pre-engineering students and an increased demand for all engineering courses.

b) Direction of program in five years

In five years we would like to see the course offerings grow by at least 100%, to 6 sections per year. This could include two to three sections of Engr 1, one to two sections of Engr 9, and one to two sections of Electric Circuits every year. At that time we will be able to consider adding laboratory components as well as introducing new courses and reactivating old ones. We hope to have more full-time instructors in the division who are able and willing to teach in the discipline.

c) Goals and objectives of program related to the college mission and strategic initiatives

The goals and objectives of the Pre-Engineering Program are to emulate the goals and objectives of the college as a whole. Despite the small size of the Engineering Department and the limited offerings of engineering courses, we intend to offer a quality program that will ensure the success of our students both at their transfer institution and in the workplace. We have and will continue to support student success by using a variety of teaching methodologies within our classes. Student learning outcomes will continue to be assessed and close communication by those within the program will allow for any changes necessary to continue to support student success and the vitality of our program.

Only 3% of the students in this program have an A.S. degree as their final educational goal and 26% have a Bachelor's degree as their goal. The remaining 71% plan on obtaining advanced degrees. A strong academic foundation is essential for these students, given that most of them will be majoring in Engineering. Those who enroll in Engineering 1 will obtain an overview of the Engineering profession and disciplines, while those who take Engineering 9 will be solidly grounded in the basis of Statics.

9. Prioritized Recommendations

a) Prioritized recommendations and needs of your program/department

	Recommendation	Estimated Cost
1	Reactivate and offer the Electric Circuits course	$0 to reactivate; $6000 to cover the cost of a PT math instructor to cover the class that would have been taught by the FT engineering instructor.
2	Add Engineering as a FSA for the interested and qualified instructor	$0
3	Investigate the demand for a section of Engr 9 in the Fall Semester, and offer it if warranted	$0 to investigate; $6000 to cover the cost of a PT math instructor to cover the class that would have been taught by the FT engineering instructor.
4	Hire tutors capable of tutoring the Statics and Electric Circuits courses	Uncertain of the cost. If the tutors also tutor math in the Math Study Center, then the cost would be minimal. (The Math Study Center generates FTES.) 5 hours of tutoring per week per semester would be 160 hours of tutoring per academic year. If outside tutors were hired and paid $50 - $100 per hour, that would be $8000 - $16,000.
5	Hire a math instructor who can also teach engineering	$0 (!) This assumes that a math instructor is being hired and the cost is included in the budget for that department.

b) Explanation of prioritization

- Activating the Electrical Circuits and Science of Materials courses is vital to the expansion of the Pre-Engineering Program and would assist our students in transferring.
- Similarly, offering an extra section of Engr 9 (if the demand exists) would help more students prepare for transfer.
- If the Electrical Circuits course is to be offered (our first priority), it will need an instructor, so adding Engineering to the FSA of an existing, qualified, instructor will be useful. Additionally, it doesn't cost anything other than a bit of time.
- As our program grows (through the addition of courses and sections, priorities 1 and 2), the need for tutoring will increase and it will not be possible to ignore this need.
- The existence of more than one or two engineering instructors will give us needed flexibility in the program. Currently, there is only one instructor willing to teach Engr 9. There is no one to substitute if necessary or to take over the entire course if the present instructor were to need a break from it. Additional engineering instructors will provide invaluable expertise, insight and assistance as we expand our program to fulfill the needs of our students.

APPENDIX I

Engineering Student Survey Questions Spring 2013

(For both Engineering 1 and Engineering 9 students)

1) What is the reason that you are enrolled in this course?

   Some possible answers: Interested in a career in Engineering, General Education course for transfer, exploring different fields, or just taking a course for units.

2) What is the highest educational degree that you plan to pursue?

   Some possible answers: Associate of Science (AS), Bachelor's Degree, Master's Degree, or PhD.

3) If you decide to major in Engineering, which branch interests you now?

   Some possible answers: Mechanical, Electrical, Civil, Structural, Computer, Bio-Engineering, Chemical, Environmental, or Systems.

4) To which university do you plan to transfer?

   Some possible answers: Dominguez, Long Beach, L.A., Fullerton, Northridge, San Diego State, Channel Islands, Pomona, San Luis Obispo, UCLA, UC San Diego, Santa Barbara, Irvine, Berkeley, Merced, USC, LMU, Stanford, Caltech, or some out of state university.

5) Which Math courses have you taken at ECC and which Math courses do you intend to take before you transfer?

Pre-Engineering Program Review Student Survey Results
Spring 2013

Table 3

University	CSULB	Cal Poly SLO	Cal Poly Pomona	UCI	USC	UCLA	LMU	CSUN	Other
# of Students Percent of (38) Total	13 34%	8 21%	21 8%	6 16%	6 16%	3 8%	3 8%	2 5%	9 24%

DEGREE	AS	BS	MS	PhD
# of Students Percent of (38) Total	1 3%	10 26%	17 45%	10 26%

Engineering Discipline	Mechanical	Civil	Electrical	Aerospace	Computer	Chemical	Environmental
# of Students Percent of Total	24 63%	8 21%	7 18%	4 11%	4 11%	3 8%	3 8%

Engineering Discipline	Industrial	Other
# of Students Percent of Total	2 5%	1 3%

APPENDIX II

The Most Popular Engineering Courses

(data from California Community Colleges Chancellor's Office website)

2012-2013 school year (Fall and Spring only)

	FALL 2012		SPRING 2013		
Course	**#colleges**	**#sections**	**#colleges**	**#sections**	**Total**
Statics	47	54	29	33	**87**
Circuits	12	13	44	50	**63**
Materials	24	29	22	24	**53**
Graphics	17	19	20	21	**40**
Dynamics	4	5	13	14	**19**
Strength	4	6	7	8	**14**

Courses referred to are: Statics, Electrical Circuits (with or without a lab), Materials (Engineering Materials, Materials Science, etc.), Graphics, Dynamics, and Strength of Materials (sometimes combined with Statics).

APPENDIX III

This is a list (not necessarily complete) of 20 schools with fewer than 10,000 FTES (credit) that offer more engineering courses than ECC (approx. 17,500 FTES). (We only looked at the 6 courses listed in Appendix II even though most of these schools also offer sections of Intro. to Engineering as well as some other courses.) The data are from the California Community Colleges Chancellor's website. This is for the 2012-2013 school year.

School	FTES	Statics	Circuits	Mater.	Graphics	Dynamics.	Strength
A. Hancock	8707	1	1	1		1	1
Chabot Hayward	9086	1	1	1			
Contra Costa	5725	1	1	1			
Desert	7080	1	1				
Consumnes	9774	2	2	1	1		
Marin	4540	1		1			
Merced	8628	1	1	1			
Monterey	6241	2	2		1		
Napa	4815	1	1	1	2		
Ohlone	8840	1	2	1	2		
SD City	9810	2	1			1	
Evergreen	6543	1	2	1			
Cuesta	8088	5		2		2	4
San Mateo	8196	1	1	1	1		
Canada	4544	2	2	2	1	2	
Sequoias	8233	1	1		1		
Shasta	7093	1	1	1			
Siskiyous	2339	1	1				
Solano	7194	1		1			
West Hills Lemoore	2963	1	1	1			
Yuba	4504	1	1	1	1		

Courses referred to are: Statics, Electrical Circuits (with or without a lab), Materials (Engineering Materials, Materials Science, etc.), Graphics, Dynamics, and Strength of Materials (sometimes combined with Statics).
The numbers in the course columns indicate the number of sections of that course which the college offered in the 2012-2013 school year (Fall and Spring semesters only).