CALIFORNIA STATE UNIVERSITY, EAST BAY

DESIGNATION CODE: **2010-11 CAPR 15**
DATE SUBMITTED: April 27, 2011

TO: The Academic Senate

FROM: The Committee on Academic Planning and Review (CAPR)

SUBJECT: Five-Year Program Review for Engineering

PURPOSE: For Action by the Academic Senate

**ACTIONS
REQUESTED:**   That the Academic Senate approve the following actions, with reference to the programs delivered by the Department of Engineering of the California State University East Bay:

1. Acceptance of the Bachelor of Science in Engineering Option in Industrial Engineering and the Master of Science in Engineering Management Five Year Reviews.
2. Approval of the Master of Science in Engineering Management for continuation without modification until the next five-year review.
3. Bifurcation of the Bachelor of Science in Engineering five-year review process into two parts; one applying to the option in Industrial Engineering (reviewed in the 2009-10 accreditation) which will continue from 2011-12 as a stand-alone Bachelor of Science in Industrial Engineering, and the other applying to the option in Computer Engineering (not-reviewed in the 2009-10 accreditation) which will continue from 2011-12 as a stand-alone Bachelor of Science in Computer Engineering.
4. Placement of the new, accredited Bachelor of Science in Industrial Engineering on the Academic Senate calendar for review in 2016-2017 (aligned with the timetable of the accreditation body for the Bachelor of Science in Industrial Engineering – the next site visit will be in 2015-16)
5. Placement of the new, non-accredited Bachelor of Science in Computer Engineering on the Academic Senate calendar for review in 2013-14, which is five years after the first students enrolled in this field of study as an option in the Department of Engineering (2008-09).

BACKGROUND

At its meeting on February 3, 2011, CAPR invited members of the Department of Engineering in the College of Science to orally present the outcome of its five-year review process which involved preparation of documents for and participation in site-inspections by representatives of the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) in 2009-10. The previous five-year review of the Bachelor of Science Program, which is documented in 04-05 CAPR 7, reflects a successful accreditation by ABET and the Bachelor of Science in Engineering degree program was approved for continuation without modification until this current review year. At that time, the Master of Science program had not yet begun and the Engineering degree program only had one option in Industrial Engineering. The graduate degree program started in 2005 with 10 students and has since grown to an enrollment of around 90 students in total.

Before discussing the review materials provided for these programs, it is necessary to point out that this review process turned out to present a number of procedural complications due to the fact that only one part of one of the programs scheduled for review was accredited. As a result, a number of lessons were

learned with respect to program review which will be discussed in this document with conclusions and recommendations offered for future Engineering program reviews.

THE PROGRAM REVIEW CONTEXT

Although as of 2010-11 the Department of Engineering had two degree programs, only the Bachelor of Science in Engineering Option in Industrial Engineering was externally accredited. The Option in Computer Engineering was not, nor was the Master of Science in Engineering Management. Thus, when the 2010-11 five-year review schedule was reviewed by CAPR in Fall 2010, it was discovered that this was a situation not explicitly addressed in 08-09 CAPR 23 (revised), the revised policy and procedures document on five-year reviews. At the beginning of the 2010-11 academic year, a number of emails were exchanged between the CAPR Chair, who was also the designated program liaison, and the Chair of the Department of Engineering concerning how to handle the review of the two Engineering degree programs. It became clear to the CAPR Chair that this situation had not been envisioned in the redrafting of the five-year review policies and procedures.

In considering this issue, there are three relevant points to consider. First, is that CAPR does not review departments but programs. Second, CAPR recognizes that, given the workload involved in preparing for external accreditation and the exhaustive self-study and strategic planning process that most accrediting bodies require (in this case 274 pages of materials for ABET), that the requirements of the internal CSUEB review be reduced to a much less intensive reporting requirement so that departments do not have to duplicate the process and generate two voluminous sets of documents that have the same basic content, but different formats as required by the accreditation and by CAPR respectively. Thirdly, the situation in which a department with an accredited program, and thus the requirement to produce an externally mandated self study of the department and its accredited program, also has a related but unaccredited program or programs, was not envisioned or explicitly considered in the policies and procedures.

When executing their program review, the Department of Engineering Program made two assumptions and one omission. The first assumption was that the department would be able to submit a single report covering both programs. The second was that the accreditation review of the Industrial Engineering portion of the Bachelor of Science program would mean that a separate outside review of the Master of Science program would not be required since the Bachelor of Science program overlaps the Bachelor of Science in Industrial Engineering almost completely, the only thing different being the student body and three graduate level core courses – everything else; the faculty, facilities, assessment program, and so forth are shared. The omission was to not include any specific self-study or planning information for the Computer Engineering option portion of the Bachelor of Science program since this option, soon to become its own degree program, was not the purview of the accreditation body, ABET, which excluded it from its considerations.

With respect to the first assumption, at the beginning of the review process, with the agreement of CAPR members, the CAPR Chair contacted departments with more than one program with the suggestion that, in this period of tight budgets and resources, they could streamline the process and submit a single self-study and five-year plan document where they have multiple programs being reviewed in the same year (e.g. undergraduate and graduate versions of the same major or different undergraduate majors) and would have one external reviewer, as long as the portions relating to each program, and not to the common elements, were clearly demarcated so that the committee could make recommendations on them effectively. However, this was done without specifically considering the special case where a department would have both accredited and unaccredited programs.

In dealing with the situation created by the complex structure of the Department of Engineering programs; partially accredited and partially not, the CAPR Chair entered into a series of emails in the Fall

quarter with the Department of Engineering Chair with respect to this issue once it was determined that the Master of Science program had not been explicitly externally reviewed, only indirectly and partially through the Bachelor of Science Industrial Engineering option accreditation review. It was determined that the clear preference of the Engineering Chair was to be permitted to be relieved of the requirement to produce a full-blown self-study for the unaccredited Master of Science program, rather to be allowed to satisfy the internal review requirement by producing a report like that detailed in Section B of 08-09 CAPR 23, adding specific detail for the program not covered in the general portions of the accreditation materials. Chair Motavalli informed the CAPR Chair that, among other considerations, "the courses in the two programs are mostly common and the same professors teach them," and that "the self study that I have sent to the senate office has all the assessment activities that we are performing in our courses. Several of those courses count toward our master program and the same procedures are used. Of course we are providing enrollment and other data related to both programs, but to repeat the same self study for the graduate program would not add value". He later communicated that "the two programs are extensions of each other and the self study provided has enough information in terms of assessment, faculty and student advising to be sufficient for both programs". In light of the lack of clear guidelines in 08-09 CAPR 23 in terms of what to do in such a situation, this was deemed a reasonable request by the CAPR Chair, by CAPR members, and by the Academic Senate Chair (Dianne Rush-Woods, personal communication in meeting with CAPR Chair) and so the Department of Engineering was given permission to submit an abridged document for the M.S. degree program with the assumption that it would contain all the necessary program-specific items not included in the accreditation documentation. Having given this green light to the Department Chair, it thus became the responsibility of the CAPR program liaison to evaluate the information and make the necessary cross-referencing needed to perform the necessary oversight and due diligence to make a recommendation. In hindsight, this has proven to be a complex process and thus such situations need to be foreseen and addressed by CAPR in its policies and procedures on five-year reviews.

SUMMARY OF THE PROGRAM REVIEW

The Department of Engineering will, as of the coming academic year 2011-12, support five degree programs and two certificate programs. Its Bachelor of Science degrees will be in Industrial Engineering, Computer Engineering, and Construction Management and its Master of Science degrees will be in Engineering Management and Construction Management. The certificate programs will be in Construction Project Administration and Construction Planning and Control. Note that the Construction Management programs are reviewed on a separate five-year cycle. Six tenure-track faculty teach in the Engineering programs: Helen Zong, David Bowen, Saeid Motavalli, Farnaz Ganjeizadeh, Farzad Shabodaghlou and Roger Doering (who has a joint appointment with the Department of Computer Science).

As reported in the five-year review documentation provided by Chair Motavalli, the Department has a very active program of learning outcomes assessment, a system that it applies to both its undergraduate and graduate degrees. The following outcome and tool matrix was provided to CAPR to illustrate the nature of the assessment process:

Mapping of Program Outcomes and Assessment Tools

Assessment Tool	Program Outcome										
	1. Math/Sc/Engr Knowledge	2. Design/Experiment	3. System Design	4. Teaming	5. Problem Solving	6.	7. Communication	8. Global/Societal Context	9. Life-Long Learning	10. Contemporary Issues	11. Engineering Practice
Prerequisite Exams	√										
Course Portfolios	√	√	√	√	√	√	√	√		√	√
Faculty Self Assessment of Courses	√	√	√	√	√	√	√	√	√	√	√
Senior Exit Survey	√	√			√	√	√				
Senior Project Evaluation by Faculty, Industry Sponsors, and IAB		√	√	√	√	√	√	√	√	√	
Co-op Evaluation by Employer and advisor	√		√	√	√	√	√		√		
Mock external Program Evaluation	√	√	√	√	√	√	√	√	√	√	√

Review of the Bachelor of Science In Engineering Option in Industrial Engineering

The undergraduate engineering program at the California State University East Bay started in 1998 as a program housed in Academic Affairs. The Department of Engineering was set up in the Fall of 2001 with around 60 students enrolled as majors. The program now has around 180 majors.

Since the last ABET visit in 2003 and the 2005 program accreditation, the department has developed a systematic process of assessment-evaluation-improvement-assessment as suggested during that review and as summarized above (it is applied to all the *Department's* programs). This process has resulted in several improvements to the curriculum and other program attributes. The reengineering of the curriculum appears to have increased the level of achievement of program outcomes and has also resulted in better alignment of the curriculum with the shifting career opportunities in industrial engineering.

The ABET external accreditation process resulted in successful reaccreditation of the California State University East Bay Engineering (Industrial Engineering Option) Bachelor of Science through September 30, 2016. During this review, which took place from October 4-6, 2010, the Engineering Accreditation Commission Team reviewed not only the engineering program, but also the mathematics, physics, statistics, and chemistry programs as well as the library, enrollment management and information

technology services on campus. The reviewers noted that the university and College of Science provide a sound framework for the Engineering program and noted the excellent computing facilities even given the budget constraints. With respect to the program itself, the principal strength was seen to be the outstanding faculty and the level of enthusiasm and appreciation of the students for the program was noted. A concern offered by the reviewers was the lack of clarity over how the required number of units of college level math and science (one year) and engineering topics (one and a half years) courses were being accounted for in student transcripts. The Department has addressed this as part of its course modifications in creating the new stand-alone Industrial Engineering Bachelor of Science program.

The external accreditation review of the Industrial Engineering was very favorable. The main concerns of the ABET team at the time of the site visit in 2009-10 was the impact of the mandated faculty furloughs on the instruction, an issue that is no longer current, and concern over the lack of technical support in running the program. The program has very little technical support to maintain its various computer labs and its software systems and this was noted by the ABET team.

The goal of the Department with respect to the new, stand-alone degree program in Industrial Engineering in 2011-12, is to hire an additional faculty member in Industrial Engineering who will teach both undergraduate and graduate courses along with one faculty each to support the other Department undergraduate programs in Computer Engineering (which will start as a stand-alone degree in 2011-12) and Construction Management (which began in Fall 2010 at both graduate and undergraduate levels).

Review of the Master of Science in Engineering Management

This degree is essentially a graduate degree in Industrial Engineering and is an extension of the Bachelor of Science degree. It is given different names across the industry and could also be termed Systems Engineering, Operations Research or Industrial and Systems Engineering. Its purpose is to train working professionals in this field for leadership roles and majors have risen from 10 in 2005 to around 90 by 2010, with increased applications meaning that more qualified students are being accepted, on average, into the program. Students take most of their units in required courses with 12-16 units as electives in either engineering, management, computer science, or statistics as appropriate for their career goals.

A separate outside review was not conducted for the MS in Engineering Management Program. The Department and the College of Science considered that since this program includes courses that are tiered with the undergraduate program in Industrial Engineering and also includes graduate-level electives taken within the College of Business and Economics, these shared program elements have already undergone extensive external review. The Industrial Engineering option and the College of Business programs are both externally accredited. Moreover, the assessment processes in both the undergraduate and graduate programs are the same and the same faculty teach the courses in undergraduate and graduate programs. Thus, if the undergraduate program is accredited, the Department considered that by extension, the graduate program can be extended the same qualities and merits. It is noted in the review document submitted, that only three exclusively graduate level engineering courses are offered, and these are taught by the same Engineering faculty that teach the undergraduate classes. Requiring there to be a separate outside review to report on three courses was deemed to be unnecessary by the Department. Note that since this review took place in 2009-10 before CAPR had assigned a liaison for this review, this had not pre-agreed with CAPR, although it is likely that CAPR would not have raised objections had it been asked on this subject.

The Master of Science degree requires 48 units of credit, including a 4 unit capstone course, 12 units of prerequisites, and 12-16 units of electives. Students are admitted as conditionally classified and progress to classified by meeting the 12 units of prerequisites at 3.0 or higher and passing the University WST. They pass to candidacy by meeting the required courses at a 3.0 or better GPA.

The goal with respect to this program is to hire one additional faculty member between now and the next five-year review – this faculty member will also teach undergraduate classes in Industrial Engineering. In order to provide more choice to students, the program will seek to develop and offer more graduate-level electives in the coming five years and to offer some of the core courses twice a year as enrollment grows.

Overall program requirements covering all Department of Engineering programs.

In reporting on the Industrial Engineering Option and the Engineering Management program, the Department of Engineering pointed out the need for upgrades to the computer labs to be able to effectively run the engineering software required for use in courses. The computers in all the Engineering Laboratories need replacement in the next five years and continued financial support will be required to satisfy yearly contractual obligations regarding software contracts. A request has been made for funds to add a Construction Management Laboratory and adding additional computing equipment to other Laboratories.

CONCLUSION

As a result of this review of Engineering programs, it is clear that CAPR and the Academic Senate, for the purposes of effective program review, be watchful in their future approval of options within degrees to avoid situations in which sufficiently dissimilar options are developed that they then could become subject to only partial external accreditation as occurred with the Bachelor of Science in Engineering program. Thankfully, this situation has now been rectified with the decision made this year to discontinue this degree and create two new degrees from the discordant options, but it should, in hindsight, never have occurred. The University should ideally not have situations developing in which only part of a degree program is accredited, and part of it is not.

Another conclusion that has arisen from this review, but which does not relate only to Engineering, is that CAPR needs to explicitly consider, by revising 08-09 CAPR 23 (revised) or its amended versions, what to do for departments like it that have more than one program, one or more of which is accredited and one or more of which is not accredited. Should CAPR require separate self-study and five-year plan documentation for each program governed by the different requirements of the two entities, external and CAPR, and what should it require by way of external review? Would it have been appropriate to go through the expense of having an external reviewer come to campus to review just the Master of Science program after having just had ABET make an extensive site visit for the Bachelor of Science?

This conclusion is relevant to the following observation concerning this five-year review. As things stand with respect to the Department of Engineering, only two of its three program elements have undergone direct review during this review cycle. No direct information was provided to CAPR on the portion of the Engineering Bachelor of Science degree that is the Option in Computer Engineering because it was not required by or of interest to ABET. While it can be assumed that all of the beneficial and well-functioning elements noted by ABET in the successful accreditation of the Industrial Engineering Option are applicable to the Computer Engineering option, this was not explicitly addressed in the external accreditation review nor in any of the documentation provided to CAPR by the Department of Engineering. The CAPR Chair/liaison did not know that this option was not part of the accreditation, and the Department of Engineering did not think to provide a separate assessment of an option it was in the process of discontinuing. The Computer Engineering Option, jointly delivered by Department of Engineering and Department of Computer Science faculty, has thus fallen through the cracks. That said, it will no longer exist after this year, becoming a new stand-alone degree offered through the Department of Engineering but still, it is presumed, offered by a mix of the two department's staff. As a stand-alone degree program, it will be subject to its own five-year review requirement. In discussion with the Department of Engineering Chair, it was suggested that the best way to remedy this situation and correct

the fact that Computer Engineering as a field of study did not get explicitly reviewed, is to bifurcate its review process from Industrial Engineering completely and put it on its own review cycle. Since it is not accredited, it need not occur in the same year as Industrial Engineering. In reviewing the past catalogs and in talking to the Engineering Chair, it became clear that this program of study was place in the catalog in 2007-08 but enrolled its first students in 2008-09. Thus, 2013-14 would be the end of its first five years of instruction and thus it seems appropriate to put it on the review calendar then, even though the degree program proper will only be in its third year. With the Computer Engineering option becoming its own degree program, a review in 2013-14 would provide a useful benchmark and deliver a strategic plan to grow the program over the next five years. It is expected that a computer engineering program expert would be invited to perform an external review of the program as required of programs without external accreditation. This suggestion was agreed to as being appropriate and acceptable by the program representatives at CAPR's April 21, 2011 meeting.

In the coming five years, CAPR notes that the strategic goals of the engineering program can be summarized as follows:

- Continued enrollment growth in all programs, especially the new undergraduate Bachelor of Science degrees in Industrial Engineering and Computer Engineering
- Strengthening of its faculty to include new tenure-track positions in Industrial Engineering and Computer Engineering (as well as seeking an additional position to support the program in Construction Management)
- Enhancement of technical support to maintain its various computer labs and its software systems
- Development of additional graduate-level electives in Industrial Engineering and increased frequency of offerings of core courses to keep pace with growing enrollment and to maintain appropriate class sizes
- Securing of the necessary resources to replace/upgrade the computers in all the Engineering Laboratories and secure annual software license renewals
- Add to Engineering department computing capacity by the addition of new computers to existing lab space and by adding a dedicated laboratory to support the Construction Management program.

CAPR will look for evidence of successful securing of these needed resources for effective program implementation and instructional quality in future annual reports.

CAPR RECOMMENDATION FOR CONTINUATION OF THE PROGRAM

CAPR recommends:

1. Acceptance of the Bachelor of Science in Engineering Option in Industrial Engineering and the Master of Science in Engineering Management Five Year Reviews.
2. Approval of the Master of Science in Engineering Management for continuation without modification until the next five-year review is complete.
3. Bifurcation of the Bachelor of Science in Engineering five-year review process into two parts; one applying to the option in Industrial Engineering (reviewed in the 2009-10 accreditation) which will continue from 2011-12 as a stand-alone Bachelor of Science in Industrial Engineering, and the other applying to the option in Computer Engineering (not-reviewed in the 2009-10 accreditation) which will continue from 2011-12 as a stand-alone Bachelor of Science in Computer Engineering.
4. Placement of the new, accredited Bachelor of Science in Industrial Engineering on the Academic Senate calendar for review in 2016-17 (aligned with the timetable of the accreditation body for the Bachelor of Science in Industrial Engineering – the next site visit will be in 2015-16)
5. Placement of the new, non-accredited Bachelor of Science in Computer Engineering on the Academic

Senate calendar for review in 2013-14, which is five years after the first students enrolled in this field of study as an option in the Department of Engineering (2008-09).

This recommendation was approved unanimously by CAPR members at its April 21, 2011 meeting.