UNIVERSITY of CALIFORNIA Riverside

BOURNS COLLEGE OF Engineering

Self-Study Report

Electrical Engineering

Submitted by:
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A. Background Information

A.1 Degree Titles

The Bourns College of Engineering consists of four departments (Chemical and Environmental Engineering, Computer Science and Engineering, Electrical Engineering, Mechanical Engineering) and four research centers. Table 1 shows degree titles offered. A fifth department, Bioengineering, will become independent of Chemical and Environmental Engineering in the fall of 2006.

Table 1. Degree titles offered.

Degree	Title	Established/Effective Dates
BS	Bioengineering	Fall 2005
BS	Chemical Engineering: Concentration in Biochemical Engineering	Established fall 1986, effective as of fall 2002
BS	Chemical Engineering: Concentration in Biochemistry	Established fall 1986, effective through 2001-02 academic year
BS	Chemical Engineering: Concentration in Bioengineering	Effective beginning fall 2003
BS	Chemical Engineering: Concentration in Chemical Engineering	Effective beginning fall 2002
BS	Chemical Engineering: Concentration in Chemistry	Established 1986, effective through the 2001-02 academic year
BS	Computer Engineering	Established fall 1999
BS	Computer Science	Established fall 1992
BS	Electrical Engineering	Established fall 1989
BS	Environmental Engineering: Concentration in Water Pollution Control	Established fall 1986
BS	Information Systems	Established fall 2001
BS	Mechanical Engineering	Established fall 1990
MS	Chemical & Environmental Engineering	Established fall 1998
MS	Computer Science	Established fall 1999
MS	Electrical Engineering	Established fall 1997
MS	Mechanical Engineering	Established fall 2001
Ph.D.	Chemical & Environmental Engineering	Established fall 2003
Ph.D.	Computer Science	Established fall 1991
Ph.D.	Electrical Engineering	Established fall 1997
Ph.D.	Mechanical Engineering	Established fall 2001

A.2 Program Modes

The undergraduate programs in the Marlan and Rosemary Bourns College of Engineering are offered only in the traditional day-time mode.

A.3 Actions to Correct Previous Shortcomings

The Electrical Engineering program had one unresolved concern after the previous ABET visit in 2000. This concern related to the curriculum in EE 175 Engineering Design Project.

While the major projects developed in EE 175 A/B are significant and require knowledge and synthesis, they lack the consideration of many of the constraints listed in Criterion I.C.3.d.(3)(C). Furthermore, student material on display indicated that several requirements of the course syllabus are not being met by all students.

We have substantially revised and improved EE 175, as detailed in the section on Professional Development, to fully address the above concerns. In particular, engineering constraints in design, including issues such as reliability, economics, ethics, intellectual property, and environment, are now specifically taught in the EE 175 lectures. Moreover, students are given guidelines to consider engineering constraints during the design phase, and are graded on it during the mid-course design review. Lastly, all student designs, presentations, and reports from EE 175 are now collected and made into a multi-media CD that is used by the department and students as promotional material. Indeed, EE 175 is now considered a hallmark course in the Electrical Engineering program, exemplifying the department's continuous effort to integrate all the engineering learning outcomes into the curriculum.

A.4 Contact Information

Table 2. Electrical Engineering contact information for ABET.

Department	Chair	Address	Telephone	E-mail
Electrical Engineering	Prof. Roger K. Lake	343 Engineering Building II University of California Riverside, CA 92521	(951) 827-2122	rlake@ee.ucr.edu

B. Accreditation Summary

This section describes, in turn, our methods for advising students (B.1), our program educational objectives (B.2), our program outcomes and assessments (B.3), the program's professional component (B.4), faculty (B.5), facilities (B.6), institutional support and financial resources (B.7), and program criteria (B.8).

B.1 Students

Criterion 1 calls for the institution to evaluate student performance, advise students regarding curricular and career matters, and monitor student progress to foster success in achieving program outcomes, thereby enabling them as graduates to attain program objectives. This subsection describes the Bourns College of Engineering's steps to fulfill Criterion 1. We first provide an overview of the student population that UCR and the Bourns College of Engineering serve, and our philosophy and approach for serving them. Next, we address student advising and then describe procedures for monitoring and verifying student credits earned toward graduation. Finally, we describe the College's Professional Development Milestones program, which helps students prepare for internship and career opportunities while they are undergraduates.

B.1.1 Student Population Characteristics and Implications

The University of California, Riverside, maintains an inclusive admissions policy and emphasizes opportunity over exclusivity. Consequently, our freshman cohort typically comprises students from a very broad range of academic, cultural, and socioeconomic backgrounds. A significant fraction (~55%) of our entering freshmen are the first in their families to go to college. There is also considerable variance within each freshman cohort in the degree of academic preparation and SAT scores.

This variance in backgrounds and preparation tends to reduce success rates both within our three colleges and from the campus as a whole. Table 3 summarizes the 6-year graduation rates for the three colleges within UCR that enroll undergraduates.

Table 3. Graduation rates form UCR colleges after 6 years.

College entered	College graduated from			Graduated from UCR
	BCOE	CNAS	CHASS	
Bourns Coll. of Engineering (BCOE)	**38.0%**	2.2%	22.8%	63.0%
Natural & Agricultural Sciences (CNAS)	3.1%	**30.5%**	28.8%	62.4%
Humanities & Social Sciences (CHASS)	0.9%	2.0%	**63.4%**	66.2%

Our graduation rates are significantly lower than we would like. We have found that the bulk of the attrition among BCOE undergraduates who enter as freshmen occurs in the first year or two, an observation consistent with the experience of other engineering programs across the nation. In our case, poor academic preparation in high school is the most important factor influencing academic success. While the campus does support numerous programs and courses designed to address this issue, UCR's charter does not include remedial education, so it is not likely that our college or our campus can significantly influence learning outcomes in high schools.

Therefore, we have decided to focus on improving retention by identifying and addressing other issues upon which we are likely to have control. Based on the exit surveys we give to graduating seniors (see Section B.3), we have determined that lack of engagement with the College in the early years and inadequate mentoring are two such issues. In response, we have initiated programs to increase students' engagement with the engineering curriculum and the engineering faculty, as discussed below.

As is typical for undergraduate programs in engineering, our students spend the first two years of their undergraduate work completing prerequisite coursework in mathematics, the sciences, and the humanities and social sciences. Unfortunately, instructors in these areas are unfamiliar with any of the engineering disciplines, and unable to motivate or mentor our students in their early years here. Consequently, our students fail to develop a clear sense of academic direction or a sense of professional pride, having no role models or mentors, either at home or on campus.

Figure 1 shows the patterns of persistence in the College of Engineering since inception. We lose between 40% and 50% of our students in the first two years alone. Most relevant to our plans are the trends in the last five years, which shows a clear and worrisome worsening of our persistence figures.

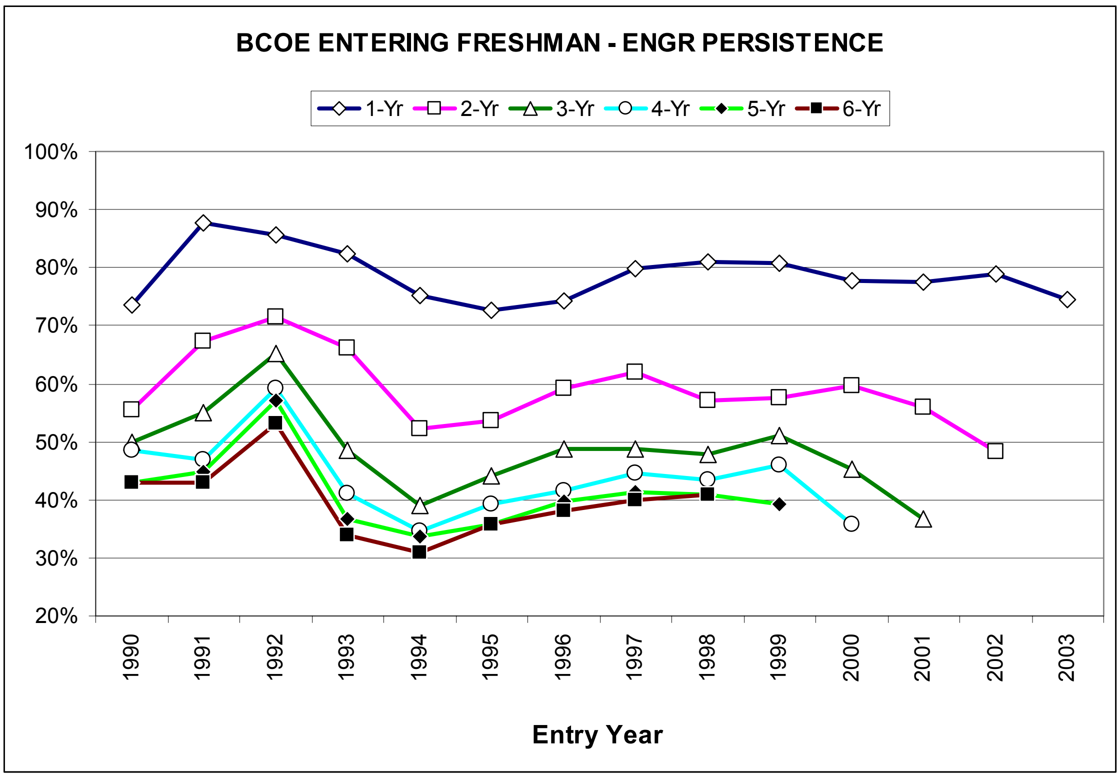


Figure 1. Persistence of entering freshmen in the Bourns College of Engineering.

Another consequence of this lack of engagement in the early years with BCOE is that our students do not appear to be building effective working relationships with their peers. They do not seem to see their peers as technically strong, or as effective partners. We see these attitudes clearly in the following summaries of responses to questions on the senior exit survey.

Questions Q028-Q030 on the senior exit survey asks students their level of satisfaction with their fellow students in terms of academic quality, ability to work in teams, and level of camaraderie. Question Q031 asks them how satisfied they were with the level of help in finding a permanent position. The satisfaction levels were to be rated numerically, with scores as follows: Very dissatisfied: 1, moderately dissatisfied:2, slightly dissatisfied: 3, neutral: 4, slightly satisfied: 5, moderately satisfied: 6, very satisfied: 7.

Figures 2 to 5 show the responses to question Q028-Q030. In each case, the responses correspond to a rating of "slightly satisfied." This is a surprisingly lukewarm rating, since they tend to be generally evenly matched in terms of abilities, as measured by metrics such as GPAs.

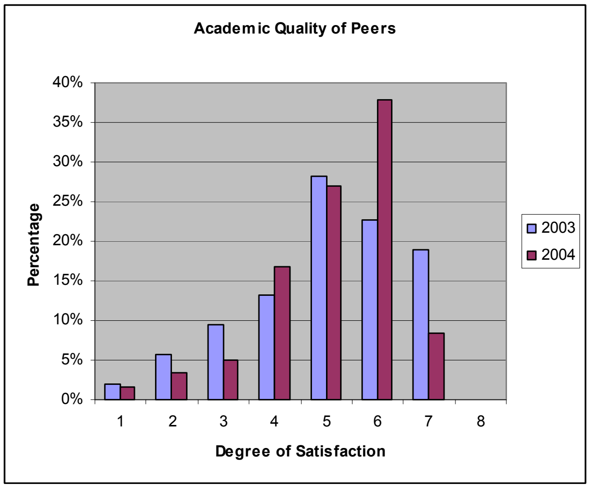


Figure 2. Student assessment of academic quality of peers.

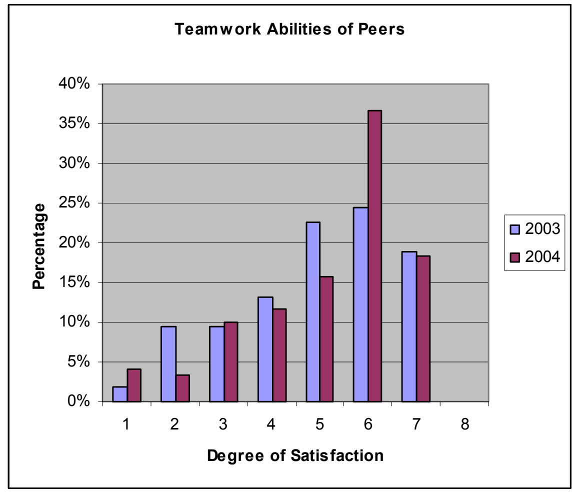


Figure 3. Student assessment of teamwork abilities of peers.

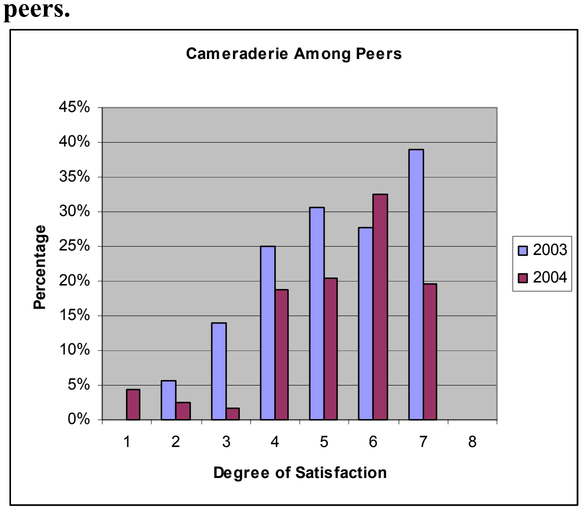


Figure 4. Student assessment of peer camaraderie.

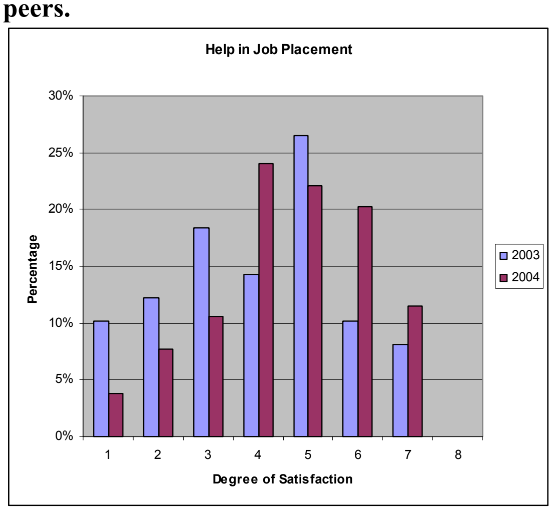


Figure 5. Student assessment of the College's helpfulness in job placement.

The College is addressing the deficiencies suggested by the charts above in several ways. The first of these is a series of 1-unit classes intended to promote engagement with the College in the early years and to help the student's professional development in later years.

This new series of classes, numbered ENGR 1 (freshmen), ENGR 2 (sophomores), ENGR 101 (juniors), and ENGR 102 (seniors) has now been approved, and we are currently in the process of tailoring the contents of these courses to our specific needs. These courses are intended to provide our students with involvement in Professional Development activities. Activities to be performed are program-specific, and will include projects, industry overviews and interactions, involvement with professional societies and clubs, team building, career guidance, and coverage of ethics and lifelong-learning issues.

The specific list of topics in these courses will include the following:

- Participate in peer-group building activity.
- Understand engineering as a creative process for solving real-world problems.
- Understand current and future trends in the student's major discipline.
- Understand some analysis tools, and their use in design and practice.
- Understand the stages of development of an engineer as a professional.
- Participate in individual and group projects.
- Participate in professional clubs.
- Participate in the Professional Development Milestones program (see Section B.1.6).
- Understand the role and importance of ethics in the engineering profession.
- Understand the importance of engaging in life-long learning.
- Participate in industry visits.

The topics listed above will be presented in workshops and discussion-style activities. We expect that these courses will increase the degree of engagement of our students with our college, and promote academic and professional success.

To further enhance the experience of our students in their early years, we also plan to restructure the freshman-level coursework in our programs to incorporate the notion of "learning communities," intended to consolidate further the opportunities for peer-group building that the ENGR 1-102 series of courses are intended to promote.

Since engineering freshmen constitute around 10% of the entering freshman pool each year, they also tend to constitute a small fraction of the enrollments in the freshman classes. Their numbers in these early classes are greatly diluted by the preponderance of students from other colleges, so their opportunities in these crucial early years to build social and academic peer groups with colleagues from BCOE are also correspondingly diminished.

As a result, the social circles of our undergraduates in their later years also tend to be formed mostly of students from the other colleges, particularly from the College of Humanities, Arts, and Social Sciences, given their larger numbers on the campus. For various reasons, students from these other colleges appear to get by with significantly less work than is expected, and serve as poor role models for undergraduates in engineering. Conversations with students in academic difficulty confirm this as a factor contributing to poor academic performance.

We plan to address this issue by clustering BCOE undergraduates in freshman classes to form *Engineering Learning Communities*. Several conceptual implementations of learning communities are in use in engineering programs elsewhere, which we could use as possible models. However, since our freshmen take the bulk of their courses in the other colleges, we are working with the other colleges to develop a model for learning communities that would be most appropriate to our campus. We also intend our learning communities to work in tandem with the Professional Development and Mentoring curriculum.

In concept, our clustering program forms groups of freshmen and enrolls them in courses so that groups, rather than individual students, are assigned to sections. Students will see the same set of peers in all their classes, and will be able to form stronger academic and social bonds with one another. We will cluster our students in the following courses:

- Math 5: Sections 024, 025, 027.
- Math 8A: Section 005.
- Math 9A: Sections 011, 012, 013.
- Math 9B: Sections 031, 032.
- Math 9C: Section 004.
- Chemistry 1A: Sections 031, 027.

We are working with the Registrar's office to structure the freshman registration system so incoming College freshmen are automatically enrolled in courses as groups. We plan to have the system in place by the fall 2006 quarter.

A new initiative for 2007 is the Engineering Dormitory, *Enginuity Hall*. Sharing a common residential environment can be an effective means for enhancing the development of social and academic peer relationships.

An engineering residence hall will be an extension of the "learning communities" concept, and reinforce the benefits it is expected to yield. We plan to make academic and professional activities and integral part of the residential experience in this hall, hosting a range of activities such as professional club activities, office hours, study groups and supplemental instruction in the residence hall.

The initial reactions to this concept from the parents of incoming freshmen, from our current students, and our staff have been enthusiastic. It appears likely that we will get a sufficient number of students to make the pilot program successful.

We have been working with the Housing Services unit on campus to make the engineering residence hall option available to as many of our incoming freshmen as possible. We seem to be on target to have a pilot program in place by this fall quarter.

B.1.2 Student Advising

Student advising in the Bourns College of Engineering operates at three levels. First, staff Academic Advisors guide the students through planning, course selection, corrective action as needed, and degree check. Second, departmental faculty engage in group and individual student advising, as well as informal mentoring. Third, other resources from within the College and from the broader campus help students make good choices and advance successfully toward the degree. All of these mechanisms are covered in sections B.1.2 to B.1.4.

Students in the College of Engineering are assigned to an Academic Advisor in the Office of Student Academic Affairs based upon the year in school and/or their last name. Students are currently distributed between four sophomore through senior advisors and one freshman advisor.

Each advisor, with the exception of the Freshman Advisor, advises approximately 275 students each year. The Freshman Advisor is responsible for all new freshmen, in addition to continuing freshmen who have not yet earned enough units to achieve sophomore standing. As a result, the Freshman Advisor's caseload is larger than the others'. We are monitoring advisor caseloads, and plans call for the addition of another advisor and/or the addition of more support for the advising staff when the caseload reaches approximately 400.

The caseload system is designed so that students and Advisors have a relationship throughout the student's career. The Freshmen advisor teaches the student how to navigate the University policies and procedures as well as teaches the student how to best utilize their Advisor and Faculty Mentor's skills.

At the start of the freshman year, each student is given a four-year course plan. Students are able to check their progress relative to this plan on-line at any time. In the spring of the freshman year, a student meets with his or her permanent staff advisor to discuss the fall schedule and make the transition to the Sophomore – Senior caseloads. The student now works with the same advisor on all academic issues through graduation. Course scheduling, academic difficulty counseling, petitions for exceptions, and graduation applications all come to the staff Advisor. This continuity allows the student and Advisor to develop a relationship of trust which leads to better service for the student and greater insight for the Advisor on the student's needs and ambitions.

It is the Student Affairs advisor's responsibility to monitor the progress toward completion of degree requirements. All of the engineering disciplines are patterned in sample program plans which form the basis of the four-year suggested course schedules. Advisors are able to assist students with creating a personalized plan to allow for actual course enrollment to vary from the standard plan, with the required courses to be rescheduled into a later term. This becomes particularly useful for students pursuing double majors, minors, changes in program, reduced course loads due to academic difficulty or extracurricular demands (e.g. employment), and students who have changed their major into the College of Engineering from another major on campus.

The Student Affairs advisors also perform a Satisfactory Academic Progress review annually, during the summer. Each student in the advisor's caseload is reviewed for degree progress. Students are counseled about course selection and academic support services to help them achieve better grades and get back on track with their Course Plan.

Prerequisites to courses are enforced by the Student Information System in accordance with the course approval forms. Should an instructor approve enrollment on an exception basis, the Student Affairs Officers can assist the student with enrollment, given reasonable written documentation (e-mail, or note from the instructor). This documentation is then placed in the student's file.

Substitutions or waivers generally require the approval of the Associate Dean for Undergraduate Education or the Undergraduate Advisor in the major. Documentation of a substitution or waiver of a degree requirement is always included in the student's college file. Advisors are authorized to input the substitution or waiver into the Student Information System.

Technical electives required for the major are selected by the student in consultation with the faculty mentor or Undergraduate Advisor for the student's major. Several majors, including Computer Engineering and Electrical Engineering, have developed focus areas to allow students to concentrate their studies in one particular area.

The Department of Electrical Engineering has an actively functioning Undergraduate Committee, which consists of five faculty members, with the Undergraduate Advisor serving as a committee chairman. The EE Department Undergraduate Advisor together with other committee members assists the students with selection of the technical electives and answers specific technical questions about the focus areas and engineering career options. The Department Undergraduate Advisor offers two group advising sessions to all EE majors each Spring quarter.

In 2004-2005, the EE Undergraduate Committee undertook a major revision of the curriculum and course structure directed at improvement of the education quality and the department-level student advising/mentoring. The revision has been undertaken in response to student complaints that they have difficulty in selecting a coherent set of technical electives, and that they are often lost among different career paths available in electrical engineering. Previously EE technical electives were not structured and the Undergraduate Advisors had to handle technical questions, which sometimes were not in their areas of expertise, e.g., a faculty member specializing in electronic materials has to handle questions in signal processing. To facilitate student orientation in EE technical electives, they have been divided into four focus area. These four focus areas coincide with four department research areas. The fifth area is Computer Engineering (CE), which is taught jointly with the CSE department as a separate degree program (also undergoing ABET review this year). The Computer Engineering research area is currently under development within the EE department. Close correlation of the technical elective (TE) focus areas with the EE department research areas allows the students to fully benefit from being at the research university. All four focus areas with the recommended technical electives for each area are listed below. For each of the four focus areas, the essential course (listed first in italics under the focus area title) has been identified. The students are strongly encouraged to take this course if they are going to specialize in a given area.

<u>Intelligent Systems (IS)</u>
EE 141 Digital Signal Processing
EE 128 Data Acquisition and Process Control
EE 140 Computer Visualization
EE 143 Multimedia Technologies and Programming
EE 146 Computer Vision
EE 144 Introduction to Robotics
EE 152 Image Processing

Nano Materials, Devices and Circuits (NMDC)
EE 133 Solid-State Electronics
EE 117 Electromagnetics-II
EE 130 Engineering Quantum Computing
EE 134 Digital Integrated Circuit Layout and Design
EE 135 Analog Integrated Circuit Layout and Design
EE 136 Semiconductor Device Processing Lab
EE 141 Digital Signal Processing
EE 160 Fiber Optic Communication Systems

Communications and Signal Processing (CSP)
EE 141 Digital Signal Processing
EE 117 Electromagnetics-II
EE 128 Data Acquisition and Process Control
EE 143 Multimedia Technologies and Programming
EE 146 Computer Vision
EE 150 Digital Communications
EE 152 Image Processing
EE 160 Fiber Optic Communication Systems

Controls and Robotics (CR)
EE 132 Automatic Control
EE 128 Data Acquisition and Process Control
EE 141 Digital Signal Processing
EE 144 Introduction to Robotics
EE 146 Computer Vision
EE 151 Introduction to Digital Control
EE 152 Image Processing

The implemented structuring of the technical electives significantly improved student understanding of the relevance of given courses to a particular specialization in electrical engineering. It increased student awareness of job opportunities and made them think about career choices more seriously. The department student advising has also been changed. The Undergraduate Committee has been modified in order to include a faculty member from each specialization area. In the new system, the students go for technical questions to the professor who is an expert in this particular focus area. Below is the list of the areas with the names of the faculty advisors. The chair of the Undergraduate Committee handles general questions and helps the students who have not decided yet on a focus area.

General questions:	Prof. Alexander A. Balandin Undergraduate Advisor, Committee Chair	alexb@ee.ucr.edu
Student petitions:	Prof. Gerardo Beni	beni@ee.ucr.edu

Advising by Focus Areas

Communications and Signal Processing (CSP) :
Prof. Amit Roy Chowdhury amitrc@ee.ucr.edu

Intelligent Systems (IS):
Prof. Matthew Barth barth@ee.ucr.edu

Nano Materials Devices and Circuits (NMDC):
Prof. Jianlin Liu jianlin@ee.ucr.edu

Controls and Robotics (CR):
Prof. Gerardo Beni beni@ee.ucr.edu

The information about the focus areas and EE faculty members in charge of the advising in the given area is posted on the EE website at:
http://www.ee.ucr.edu/index.php?option=com_content&task=view&id=202.

The completion of core requirements is monitored by the electronic degree check. The Humanities and Social Sciences requirements are also monitored by the electronic degree check. This process uses the approved breadth list to place completed courses into the appropriate categories for both breadth and depth. The only element which must be manually monitored is the aspect of the depth requirement which necessitates that one of the two upper-division courses be from the same area as another course.

Bourns College of Engineering Program for Students in Academic Difficulty

Students in academic difficulty are monitored by the Student Affairs advisors on behalf of the Associate Dean. Upon receipt of quarterly grades, the advisors review the academic records of students who achieve less than a 2.0 to determine whether the student should be placed on Academic Probation, placed on Continued Probation, or dismissed from the University. A student in danger of being dismissed has the opportunity to submit an appeal, which is then reviewed by the Associate Dean. If dismissal procedures must be instituted, this is done by the Associate Dean.

Because the College's Academic Difficulty policy only allows for two consecutive quarters in academic difficulty before the student is dismissed from the University, a multilayered process has been established to try and retain these students.

After grades are posted for a quarter, Academic Advisors manually place a hold on the registration of each student in academic difficulty to prevent him/her from making any changes to his/her registration (University regulations limit such students to 13.0 units per quarter) for the upcoming quarter prior to completing difficulty procedures. Additionally, no later than the first week of the quarter, e-mail is sent to each student in difficulty to inform him/her of his/her status. The notification clearly states what the student must do to remove registration holds and restore good standing.

Each student in difficulty is required to attend an Academic Success Workshop. Workshops are offered during the first two weeks of every quarter. The College offers a lower-division workshop for those students who have completed fewer than 90 units and/or no upper-division coursework. An upper-division workshop is offered for those students who are juniors or seniors and well into their major having completed upper-division coursework.

The Academic Success Workshop is designed to help students identify what it was that caused them to be in difficulty and equip them with strategies to rectify the problem and improve academic success. In the workshop, facilitators cover topics from how to identify and improve motivation to study strategies, and identify campus/college resources to facilitate the process of academic recovery. In the workshop, students are given a packet of materials to complete that includes an Academic Progress Review, Time Management Plan or Major GPA calculation (depending on class level), a Checklist that identifies various reasons why students end up in difficulty, and instructions for preparing a personal statement (essay).

If a student does not attend an Academic Success Workshop during the first two weeks of the quarter, he/she must then see an Academic Success Counselor (trained paraprofessional) to discuss all of the material covered in the workshop. The student still needs to complete all of the pieces of the packet as provided in the workshop. In addition, Success Counselors are available to all students throughout the quarter for advice.

A student must then set an appointment to meet with his/her academic advisor to discuss the various materials from the workshop and review the personal statement and checklist to further provide the student with support and strategies to resolve the issues that put him/her in academic jeopardy. The student is referred to appropriate campus resources such as the Counseling Center, Career Center, and Learning Center to meet with professionals with expertise to manage his/her personal issues surrounding academic difficulty. The student is also encouraged to visit his/her advisor prior to registration for the next quarter to discuss how things are going and plan an appropriate schedule. If the student does not complete all parts of the packet (time management plan, essay questions, etc.) the student is asked to complete the packet fully and return before the hold is removed. The advisor also reviews the student's complete grade history to be sure that the student is in a successful major choice.

Prior to registering for the subsequent quarter, a student in academic difficulty must complete a course plan and submit it to his/her academic advisor for review and approval. If the course plan is inappropriate the student is advised to come in for guidance or to given advice as to how to better select courses and asked to resubmit.

Additionally a student must complete a follow-up assessment to gauge how helpful the workshop was in helping him/her reach his/her goals for the quarter and if the student has been able to stick to his/her plan for success.

Students who wish, or need, to change their major are encouraged to contact their desired new department for advisory information.

About 80% of the students who are subject to the Academic Difficulty registration hold do agree to go through the process described above. Although we do not yet have benchmarking data, this process appears to be more effective than its predecessor, in which the student signed a “contract” to improve performance. Effectiveness is indicated either by a return to good standing in the Engineering program or successful transition to another major before the student’s grade-point average is so low that remaining in the University is at risk.

Additional information about BCoE’s Academic Standing policy is available online at: http://www.engr.ucr.edu/studentaffairs/policies/acad_stand.shtml.

Bourns College of Engineering Faculty Mentoring Program

While Staff Academic Advisors in the Office of Student Affairs provide academic advising (guidance with registration, campus resources, course planning, etc.), Faculty Mentoring is a different kind of advising assistance. The Faculty Mentor’s goal is to promote a strong relationship between students and professors in the department as early as the first quarter of the freshman year. Faculty Mentors are available for students to consult on matters pertaining to career planning, understanding engineering in general, and specifically for gaining a better appreciation of their major. Mentors also provide guidance on what it takes to be successful as an engineering student, and provide suggestions to enable students to gain confidence and self-motivation.

Faculty Mentoring is an opportunity for student and faculty to interact in a less intimidating situation. The program is designed for students to gain greater insight about classes and how course material relates to post graduate goals. This is the time for students to really understand how what they do in the classroom is connected to what Engineers actually do in the real world.

Faculty Mentoring helps students to clarify course guidelines, the syllabus, a specific assignment, lecture, discussion, and career goals; better understand comments on papers or assignments; improve grades by providing studying assistance; communicate about expectations; get advice on graduate study or future plans; and make suggestions for self-improvement.

Electrical Engineering majors have access to a Faculty Mentor (Advisor) but are not required to meet on a formal basis. Computer Engineering, Computer Science, and Information Systems freshmen are required to meet with a Faculty Mentor in the first quarter of enrollment as a condition of registration. All Bioengineering, Chemical Engineering, and Environmental Engineering majors, regardless of class level, are required to meet with their assigned Faculty Mentor as a condition of registration for every quarter of enrollment. Freshmen in Mechanical Engineering are required to meet with their assigned Faculty Mentor as a condition of registration every quarter of their first year of enrollment.

Instructions for meeting with Faculty Mentors and contact information is provided via e-mail, posted on the College of Engineering Office of Student Academic Affairs website and available from each staff Academic Advisor. Students are encouraged to contact Faculty Mentors in person or by e-mail to schedule a mentoring session. Before the appointment, each student must obtain a Faculty Mentoring Confirmation slip from the department’s administrative office. At the end of the meeting, the Faculty Mentor signs the confirmation slip verifying completion of the requirement. The student then brings the signed slip to the Office of Student Academic Affairs for removal of the registration hold.

B.1.3 Monitoring Student Credit-Hours

The College's Student Affairs advisors, Student Affairs Officers II, serve as both college office advisors and departmental advisors for each of the College's engineering disciplines. As departmental advisors, Student Affairs advisors discuss academic progress with students on a quarterly basis, and at additional times as changes warrant. Advising duties are split between freshmen and sophomore through senior students.

Freshman Advisor: Tara Brown

Sophomore – Senior Advisors:
A – F: Suzanne McCusker
G – K: Lisa Guethlein
L – P: Sonia De La Torre
Q – Z: Thomas McGraw

Since departmental and college advising is provided from one centralized staff, separate certification at the department level is not performed.

Once students file their Applications for Graduation (normally three weeks prior to the beginning of the graduation quarter), the Student Affairs Officer performs a preliminary degree check to assess completion of all University, College, major, and ABET requirements.

Students also have access to their own degree audit via a secure web interface. Bourns College of Engineering students are especially adept at utilizing this tool to assess their own degree progress. The audit takes the place of the preliminary as well as the final degree check that were formerly performed manually. As such, hard-copy tracking of graduation requirements is no longer done.

Upon receipt of final grades, a final degree check is performed, and students are cleared to graduate if they have satisfied all listed requirements. If the requirements are not satisfied, the student is notified by the Registrar's Office and asked to contact their College office.

Transfer credit is honored and recognized for comparable subjects as determined by course articulation. Transfer credit is determined by faculty review. Each academic department has exclusive responsibility for the evaluation of transfer courses in its discipline, for the benefit of the campus as a whole. In each academic department, the Undergraduate Faculty Advisor is charged with reviewing any courses in their department submitted to the campus for consideration. Requests for course articulation are sent to the department by the Office of Student Academic Affairs and are accompanied by a course syllabus, course description, course name and table of contents of the text, and any lab assignments. Courses are reviewed for comparability of engineering topics, lecture material, laboratory assignments (as appropriate), and prerequisites. In this way, each academic department is of service to the campus, and consistency is maintained. Individual academic departments do articulate courses outside their own field of expertise and recognizes the existing articulation completed by faculty in the respective academic departments. This ensures transfer credit for each student is treated equitably, regardless of the student's major.

The Office of Student Academic Affairs, specifically Thomas McGraw, maintains the documentation and collection of these course articulation requests within College of Engineering on the campus Student Information System database. The campus Articulation Officer, Thea Labrenz, serves as the manager of this database of comparable courses, which interfaces with the statewide database, ASSIST, available via the World Wide Web. The database contains all approved comparable courses for use by all campus departments and California Community Colleges, and further contributes to consistency and efficiency.

B.1.4 Professional Development Milestones

The Bourns College of Engineering Professional Development Milestones program was designed to lead students to professional success after graduation. The Professional Development Milestones parallel a student's academic path and allow a student to plan and track his/her professional development as he/she would track his/her academic progress.

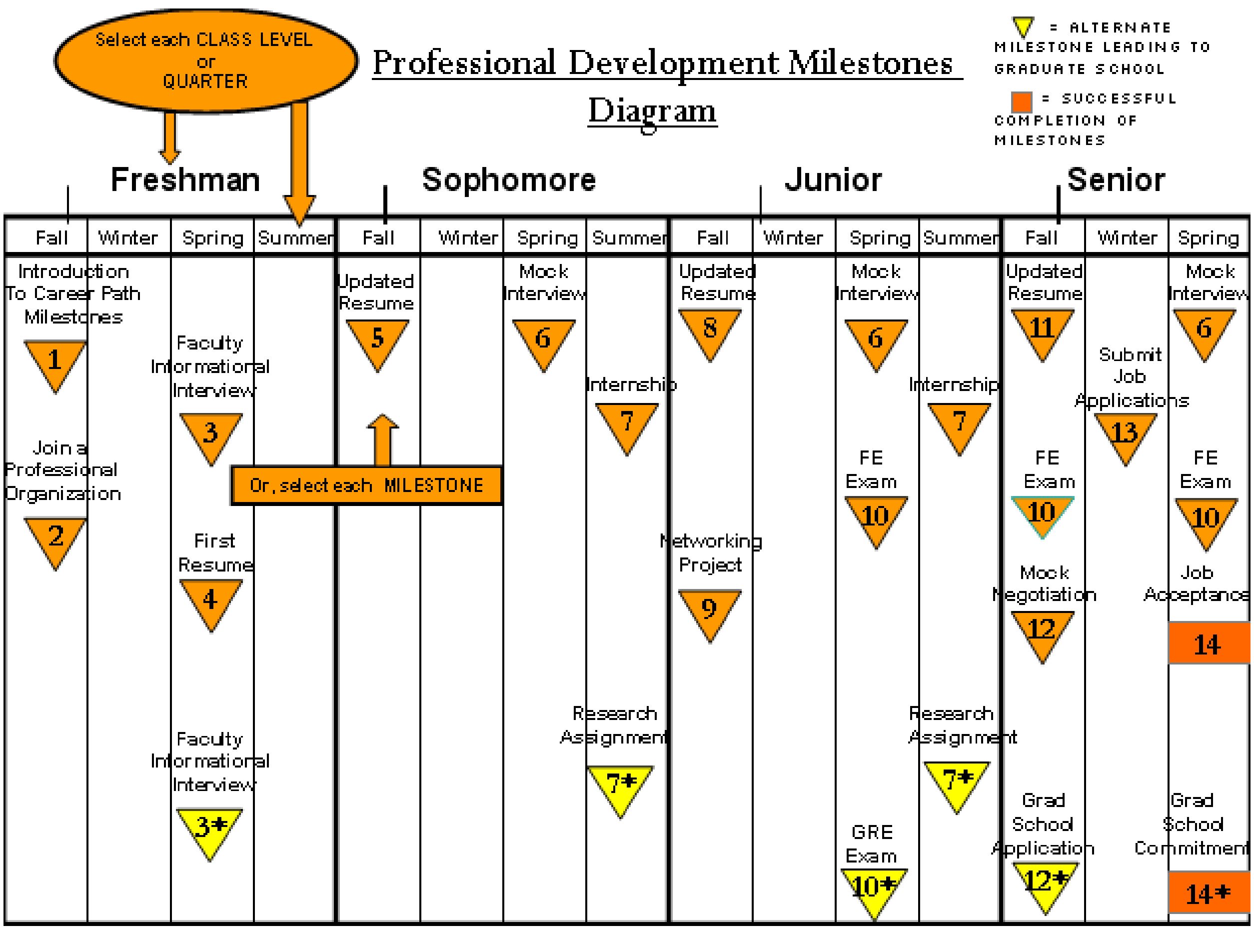


Figure 6. Diagram of key points during an undergraduate's tenure at which the Professional Development Milestones program prompts the student to take action in preparation for internships and academic or industrial career opportunities.

Earning a college degree is no guarantee of professional success. Interpersonal skills, the ability to communicate effectively, leadership qualities, internship and/or research experience, networking skills, and many other characteristics determine professional success. The Bourns

College of Engineering Professional Development Milestones program allows students to gain experience and develop the skills, abilities, and characteristics that determine professional success. Among other milestones, the College strongly encourages all students to complete at least one internship and at least one research experience prior to graduation. The Professional Development Milestones outline a plan that leads a student through each milestone and related activity as he/she makes progress toward professional success in graduate school, industry, research, academia, management, leadership, and/or many other professional endeavors.

The Professional Development Milestones program (formerly known as Career Path Milestones) is an interactive, web-based resource. Figure 6 shows a diagram of key points during an undergraduate's tenure at which the Professional Development Milestones program prompts the student to take action in preparation for internships and academic or industrial career opportunities. The web site (http://www.engr.ucr.edu/studentaffairs/milestones/) maps actions that a student should take during each undergraduate quarter. Beginning in the freshman year, for example, it guides students to relevant professional organizations to join and resume-writing workshops. In the sophomore year, it connects students to resources for finding internships and research experiences. Other milestones include target dates for taking the GRE exam, revising resumes, and having mock job interviews.

At this time, Professional Development Milestones is used only for Bourns College of Engineering undergraduates. It is gradually expanding to other undergraduate sequences at UCR and other institutions, and eventually can be expanded to serve graduate students.

B.2 Program Educational Objectives

This section describes the Electrical Engineering Program Educational Objectives and their relationship to the institution's mission (Section B.2.1). Section B.2.2 lists the Department's constituencies. Section B.2.3 sets forth the processes used to establish and review the Program Educational Objectives, and B.2.4 provides an analysis of the relationship between each objective and the curriculum. Section B.2.5 discusses the extent to which the Department is achieving the Program Educational Objectives and the methods for reviewing progress and making changes. Finally, Section B.2.6 describes the mechanisms we have used to determine our success in achieving the objectives, and the results that those measurements have produced; and Section B.2.7 describes specific actions taken to improve student performance in the freshman Chemistry course.

B.2.1 List of Program Educational Objectives and Links to the Institution's Mission

The program educational objectives (PEOs) describe the expected accomplishments of graduates during the first few years after graduation. The Electrical Engineering (EE) PEOs are clearly stated in UCR General Catalog, and publicized on the EE departmental website (http://www.ee.ucr.edu/). They are *to produce graduates who shall be able to*:

PEO 1. *develop and pursue successful careers in electrical engineering (EE)*

PEO 2. *apply EE knowledge and skills to further careers in a broad range of professional occupations*

PEO 3. *conduct successful graduate studies and research at major research universities*

PEO 4. *demonstrate innovation and creativity, and pursue lifelong learning in solving engineering problems*

PEO 5. *work effectively in a team environment, communicate well, attain professional growth, and provide leadership in engineering*

PEO 6. *exercise professional responsibility and sensitivity to a broad range of social concerns, such as ethical, environmental, economic, regulatory, and global issues*

The EE PEOs are designed to be *general* statements of our goals for EE graduates, and to be *measurable* (e.g. through surveys of alumni on factual information such as job status/position, number of patents, publications, etc.). The EE PEOs are linked to the Engineering College Mission (ECM) as shown below:

ECM 1. *Produce engineers with the educational foundation and the adaptive skills to serve rapidly evolving technology industries.* ***(link to PEO 1 and 2)***

ECM 2. *Conduct nationally recognized engineering research focused at providing a technical edge for the U.S.* ***(link to PEO 3)***

ECM 3. *Contribute to knowledge in both fundamental and applied areas of engineering.* ***(link to PEO 3 and 4)***

ECM 4. *Provide diverse curricula that will instill our students with the imagination, talents, creativity and skills necessary for the varied and rapidly changing requirements of modern life and to enable them to serve in a wide variety of other fields that require leadership, teamwork, decision making, and problem solving abilities.* ***(link to PEO 5 and 6)***

ECM 5. *Be a catalyst for industrial growth in the Inland Empire.* ***(link to PEO 1,2,3,4,5 and 6)***

Generalizing further, we show below the links between the ECM and the Institutional Mission (IM):

University of California, Riverside is a research university committed to the creation and transmission of knowledge at the highest level, and to the translation of that knowledge for the public good ***(link to ECM 3)****. Our comprehensive programs and services, excellent faculty and staff, and vibrant and attractive physical environment are designed to: provide a high quality learning environment for undergraduate and graduate students; advance human knowledge and accomplishment through research and scholarship* ***(link to ECM 2****); enhance the public good through community service and initiatives* ***(link to ECM 5****); seek pre-eminence among U.S. research universities, recognizing UCR's quality in every area.*

Thus, we see that IM and ECM provide a high-level structure (see Figure 7 in Section B.2.2) for the more specific PEO developed by the EE department.

B.2.2 Constituencies

As in any quality control process, it is important to understand the *constituencies* involved with the product. The following constituencies are deemed vital for establishing and maintaining both the PEOs and program outcomes (to be discussed in B.3.1):

1. Faculty
2. Students
3. Alumni
4. Industry/Employers

The EE faculty members form an important constituency because they carry the main responsibility for educating the students, and for establishing, maintaining, and continuously improving the educational program. The students are the major "clients" who benefit directly from the education received at UCR. The alumni provide an important input on the quality of the EE program from the perspective of a graduate who has had to rely on the skills learned at UCR in his/her career. Industry is represented by the Board of Advisors (BOA), a group of senior executives from major local and national corporations (see Table 4) that meets annually, to provide their perspective on our educational activities, and to provide input that guides the continuous improvement of our educational program.

Table 4. Electrical Engineering Department Board of Advisors (BOA)

Name	Affiliation
Ms. Jean M. Easum	Naval Surface Warfare Center
Dr. Hossny El-Sherief	Northrop Grumman Corporation
Mr. Robert Kelly	X-Prize Foundation
Mr. Kumaran Krishasamy	Broadcom Corporation
Dr. James Maniscalco	Northrop Grumman Corporation
Professor Argogaswami J. Paulraj	Stanford University
Dr. Ravi Rajamani	Pratt & Whitney
Mr. William Rhoades	Xerox, retired
Dr. Patrick M. Sain	Raytheon Electronics Systems
Mr. John L. Sevey	City of Riverside Public Utilities Dept.
Dr. N. Sureshbabu	Ford Motor Company
Dr. Allyson Yarbrough	The Aerospace Corporation
Mr. Ron Young	General Motors Adv. Technology Vehicles

The overall framework for the EE PEOs is shown schematically in Figure 7. Using an architectural analogy, we may state that the EE PEOs rest on *four pillars* of constituents, the faculty, students, alumni, and industry. The Institutional Mission and Engineering College Mission provide a *roof*, which guides and defines the high-level structure of the PEOs.

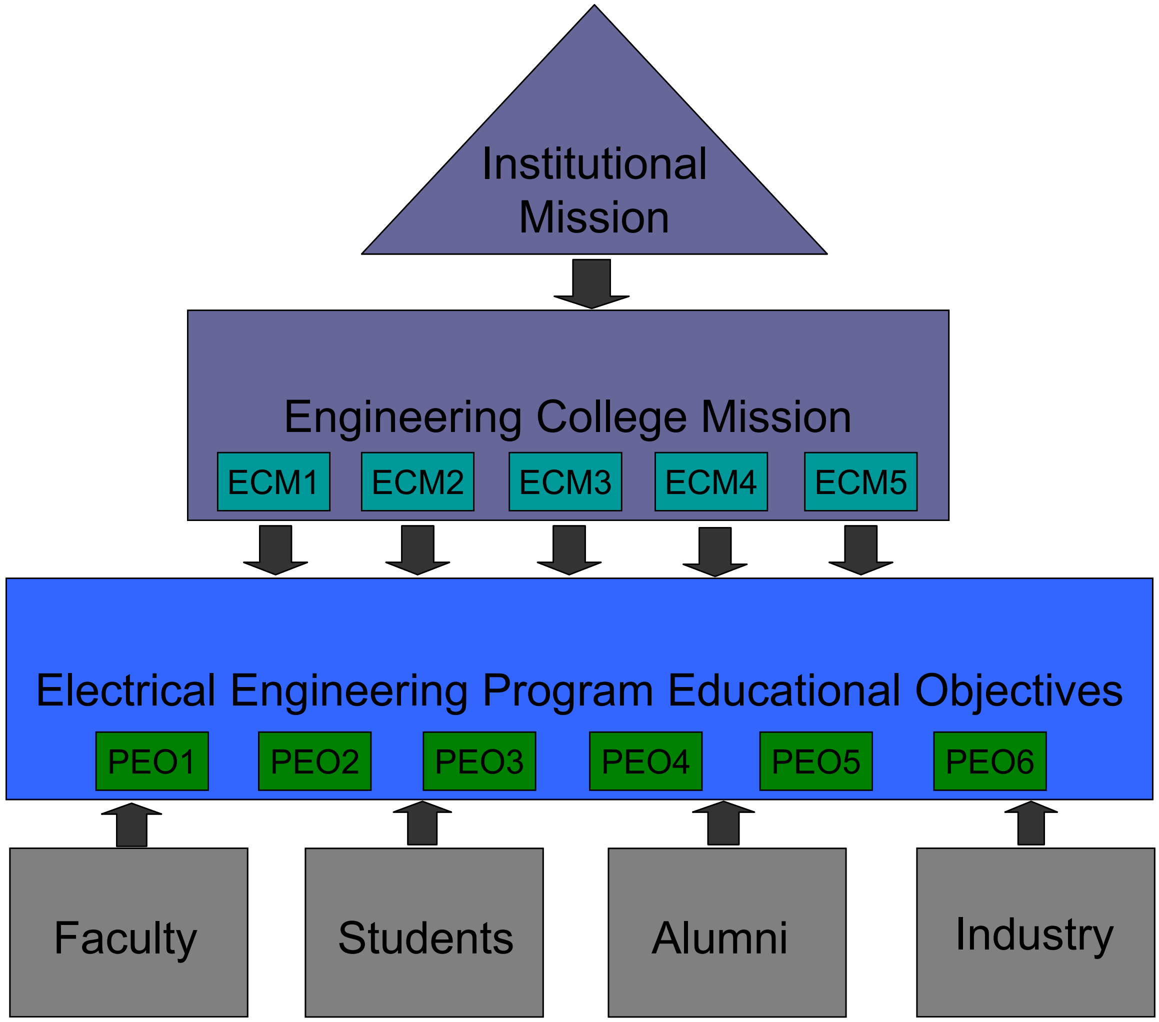


Figure 7. Framework for Electrical Engineering Program Educational Objectives.

B.2.3 Process to Establish and Review PEOs

In 2003, the EE Department tasked the Undergraduate Committee to formulate a quantitative assessment process for PEO and program learning outcomes. The following is a summary of the original document discussed and approved by the EE faculty:

EE Assessment and Feedback Mechanisms

Learning Outcome Systems Process / Individual Course and Course Sequence Level

1. Grades in homework assignments, lab reports, short tests and examinations. Review of the student performance (grade received) for feedback on whether the course/program objectives are met.

2. Student Evaluation of Teaching. Evaluations administered near the end of each quarter allow students to provide the instructor with anonymous feedback on the effectiveness of the course. The questions in the evaluation forms include questions relevant to the stated program objectives like "Have you learned something you consider valuable?"

3. End-of-course student assessments/surveys. Course surveys are distributed at the end of each course. The course survey is based on the course objectives, and learning outcomes 1-11 from the course objective matrix. Students are asked how well the course learning objectives, and outcomes were achieved.

Educational Objectives Systems Process / Program Global Level

4. Senior Exit Surveys. The survey allows the graduating seniors to rank how well the program met the objectives and outcomes. The senior Exit Surveys are distributed to the faculty and analyzed. The Undergraduate and ABET Committees then draft an action plan for improvement.

5. BOA (Board of Advisors) surveys. Each year, EE department organizes a meeting with industry representatives serving on the BOA. The Undergraduate and ABET Committees are tasked with collecting and analyzing the BOA feedback on the courses content, program objectives, etc.

6. Quantitative assessment of the EE 175 Senior Design project using ABET 2000-based evaluation forms.

7. Alumni Surveys. These surveys are collected from the set of alumni and analyzed with the goal to determine the importance and relevance of the program objectives and outcomes, as well as their achievement.

The assessment procedures have been continually revised and improved since 2003 to incorporate more quantitative assessment elements (such as the relevance matrix discussed in section B.3.2).

Figure 8 shows a schematic flow-diagram of the quality control feedback process developed by the EE department for both PEO and program learning outcomes. There are actually two interconnected feedback loops shown in Figure 8, a "micro" loop for each individual course, and a "global" loop for the program as a whole.

The instructor for each undergraduate course is required to keep a course file, documenting important information such as syllabus, course matrix (i.e. course objectives vs. outcomes), testing/measurement information, course assessments, report, and recommendations for future improvements. The loop is "closed" each time a new instructor teaches the course by a mechanism we call instructor "sign-on," a procedure whereby each new instructor reads and signs off on the recommendations made by the previous instructor (could be the same person) for the improvements in the course curriculum.

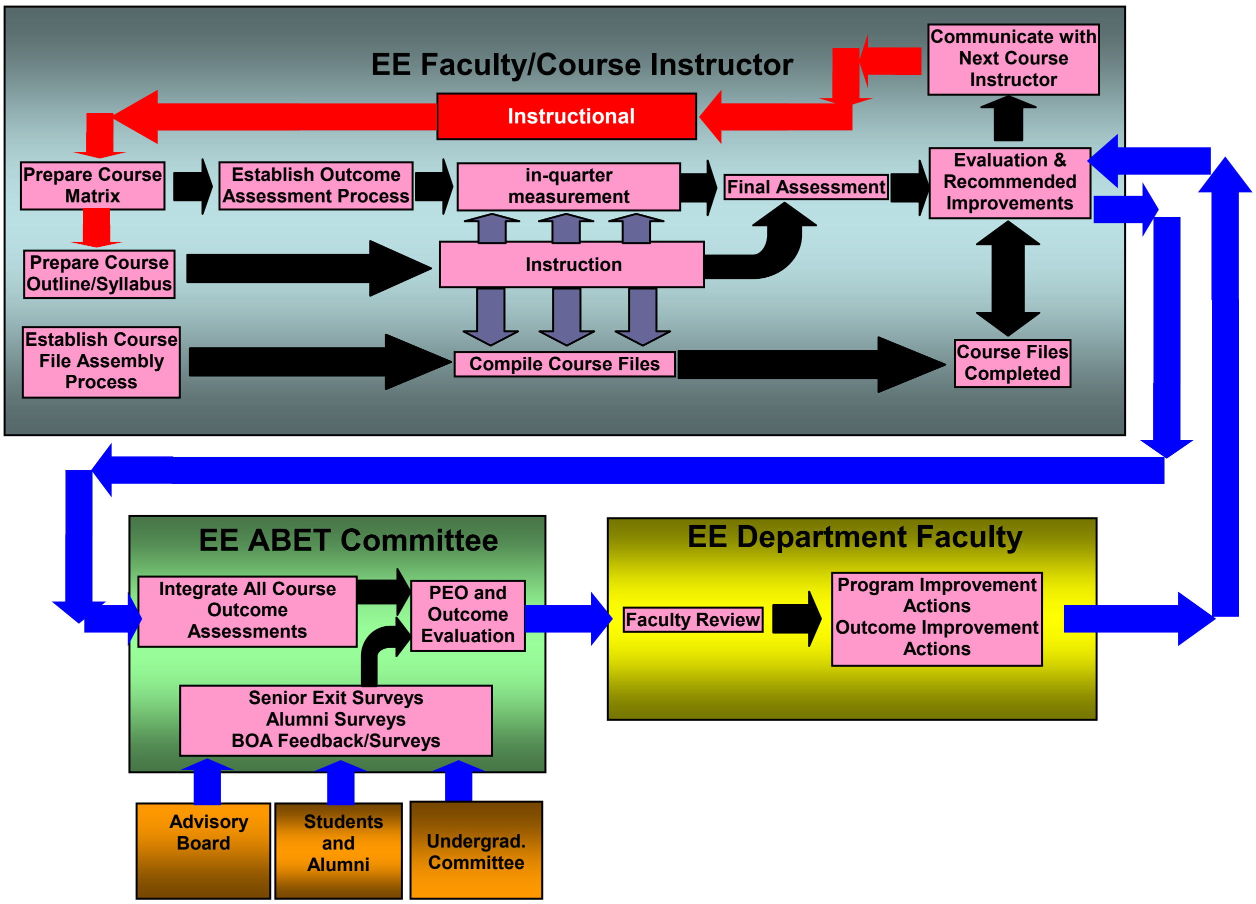


Figure 8. Schematic diagram for the continuous assessment and improvement process.

The information in the course files is integrated and analyzed by the EE ABET committee at the end of each academic year. Additional data obtained from the industry Board of Advisors, students, and alumni are analyzed. Based on this analysis and in consultation with the Undergraduate Committee, recommendations may be made to the faculty for changes and/or improvements in the PEO, outcomes, or any aspect of the program. If the faculty approves, the improvement actions are then propagated forward to make the recommended changes in the EE program. We note that the assessment and improvement processes are similar for both PEO and program learning outcomes, and actually these two processes run in parallel. The assessment process is described in more detail in section B3.2, where the program outcomes are the major focus.

As a specific example of our program improvement process, the EE PEOs were recently reviewed during a program evaluation visit by a consultant with expertise in the ABET accreditation process. The program review revealed that some of our PEO were too similar to the learning outcomes, and/or may be difficult to measure effectively. Thus, the ABET committee, in consultations with the Chair and Undergraduate Committee, reformulated the EE PEO by revising the statements to make them more general and measurable. The proposed new PEO were presented to our BOA on May 12, 2006, revised based on BOA feedback, and approved by the EE faculty on May 17, 2006. The resulting improved PEO are shown above in section B.2.1.

B.2.4 Relationship between PEOs and Curriculum

The relationships between PEOs and EE curriculum are demonstrated in Table 5. This table shows a sample four-year program for an EE student. The first two years of the EE curriculum provide the foundation technical courses, and the broad education necessary for an engineer. The first two years are linked to PEOs 1, 2, 5, and 6. PEO 1 is especially well represented in the first two years of the curriculum. The second half of the EE program in years 3 and 4 teaches the more specialized engineering skills, including the majority of required EE courses, and technical electives. The capstone EE engineering design course, EE 175A/B, and the majority of EE technical electives are taken in the senior year. Thus, not surprisingly, the senior year curriculum is most closely linked to all EE PEOs 1, 2, 3, 4, 5, and 6.

Table 5. Example 2005 program, including course credit hours, and relationships between courses and PEOs.

Freshman Year	Fall	Winter	Spring	Notes	PEO
MATH 009A-C	4	4	4	Foundation Math	**1**
CHEM 001A	4			Foundation Chemistry	**1**
PHYS 040A-B		5	5	Foundation Physics	**1**
ENGL 001A-C	4	4	4	Writing/Communication	**6**
Human./Soc. Sci.	4			Elective in Humanities/Social Sciences	**5, 6**
Soph. Year	**Fall**	**Winter**	**Spring**		
MATH 010A-B MATH 046	4	4	4	Foundation Math	**1**
CS 010, CS 061		4	4	Programming and Comp. Architecture	**1,2**
PHYS 040C	5			Foundation Physics	**1**
EE 001A-B	4	4		Basic Electronics	**1**
ME 010			4	Foundation Mechanics	**1,2**
Biol. Sci. .		4		Elective in Biological Science	**1,2**
Human./Soc. Sci.			4	Elective in Humanities/Social Sciences	**5,6**
Junior Year	**Fall**	**Winter**	**Spring**		
EE 100A-B, EE 105, EE 110A-B, EE 116, EE 132	8	12	8	Advanced Electronic Circuits and Devices, Control Systems, and Signal Processing	**1, 2**
EE 120A-B	5		5	Digital Systems	**1, 2**
Human./Soc. Sci.	4	4	4	Electives in Humanities/Social Sciences	**5, 6**
Senior Year	**Fall**	**Winter**	**Spring**		
EE 115, EE 141, EE 175A-B	8	4	4	Comm. Systems, DSP, and Engineering Design Project.	**1, 2, 4, 5, 6**
Tech. Electives	4	8	8	Advanced Tech. Elect.	**1,2,3,4**
STAT 155 or 161	4			Probability and Stat.	**1, 2**
Human./Soc. Sci.		5		Elective in Humanities/Social Sciences	**5, 6**

B.2.5 Evaluation of PEO Achievement

The EE department uses both qualitative and quantitative tools to evaluate PEO achievement. The qualitative tools include discussions among the faculty, students, and BOA, as well as formal evaluations of our program by ABET consultants. The annual BOA meeting is particularly useful to hear the industry view on the EE PEO achievements, and areas where the EE program can be improved. The quantitative tools are based on alumni surveys, BOA surveys, and to a lesser extent on senior exit surveys.

The alumni surveys are administered by the UCR College of Engineering. The first Alumni surveys were performed in 2005. The results are posted on the College of Engineering website for every program (http://www.engr.ucr.edu/abet2000/stats/). Figure 9 shows the survey data obtained in 2005 on the "relevance" of the EE PEOs, with 1 being least relevant and 5 most relevant. Note that at the time of 2005 survey we had a different set of PEO than those discussed in Section B.2.1. The old set of PEO used for the 2005 alumni survey is shown below:

1. *demonstrate the ability to apply mathematics, engineering sciences, computer applications, and natural sciences to electrical engineering practice*
2. *are prepared for entry into careers in electrical engineering in the areas of intelligent systems; materials, devices and circuits; communications and signal processing; and controls and robotics*
3. *are prepared to pursue graduate education and research in electrical engineering at major research universities*
4. *are capable of synthesizing principles and techniques from engineering, mathematics, engineering planning and project management to develop and evaluate alternative design solutions to engineering problems with specific constraints*
5. *exercise professional responsibility and sensitivity to a broad range of social concerns, such as ethical, environmental, economic, regulatory, and global issues*
6. *work effectively in a team environment, communicate well, and are aware of the necessity for professional and personal growth.*

While the new PEO are formulated to be more general, there is a very close correspondence between the new and old PEO. Thus, the results of Figure 9, all clustering near the maximum score of 4-5, provide a validation for the relevance of EE PEOs.

In 2005, we instituted a policy of surveying the BOA to get additional quantitative data. In the 2005 survey, the BOA members were asked to rate 7 specific statements on the quality of the EE program on a scale of 1 to 5. The results are shown in Table 6. It was gratifying to get near perfect scores from the BOA on our "practice of continual improvement in education," and a confirmation that "EE faculty take ABET requirements seriously." The BOA survey did indicate that the EE program needs to respond faster to technological changes in industry. In this regard, the EE program has recently introduced several new undergraduate courses addressing state-of-the-art technology, including EE 160 Fiber-Optic Communication Systems, EE 137 Introduction to Semiconductor Optoelectronic Devices, and EE 136 Semiconductor Device Processing. The department also endeavors to recruit new faculty in areas of Electrical Engineering which the BOA recommends to be of key local industrial relevance.

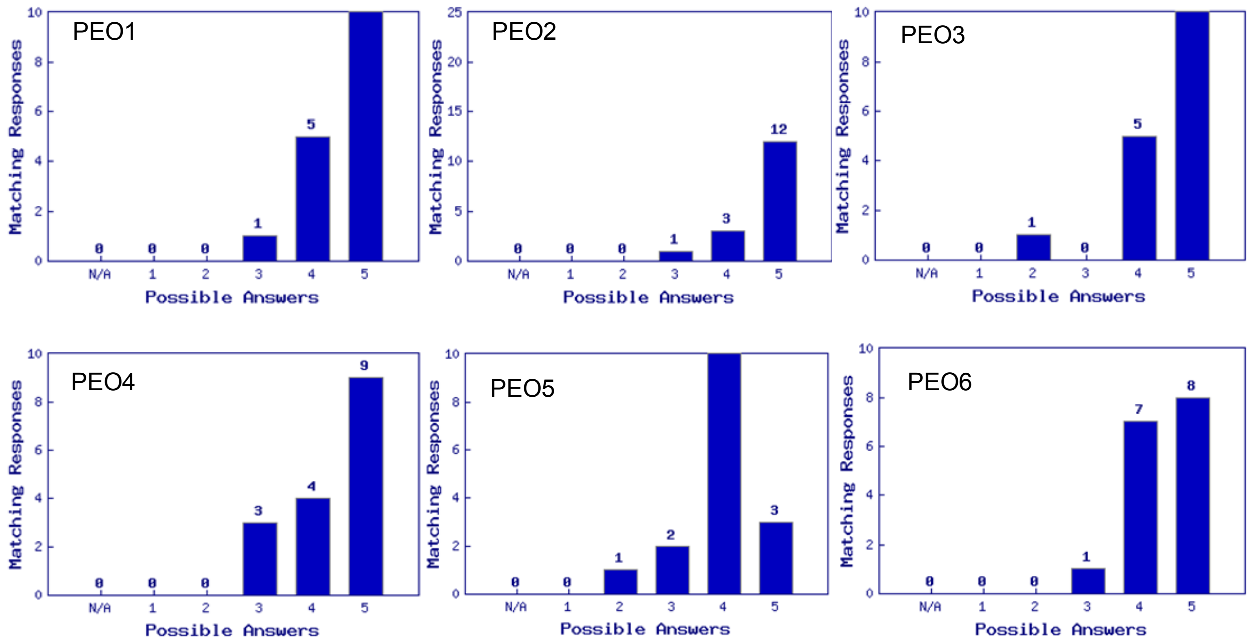


Figure 9. Alumni survey results on the relevance of EE PEOs, with 1 being least relevant, 5 most relevant.

The data obtained from senior exit surveys is analyzed every year, often resulting in specific recommendations for program improvement. For example, Appendix IIIA shows a memo written to the EE faculty in 2004 summarizing the analysis of senior exit surveys, as well as giving specific recommendations for program improvement. We have experimented with different means of administering the senior exit survey. We now administer it through the Office of Student Academic Affairs. Students must complete the exit survey when they file their applications for graduation. Graduation applications are not accepted without the survey. This assures 100% participation in the survey.

Table 6. Industry Board of Advisors (BOA) Survey Results for 2005.

BOA Survey Question	Avg. Score (scale of 1-5)
EE department follows a practice of continual improvement in education.	4.71
Engineering design is integrated into EE curriculum.	4.33
ABET requirements are taken seriously by the EE faculty.	4.71
Needs of industry are taken seriously by the EE faculty.	4.43
Educational programs are updated promptly in response to major technological changes/shifts in industry.	3.86
Overall, the EE undergraduate education program at UCR meets the needs of industry.	4.29
Overall, EE department values and responds to industry feedback on EE curriculum.	4.57

B.2.6 Evidence of Program Improvement

The EE department has experienced dramatic growth since the last ABET visit in 2000. We have added nine outstanding new faculty members to the EE program, bringing the total number of EE faculty to 19 as of June 2006, and we plan to add two more this year. A modern new facility, Engineering Building II, has been built for the faculty and students in Electrical Engineering and Computer Science and Engineering (see Section B.6). It includes state-of-the-art classrooms, teaching laboratories, experimental laboratories, office space, design studios, and meeting rooms.

The EE teaching program has gone through a major modernization as well, as evidenced by the rapidly expanding EE curriculum. Table 7 shows the new courses added during 2001-2006. As seen in the table, the EE program has added nine new courses and made modifications/improvements in seven existing courses. In response to student input, in 2004-2005 the EE Undergraduate Committee implemented a new program of "focus areas" based student advising, as detailed above in Section B.1.2.

In 2005, the EE department began a policy of surveying alumni to better quantify the progress achieved by the EE program, as well as to identify areas that still need improvement. The results of the 2005 Alumni Survey on PEO assessment are shown in Figure 10, with a score of 1 being worst and 5 best. Most of the PEOs scored near the maximum of 4-5, indicating a strong confidence of the alumni in the EE program at UCR. The only possible weakness appears in PEO6 (note this is from the old set of PEOs) relating to teamwork and communication skills, which scored slightly lower. Thus, to strengthen the EE graduates ability to communicate effectively, the EE department recently voted in favor of expanding the course requirements to include ENG 180 Technical Communications:

> ENGR 180. Technical Communications (3) Lecture, 2 hours; workshop, 3 hours. Prerequisite: ENGL 001C or ENGL 01SC. Develops oral, written, and graphical communication skills needed by scientists and engineers. Topics include giving oral presentations, working in small groups, and preparing and critiquing reports, proposals, instructions, and business correspondence. Workshop involves extensive oral presentations, communication in small groups, and written projects.

We believe adding ENG 180 as a required course will improve the EE program, and in particular our graduates ability to communicate effectively and work well in a team environment.

Figure 11 shows data obtained from the Senior Exit Surveys. These data are particularly useful to quantify program improvement because they show a six-year trend from 2000 to 2006. In Figure 11, we focus on the survey data of most relevance to the PEO, in particular:

1. Quality of Instruction.
2. Quality of Courses.
3. Breadth of Curriculum.
4. Computing Resources.
5. Laboratory Facilities.

Table 7. New and/or modified courses introduced during 2001-2006 period.

Course	Title	First Effective	Change Effective	Status
EE 002	Electrical & Electronic Circuits	Fall 2002	Fall 2005	New
EE 010	Intro to Electrical Engineering	Fall 2003		New
EE 115	Intro to Communication Systems	Fall 2006	Fall 2006	Change
EE 120A	Logic Design	Fall 2002	Fall 2004	Change
EE 134	Digital Integrated Circuit Layout and Design	Fall 2001		New
EE 135	Analog Integrated Circuit Layout and Design	Winter 2002		New
EE 136	Semiconductor Device Processing	Spring 2005		New
EE 137	Intro to Semiconductor Optoelectronic Devices	Fall 2005		New
EE 150	Digital Communications	Winter 2001	Winter 2006	Change
EE 160	Fiber-Optic Communication Systems	Spring 2005		New
EE 175A	Senior Design Project	Winter 2002		Change
EE 175B	Senior Design Project	Winter 2002		Change
EE 190	Special Studies	Spring 2002		New
EE 191	Seminar in Electrical Engineering	change pending	Fall 2006	Change
EE 191E	Seminar in Electrical Engineering	change pending	Fall 2006	Change
EE 198I	Individual Internship in Electrical Engineering	Spring 2006		New

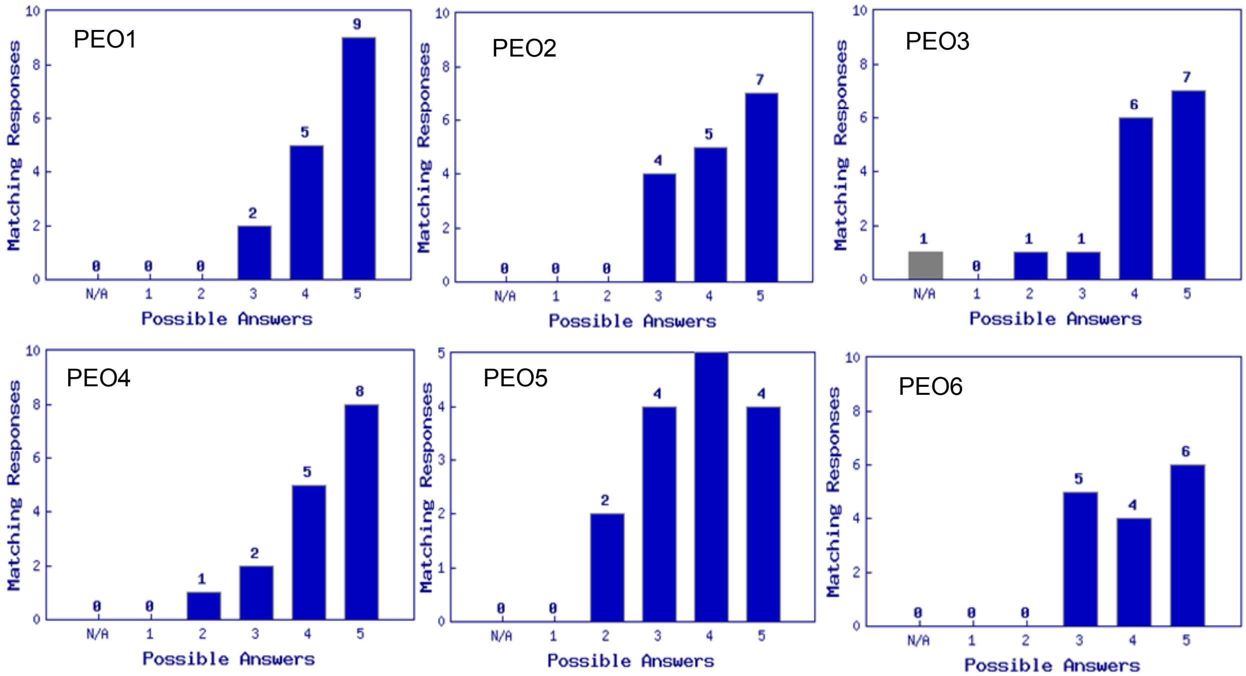


Figure 10. Alumni survey assessment of the EE PEOs, with 1 being worst, 5 best.

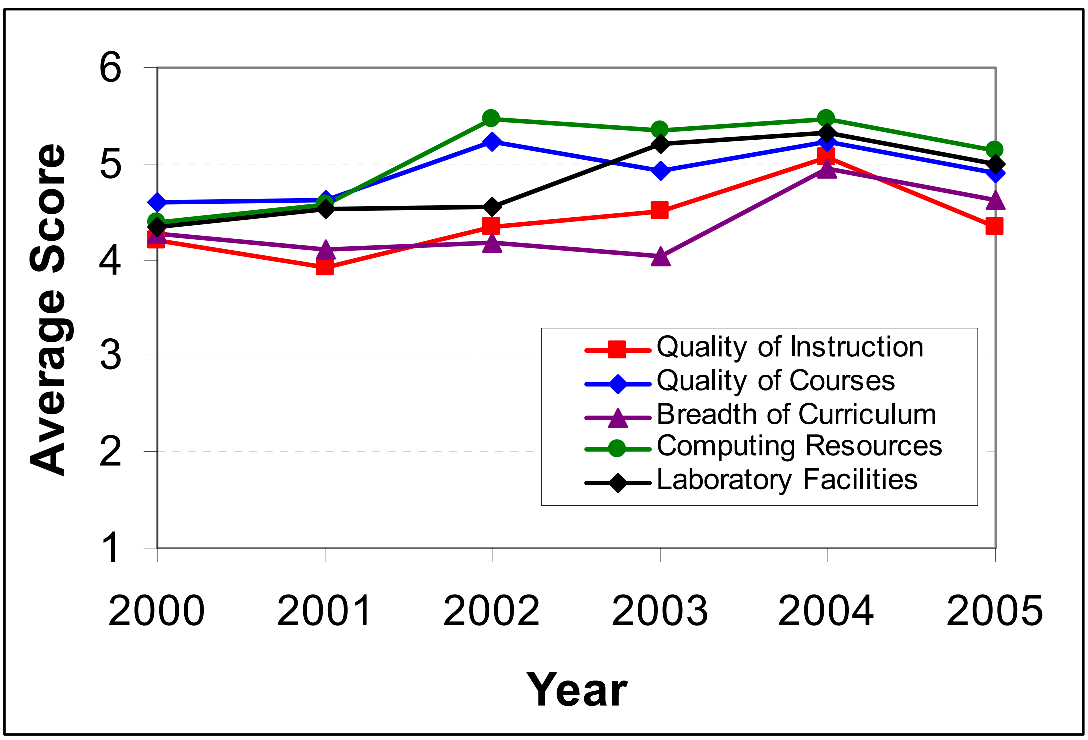


Figure 11. Program relevant data obtained from Senior Exit Surveys.

While Figure 11 shows some fluctuations from year to year, the overall trend is positive, providing evidence of program improvement in the above areas. Additional data from Senior

Exit Surveys, also relevant to PEOs, is presented in Section B.3 and discussed below in relation to program outcomes.

During the past two years, the EE department has considerably strengthened its education quality control process, adding the instructor “sign-on,” and relevance matrix requirements, as detailed in section B.3.2. Work is continuing to improve the processes. For example, we are currently developing a new web-based system for data collection and monitoring that will replace the current “course file” based system. We hope this will improve the ease-of-use, accuracy, and data-collection capabilities of our process.

The Bourns College of Engineering initiated an alumni survey (not to be mistaken with the senior exit survey) in 2006 to begin tracking how well our graduates are achieving our program objectives. The College has approximately 600 alumni who graduated between 2000 and 2003, and who thus are in that “window” of interest to ABET – three to five years after completion of the bachelor’s degree. We use a single survey tool for all alumni. It is designed to quantify the extent to which our alumni are achieving objectives common to all of the College’s degree programs; these include the ability to succeed in graduate school, the ability to succeed in industry, the ability to work in teams, the ability to apply mathematics and engineering principles on the job, and the ability to contribute to the profession through inventions and publications. The current methodology begins with an e-mail message from the dean to the target alumni, followed by a second e-mail containing the actual survey. College staff then follow up by phoning those who do not respond.

The response to the alumni survey so far has been low – less than 10%. Going forward, we expect to increase the response rate by (1) working with UCR’s alumni relations office to improve our contact database and (2) making more contacts via phone or a web-based interface. Since each alumnus will be in the survey “window” for three years and the overall population is relatively small, we are confident of obtaining data on a very high percentage of alumni at least once in the five years after graduation. This will provide us with good, quantifiable data on the performance of our alumni with respect to our program objectives. It should be noted, however, that the survey results will always be a trailing indicator because of the long lag time between a change to the curriculum and the ability to measure what impact it has on our alumni’s success and effectiveness three to five years after graduation.

Based on the limited returns from the pilot study in 2006, we are seeing high proportions of our alumni achieving the prescribed degree objectives (Table 8). The survey, the tabulated results, and the written comments of the respondents will be available for review during the site visit.

Table 8. Results of 2006 Bourns College of Engineering alumni survey.

Metric	% of alumni answering yes
Took admissions test in pursuit of a postgraduate degree	>60
Was accepted to graduate school	~75
Plan to attend, is attending, or has attended graduate school	~70
Have completed an advanced degree	~20
Accepted a job offer within three months of graduation	>60
Accepted a position related to the engineering degree earned	80
Had a starting salary in the range of $40,000 to $60,000	50
Currently earning more than $75,000	>30
Still working in the field in which the engineering degree was earned	80
Have worked on projects with multidisciplinary requirements	70
Have worked on projects that have addressed professional and ethical concerns	60
Are required to apply mathematics and engineering principles on the job	>90
Consider the UCR education reasonably sufficient to conduct their duties	~90
Have collaborated on projects leading to patents or other types of disclosures	40
Have published in professional journals	~30

B.2.7 Improvements in Freshman Chemistry

Achievement of Outcome 1 (see Section B.3) depends heavily on coursework offered in departments not controlled by the Bourns College of Engineering. We have noticed that freshmen historically have had difficulty with the freshman series of courses in Chemistry (Chem 1A, 1B, 1C). The failure rates for engineering undergraduates in Chem 1A has been around 25% or so, with undergraduates in the sciences failing at a slightly higher rate.

These courses are structured primarily as lecture courses, with 3 hours of lectures per week, and an accompanying 3-hour laboratory component, amounting to a total of 4 quarter units. These courses are large service courses, and have total enrollments of 1300+ across all sections.

An experiment was conducted by the College of Natural and Agricultural Sciences to test the effectiveness of adding an hour of discussion on overall success rates in these classes. A number of calculus-ready students were selected, and the students were divided into two groups, only one of which was required to participate in an hour-long discussion section each week.

Each Chem 1 discussion section of 20-25 students was led each quarter by one of three experienced TAs appointed by the Chemistry Department. For these discussion sections, students were required to complete homework problems assigned by the course instructor, took quizzes covering the lecture material, and participated in other appropriate activities designed to clarify lecture principles and concepts. Access to on-line practice exams was made available to students in these sections. As far as possible, students stayed in the same Chem 1D discussion section for each of the three quarters of the course.

These students also participated in mandatory workshops throughout the year given by peer mentors who were trained and supervised by the Learning Center. Workshops focused on problem-solving skills, test-taking skills, library usage, and other university acclimatization issues. These workshops taught such skills not in the abstract, but in the context of the Chem 1 course material. The students developed a sense of community with their peer mentor and other students in the group, and developed study strategies as academic partners for success in the sciences.

The results of this experiment are summarized in Table 9, which shows the failure rates (a D or F grade) for students who attended discussion sections ("participants") and those who did not ("non-participants").

Table 9. Failure rates in traditional and enhanced approaches for Chemistry 1.

	Non-participant section 1	Non-participant section 2	Participant section	Rate for <u>Participants</u> Only in Participant Section	Rate for <u>Non-Participants</u> Only in Participant Section
CHEM 1A	110/292 (37.7%)	78/306 (25.5%)	42/319 (13.2%)	4/192 (2.1%)	38/127 (29.9%)
CHEM 1B	27/169 (15.9%)	60/198 (30.3%)	23/261 (8.8%)	4/132 (3%)	19/129 (14.7%)
CHEM 1C	24/105 (22.9%)	28/161 (17.4%)	10/230 (4.3%)	1/119 (0.8%)	9/111 (8.1%)

Sections with no participants are shown as "non-participant sections." The third column ("participant section") shows the outcome for a section with between 50%-60% participants. This section had the smallest fraction of D/F grades.

A breakdown of the participant and non-participant D/F rates for the lecture-only section is shown in the last two columns. Clearly, the D/F rate for participants was by far the lowest of all the students in this course, even when compared with students in the same lecture section. Not all other variables were controlled, however. For example, the non-participants in this section included non-freshmen and some were repeating the course.

Given the clear evidence of the positive contributions that the discussion section has made to student success, BCOE has agreed to partner with the College of Natural and Agricultural Sciences to adding a discussion section to the Chem 1A/B/C courses, and test its effects on student success in a regular quarter. If the outcomes are positive, we will explore the option of making the discussion a permanent feature of the course.

B.3 Program Outcomes and Assessment

This section describes our Program Outcomes (Section B.3.1) and our assessment of them (B.3.2). Section B.3.3 presents an example of our outcome assessment, evaluation, and improvement cycle. Section B.3.4 describes evidence of program improvement made in response to the assessments. Finally, Section B.3.5 describes the materials that will be available to examiners during the site visit.

B.3.1 Program Outcomes

In accordance with ABET Criterion 3, the program outcomes describe what students are expected to know and are able to do by the time of graduation. The EE department adopted the following eleven program outcomes that we believe all electrical engineering graduates should possess:

O1. *Ability to apply knowledge of mathematics, science, and engineering.* **[PEO1, PEO2, PEO3, PEO4]**

O2. *Ability to design and conduct experiments, as well as analyze and interpret data.* **[PEO1, PEO2, PEO3]**

O3. *Ability to design a system, component, or process to meet desired needs.* **[PEO2, PEO4, PEO5, PEO6]**

O4. *Ability to function on multidisciplinary teams.* **[PEO5, PEO6]**

O5. *Ability to identify, formulate and solve engineering problems.* **[PEO1, PEO2, PEO3, PEO4]**

O6. *Understanding of professional and ethical responsibility.* **[PEO5]**

O7. *Ability to communicate effectively.* **[PEO2, PEO6]**

O8. *Broad education necessary to understand the impact of engineering solutions in a global and societal context.* **[PEO5]**

O9. *Recognition of the need for and an ability to engage in lifelong learning.* **[PEO3, PEO2]**

O10. *Knowledge of contemporary issues.***[PEO2, PEO2, PEO5]**

O11. *Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.* **[PEO1, PEO2, PEO4]**

Outcomes O1, O2, O3, O5, and O11 are sometimes referred to as the "hard" outcomes, as they relate directly to the technical skills required of an engineer. The so-called "soft" outcomes, O4, O6, O7, O8, O9, O10, while not directly related to specific technical or scientific skills, are nevertheless deemed to be important for a successful engineering career in a world of rapidly changing technology and globalization. The program outcomes support the achievement of our program educational objectives. The connections to the PEOs are indicated in brackets next to each program outcome above. Note that we label the outcomes above by numbering 1, 2, 3,…, 11, which corresponds to a, b, c,…, k, in the usual alphabetical notation.

Finally, it is important to emphasize that, while all learning outcomes are considered to be equally important for a graduate of the EE program, they are not necessarily equally distributed in the EE course curriculum. For example, outcome 11, "ability to use the techniques, skill, and modern engineering tools necessary for engineering practice," may be more heavily represented in the EE curriculum than outcome 6, "ethical responsibility." However, the EE students also get exposed to ethical issues in their humanities courses in addition to the EE courses, while the humanities courses may teach very little on outcome 11. We believe the problem of how best to "weigh" each outcome in the EE curriculum has yet to be definitively settled, and requires further study. To better understand this issue, we are continuously measuring the outcome distribution in the EE course curriculum, as discussed in more detail below in section B.3.2, to quantify the trends in how EE faculty incorporate all the learning outcomes into their courses.

B.3.2 Outcome Assessment and Evaluation

The process of continuous program assessment, evaluation, and improvement is depicted in Figure 8. Essentially, this is a quality control process, similar to ISO 9000 in industry. However, while an industry quality control process deals with some device or gadget as the product, we have a far more complex and more difficult product to measure, i.e. the students. As in every control system, our process involves feedback loops. The inner "micro" loop in Figure 8 controls the quality of individual courses, while the outer "global" loop controls the overall program and outcome assessment and improvement process. The two loops operate on different time scales, and are *coupled* in the sense that one loop can effect change in the other. Below we detail the operation of each loop (process), their inter-relationships, and impact on program outcome assessment.

The EE course assessment, evaluation and improvement process, depicted in the inner loop of Figure 8, is intimately related to the program outcomes. To facilitate and document this process, the instructor for each EE course is mandated to prepare and maintain a *course file*, which includes:

1. Standard Information
    - 1.1. Course Outline
    - 1.2. Course Objectives
    - 1.3. Course Matrix (outcomes per objective)
    - 1.4. Evidence of Design
    - 1.5. Evidence of Science
    - 1.6. General Syllabus
    - 1.7. Assessment Process

2. For each instrument (i.e. assignment or test), including homework, quiz, midterm, lab assignment, project, and final exam:
    - 2.1. Copy of the instrument, plus its key or solution if any
    - 2.2. Copies of graded work (best, average, worst)
    - 2.3. Scores placed in Grade Book (in Excel format)

3. Relevance Matrix (in Excel format) covering *sufficient* number of instruments (final exam, labs, etc.) to provide a complete coverage of the course objectives.

4. Feedback and Improvement Actions
   A. Prior Final Report and “Sign-On”
   B. Exit surveys of students and instructors
   C. Grade Book showing per instrument score
   D. Assessment report (based on student performance, relevance matrix, surveys, etc.)
   E. Final report with recommendations for improvement

Prior to the start of the term, each instructor prepares a syllabus, a set of eight (or more) specific *course objectives*, and a *course matrix*. A copy of the course objectives is provided to the students in the first week of class, and the students are surveyed on how well they learned the course objectives during the final week of class. Including specific course objectives is a useful tool for distilling the course curriculum, and its relationship to the program learning outcomes. In this regard, the course matrix is a key tool for quantifying the relationship between course objectives (and hence curriculum) and program outcomes. An example of a course matrix is shown in Table 10 for EE 160. In this example, there are nine specific course objectives. Each objective is rated on a scale of 0-3 for its relevance to the program outcomes.[1] In addition to the course matrix, another useful tool employed in the course improvement process is the *relevance matrix*, introduced in 2005 to better quantify the program outcome assessment and evaluation of each course. An example of a relevance matrix is shown in Table 11 for EE 140. The relevance matrix allows an instructor to correlate the student performance with the course objectives, and hence outcomes (e.g. the average grade for each instrument forms a “row vector” than can multiply the relevance matrix, thus obtaining a vector with each element representing the achievement of the corresponding course objective). These quantitative tools are employed, along with analysis of student exit surveys, for course assessment and evaluation.

At the end of each course, the instructor writes the *assessment report*, including his/her recommendations for improvement. The feedback loop is “closed” when the next instructor reads the prior assessment report, and “signs-on” to the improvement actions. The instructor sign-on, introduced in 2003-2004, is a key mechanism to propagate the knowledge learned by one instructor forward to the next instructor. An example of instructor sign-on is shown in Appendix IIIB for EE 116. The results of all the course outcome assessments are integrated and fed into the outer (“global”) feedback loop, along with additional data from senior exit surveys, alumni surveys, and industry board of advisors (BOA). The data are analyzed by the ABET Committee with input from the Undergraduate Committee. Thus, specific recommendations for improvement are generated for faculty review. Note the key constituencies in this process include faculty, students, alumni, and industry. The program faculty review occurs at least once every year, typically in early fall quarter. At the faculty review meeting, the recommendations made by ABET Committee are discussed and voted on. If approved by the faculty, specific improvement actions are assigned by the Chair to the relevant faculty committees for

[1] The numerical system is based on an idea presented by Fiedler and Brent in the article “Designing and Teaching Courses to Satisfy the ABET Engineering Criteria” (*Journal of Engineering Education*, January 2003).

implementation, thus closing the feedback loop for the EE program assessment, evaluation, and improvement process. An example of this process in action is given below for the 2004-2006 two year cycle.

Table 10. Course matrix for EE 160, Fiber Optic Communication Systems, taught in 2006. Each objective is rated on a scale of 0-3 for relevance to program outcomes.

Item	OUTCOME-RELATED LEARNING OBJECTIVES	OUTCOMES										
		1	2	3	4	5	6	7	8	9	10	11
1	Understand and be able to explain the physical principle for how an optical fiber guides light.	1						2			1	1
2	Be able to estimate the limitations on transmission speed and/or distance caused by fiber dispersion.	3		1		2						3
3	Understand and be able to explain the advantages, and limiting characteristics of semiconductor lasers as used in fiber-optic communications.	2	1	1				2			1	1
4	Understand and be able to explain the operating principles of semiconductor photodetectors, and the main noise sources that corrupt the detection process.	2	1	1				2			1	1
5	Be able to estimate the receiver sensitivity for P-I-N, APD, and optically pre-amplified receivers.	3		1		2						3
6	Understand and be able to explain the operating principle, advantages, and limitations of erbium doped fiber amplifiers.	2	1	1				2			1	1
7	Learn how to use basic fiber-optic test equipment for measuring optical power, optical signal spectrum, and receiver sensitivity.	1	3		3	1						3
8	Design fiber-optic communication links limited by loss and/or fiber dispersion.	3	1	3		3		1			1	3
9	Be able to write an essay on the history, and impact of fiber-optic technology on telecommunications.							3	3	2	3	
	SUBTOTALS	17	7	8	3	8	0	12	3	2	8	16

Table 11. Relevance matrix for EE 140, Computer Visualization, taught in 2006. The course grading instruments, as shown on top row, are Labs (L), Homeworks (H), Midterm (M), Final (F), and Project (P).

	L1	H1	H2	H3	L2	H4	L3	L4	H5	L5	H6	H7	L6	M	F	P
Obj1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Obj2	1	0	0	1	1	1	1	1	0	0.5	0	0	0.25	0.5	0.5	1
Obj3	1	0	0	1	1	1	1	1	0	0.5	0	0	0	0	0	0.5
Obj4	0	0	0	0	0	0.25	0	0.25	0.5	0.5	1	1	1	0	0.5	1
Obj5	0	1	1	1	0	1	0	0.25	1	0.25	1	1	0.5	1	1	0.25
Obj6	0	0	0	0	0	0	0	0.25	0	0.5	0	0	1	0	0	1
Obj7	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Obj8	0.25	0	0	0	0.25	0	0.25	0.25	0	0.25	0	0	0.25	0	0	1

B.3.3 Example of Outcome Assessment, Evaluation, and Improvement Cycle

As a specific example of our process in action, we describe the two-year, 2004-2006, assessment and improvement cycle.

Assessment Process

The ABET committee collected and analyzed the 2004-2005 data from the course files, senior exit surveys, alumni surveys, and industry BOA. The EE alumni surveys provided especially compelling data. For clarity of analysis, the data are separated according to “hard” versus “soft” outcomes in Figures 12 and 13, respectively. We note that while the “hard” outcomes tend to average near the maximum score of 5, many of the soft outcomes average significantly lower, near a score of 3-4. These results were confirmed by studying the data obtained from the course files, and in discussions with the industry BOA members. Figure 14 shows the analysis of outcome distributions in the EE course curriculum, obtained from the course files by integrating all the course matrix data for 2004-2005. The data shown in gray bars reflects only the course curriculum (essentially based on faculty input), while the data in orange bars includes a weighting factor for the corresponding course grades achieved by the students. The data in Figure 14 confirmed that the soft outcomes are relatively poorly represented in the EE course curriculum in comparison with the hard outcomes. The end of course assessment data for students and instructors, averaged over all courses in 2004-2005, is shown in Figure 15. The students and instructors were asked to rate the achievement of each outcome on a scale of 1 to 5. Interestingly, while students tended to rate achievement of all outcomes at or above 4, the instructors rate achievement of some of the soft outcomes, especially 4, 6, 7, and 8, significantly lower. This discrepancy between student and instructor perception of outcome achievement provided additional evidence in favor of strengthening the soft outcomes. Additional qualitative data came from discussions with the industry BOA. In particular, BOA members stressed the need to improve student communication skills.

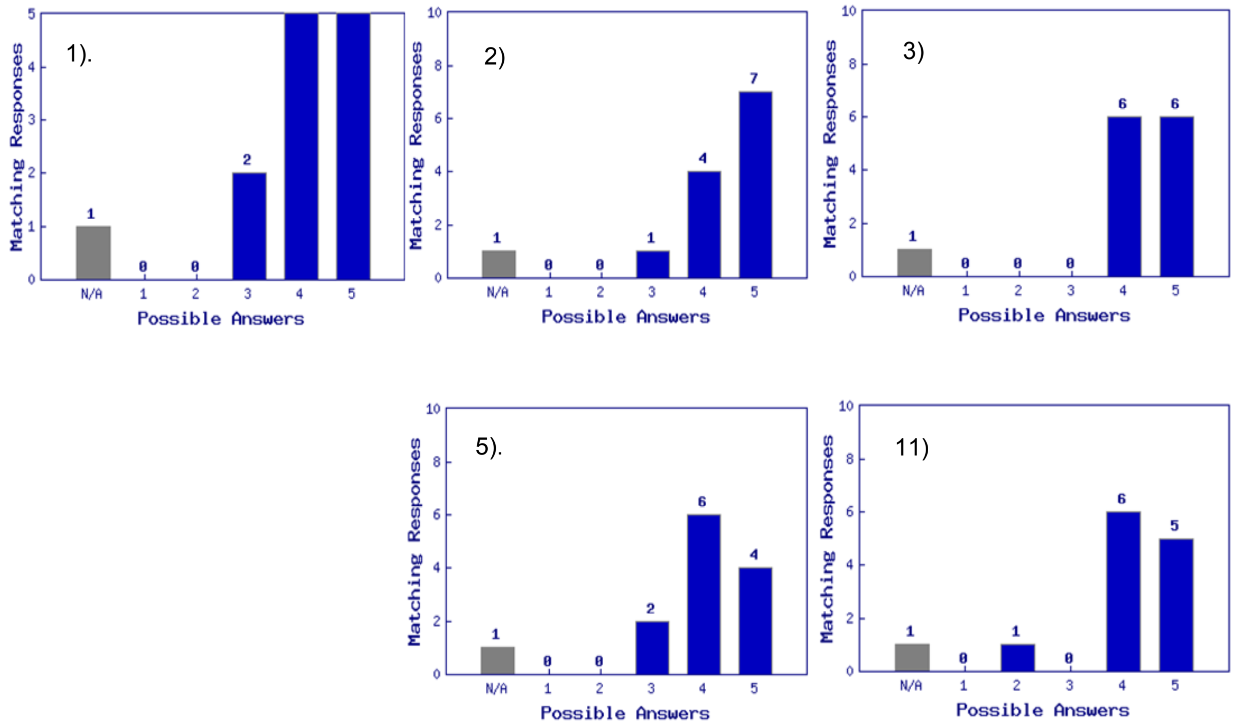


Figure 12. Alumni survey results on the "hard" outcomes. The number refers to the outcome (1 = a, 2 = b, etc., 11 = k).

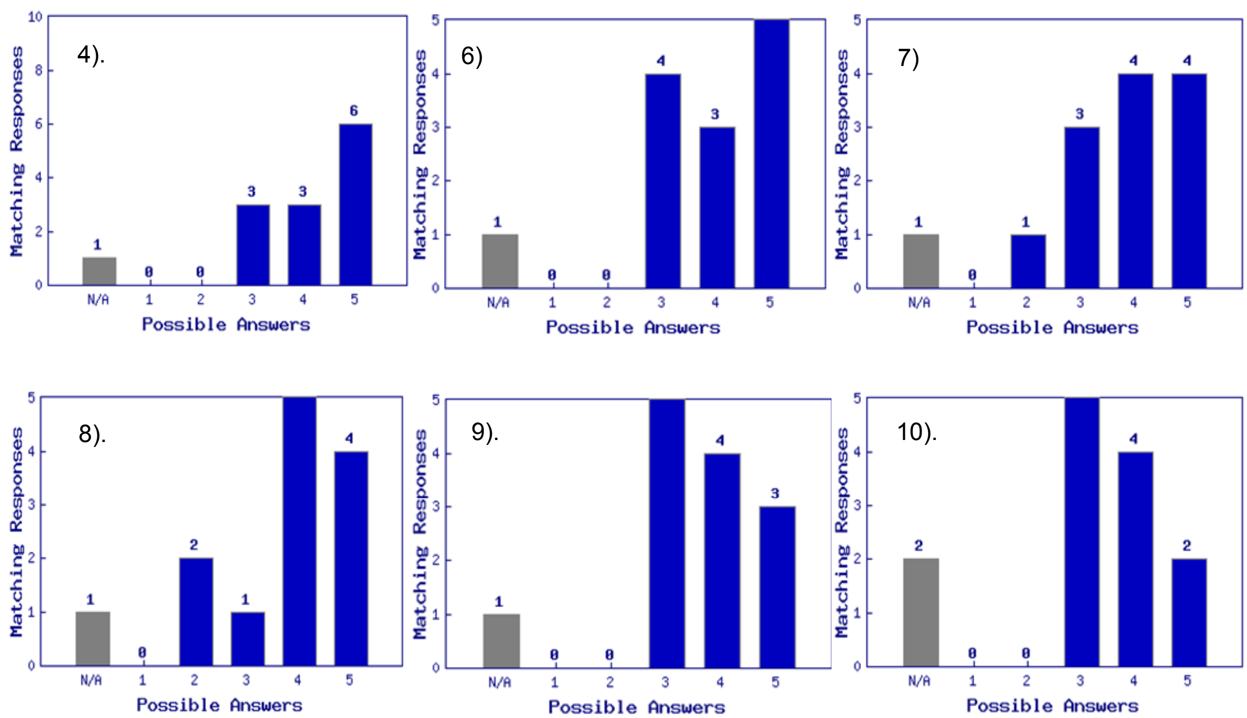


Figure 13. Alumni survey results on the "soft" outcomes. The number refers to the outcome (1 = a, 2 = b, etc., 11 = k).

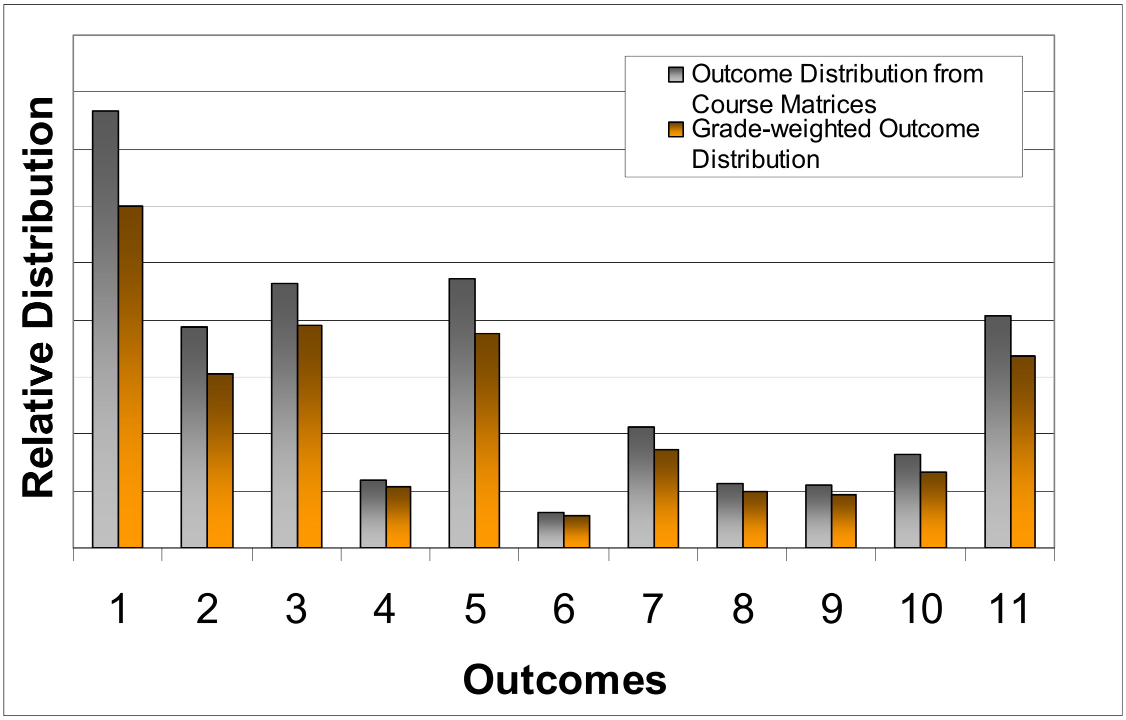


Figure 14. Outcome distribution in course curriculum.

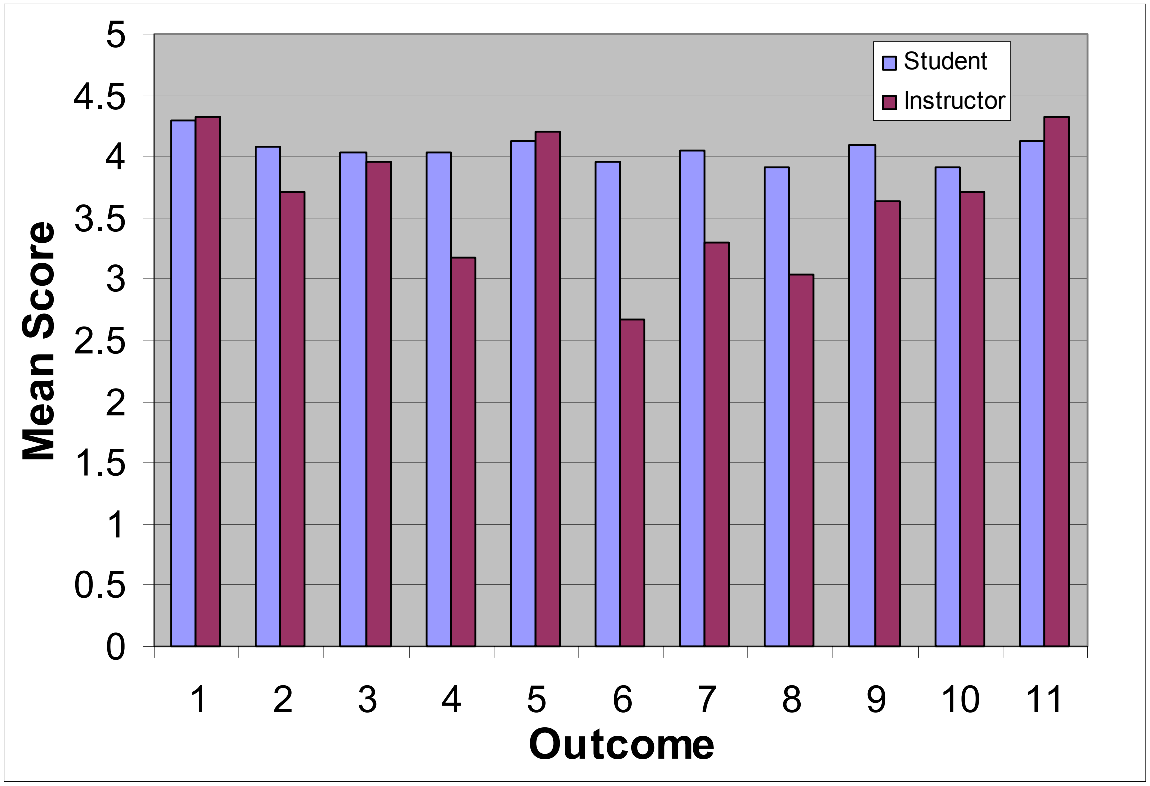


Figure 15. End of course student and instructor assessments averaged for all of 2004-2005.

Improvement Actions

Thus, based on both qualitative and quantitative assessment data, analysis, and evaluation, the ABET committee developed specific recommendations for improvement. The recommendations included introducing new courses with greater focus on the soft outcomes, and/or strengthening the existing courses. The issue was discussed at a faculty meeting in fall 2005. The EE faculty agreed to strengthen the existing course curriculum in the soft outcomes. Taking EE 175 as a specific example, we introduced a new lecture on “Environmental Issues.” Additionally, a unique *interdisciplinary* collaboration with the Music Department starting in 2006, with a view toward strengthening outcomes O4, O6, O8, and O10. EE 160, Fiber-Optic Communication Systems, introduced new reading assignments, and an essay requirement on the history of fiber optic technology and its impacts on society (O7 and O8). Several instructors have modernized and/or added new course textbooks in 2005-2006, such as EE 134 and EE 160, in accordance with outcome O10. In response to industry BOA suggestions to improve student communication skills, the faculty recently considered (faculty meetings of March 8 and March 10, 2006) the adoption of a new technical writing course (ENG 180) requirement to strengthen program outcome O7. While most faculty members agreed that such a course would be very useful to the students, the initial vote on March 8 split on whether to make it a requirement, thus displacing an advanced technical elective. Due to the importance of this issue, the Chair scheduled a second meeting on March 10, where the faculty debated again, and this time approved the adoption of ENG 180 as a required course for graduation.

B.3.4 Evidence of Program Outcome Achievement

The grade-weighted outcome distribution shown in Figure 14 provides some measure of outcome achievement by the students. As expected of an engineering curriculum, the engineering focused outcomes 1, 2, 3, 5, and 11 show the strongest response. Note that the grade-weighted data (shown in orange) follow almost exactly the same distribution as the outcome distribution obtained from course matrices alone (shown in gray). This indicates, at least from the point of view of grades, that the students are achieving the outcomes as desired by the instructors. Otherwise, there would likely be a discrepancy between the distribution obtained from instructor data alone, and the student grade-weighted data (e.g. as we observed a difference between students and instructors in the end-of-course assessment data).

The senior exit surveys provide particularly compelling evidence on program outcome achievement and improvement because they were taken annually over a relatively long time scale (~ 6 years). Figure 16 shows the longitudinal data from 2000 to 2005 on several topics that relate directly to the program outcomes. The relevant outcomes are listed in the Figure 16 legend next to each question topic. The data show a clear positive trend from 2000 to 2005; most of the outcomes either held steady or improved. Note that the curves are also *converging* toward each other as they improve, implying a convergence in the quality of all the outcomes toward a uniform standard. The strong “spike” in 2002 in the score for Design Experience is most likely due to the hard work the EE faculty put into improving the EE 175 Engineering Design Project course. As shown in Table 7, a new improved version of EE 175A/B was introduced in 2002, which correlates perfectly with the spike in the Design Experience data shown in Figure 16.

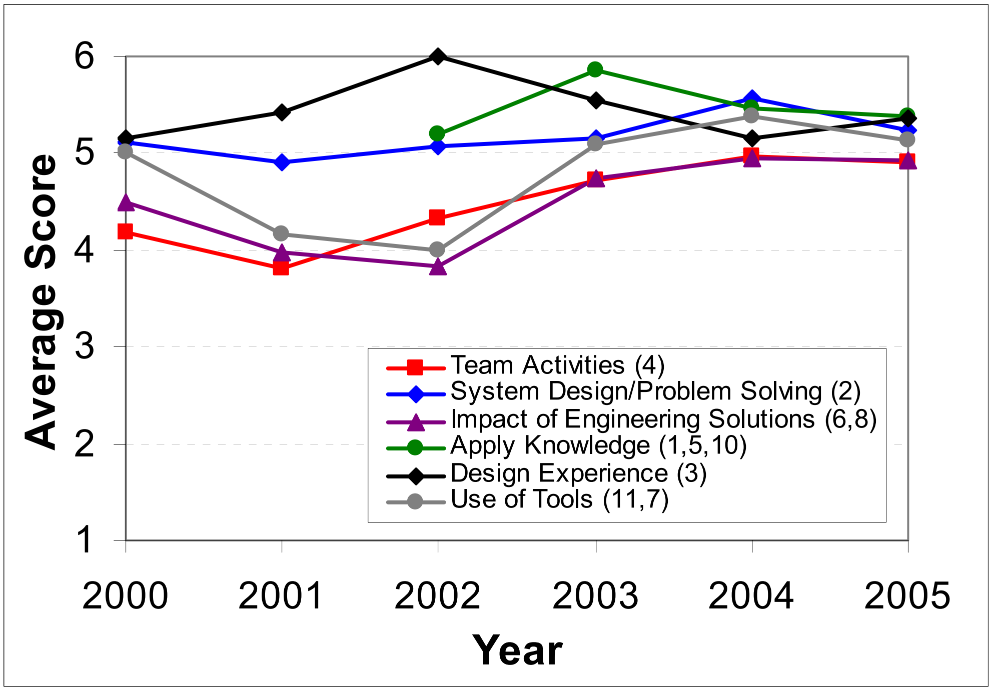


Figure 16. Outcome relevant data from Senior Exit Surveys. Relationships to specific outcomes are indicated in the legend.

Additional evidence is obtained from the 2005 Alumni surveys shown in Figures 12 and 13. Most of the outcomes scored very well in the survey, scores concentrating near 4 (out of 5), although the "soft" outcomes scored relatively lower than "hard" outcomes. We recently implemented a new BOA survey that asks directly how well (on a scale of 1-5) our EE graduates achieve the learning outcomes. The results of the new 2006 BOA survey are shown in Figure 17. Again, the BOA survey shows good results for the "hard" outcomes, and relatively weaker results for the soft outcomes, especially outcome 10 on "knowledge of contemporary issues." We have made specific program adjustments to improve the soft outcomes as discussed above, and we intend to continue monitoring the Alumni and BOA surveys closely for signs of improvement in 2007 and 2008.

We found that Outcome 6 on the "understanding of professional and ethical responsibility" is particularly difficult to implement in an engineering curriculum. However, the Electrical Engineering faculty is committed to this noble goal. Indeed, intellectual honesty is a bedrock principle of our teaching. The hallmark Electrical Engineering course, EE 175 Engineering Design Project, includes many lecture topics which relate to ethics issues, such as Intellectual Property, Engineering Ethics, Engineering Economics, and Environmental Issues. We are also pleased that Electrical Engineering students are exposed to ethics issues in several required humanities courses. For example, Appendix IIID shows the essay topics in English 1B taught in Spring 2006; all the essay topics clearly involve ethical issues. We are continuing to study ways of integrating more professional ethics into the Electrical Engineering students' course of study.

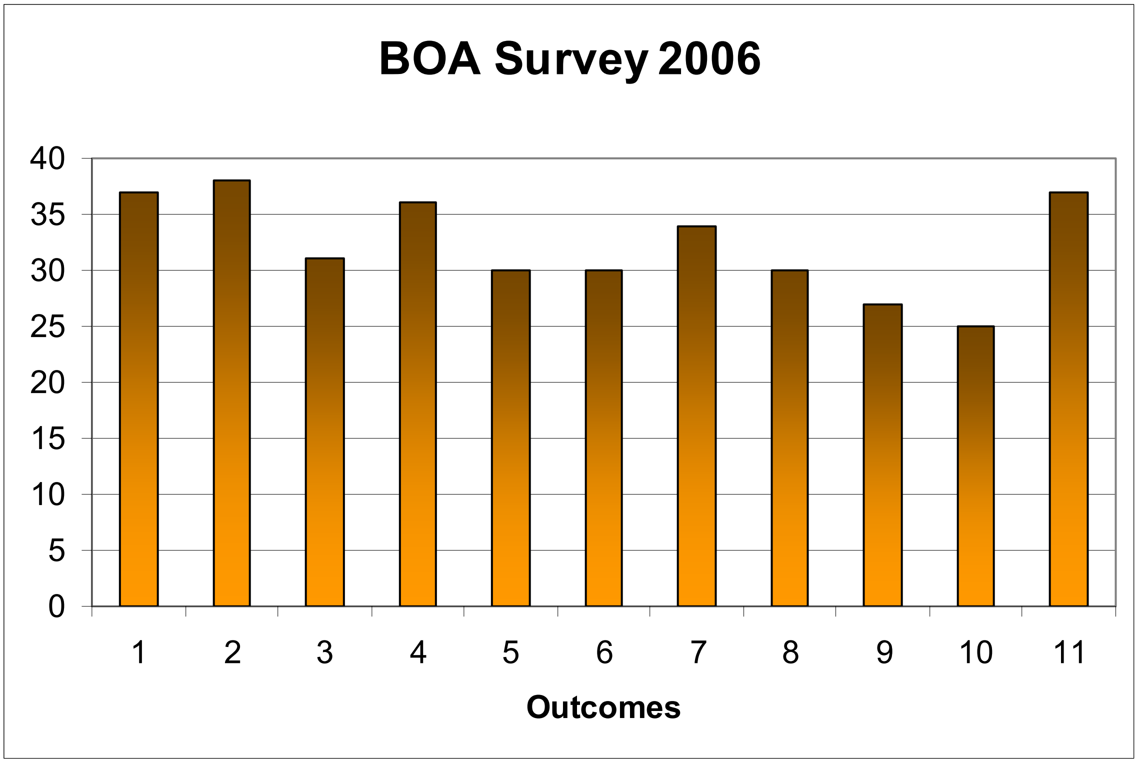


Figure 17. BOA survey results for 2006. Scores for each outcome is summed for all individual surveys to obtain the value given in each outcome column above.

B.3.5 Other Outcome Analysis Mechanisms

The College and the campus also perform assessments to evaluate student expectations and performance. At the campus level, the most significant assessment tool is the UC Undergraduate Experience Survey, or UCUES. This is a uniform questionnaire, which is administered at all UC campuses. Each campus also is able to add its own questions. The questionnaire is administered every two years, although there is some discussion of converting to an annual format. While UCUES does not enable us to compare our student responses directly with those of non-UC campuses, it does provide a basis for comparison with all of the other UCs with undergraduate programs (note that UC San Francisco has no undergraduate programs).

UCR also conducts an annual senior survey. This survey is not particularly valuable for assessing engineering outcomes because it is designed to obtain information from all seniors throughout the campus.

The campus has developed a single relational database (200 fields) to answer queries on student performance and trends, with longitudinal information. There is tiered access to different levels of detail; this protects the privacy of the students for whom data are gathered. As the database is populated with new information, it should be a valuable resource for providing information on the performance of engineering students in non-engineering courses and for evaluating their overall experiences.

The Bourns College of Engineering will begin to administer a new assessment tool in the fall of 2006. All incoming freshmen will receive a questionnaire designed to explore their expectations. In the fall, a second questionnaire will examine how well the actual experience matched the expectations.

B.3.6 Materials Available for Review

The following materials will be made available for review during the ABET accreditation visit:

1. All the *course files*, including the material described in section B.3.2 above, for two full academic cycles 2004-5 and 2005-6.
2. Eleven *outcome files*, which will present the evidence for outcome assessment, improvement, and achievement, organized by outcome for clarity of presentation and analysis.
3. Copies of student senior design presentations, including video recordings of the oral presentations in 2006.
4. A presentation given by the Chair, Prof. Roger Lake.
5. A tour of the teaching facilities, including the teaching labs.
6. Additional information, such as faculty meeting minutes, department 5-year plan, ABET meeting minutes, BOA meeting minutes, senior design presentations, and new results from Senior Exit Surveys, and Alumni Surveys.
7. EE faculty and staff will also be available for interviews.

Every effort will be made to provide any additional materials requested by the ABET team.

B.4 Professional Component

The Electrical Engineering curriculum, shown in Table I-1 in Appendix I, is designed in accordance with the program educational objectives, and with a view toward achieving the program outcomes. The curriculum can be classified roughly into five basic components:

1. <u>Foundation Mathematics and Sciences</u>: This component, typically covered during the first two years of a student's education, includes the foundation courses in Mathematics, such as Calculus, Vector Analysis, Linear Algebra, Probability and Statistics, and Differential Equations; and the Sciences, such as Physics, Chemistry, and Biology. A total of 51 credit hours are devoted to these critical foundation courses.

2. <u>General Education</u>: We feel strongly that a good engineer must have a broad education to appreciate his/her role in society. Thus, all engineering students are required to select and take elective courses in the Humanities and Social Sciences, worth at least 24 total credit hours. Additionally, 12 credit hours of English, focusing on communication and writing skills, are required during the freshman year.

3. <u>Foundation Engineering</u>: This component is similar to 1 in that it covers *foundation* courses required for most engineers, including basic circuit theory (EE 01 A/B), computer science

(CS 010, CS 061), and mechanical engineering (ME 010). These courses are typically taken in the sophomore year, and add up to 20 total credit hours.

4. Electrical Engineering: This component includes all the *advanced* courses required for Electrical Engineering, such as Advanced Electronic Circuits and Devices, Electromagnetics, Digital Systems, Signal Processing, DSP, and Communication Systems, as well as advanced technical electives. This component includes most of the "meat" of the pure Electrical Engineering curriculum (with the exception of EE 01 and EE 175 discussed elsewhere in 3 and 5). Not surprisingly, it requires a very substantial investment of 66 total credit hours.

5. Engineering Design Project: A key component of professional development for an engineering student must involve the design process. Especially important are the design, teaming, and communication skills necessary for achieving success in industry. For this purpose, the EE faculty developed EE175 A/B Senior Design Project, a required 8 credit hour two-quarter course sequence. We view the Senior Design Project as the culmination of all the course work in the bachelor's degree program in Electrical Engineering. In this comprehensive two-quarter course, students are expected to apply the concepts and theories of electrical engineering to a novel engineering design project. A written report, giving details of the project and test results, and an oral presentation giving the details of the project, is required to complete the course satisfactorily. The syllabus for EE 175 is shown in Appendix I-B. The EE 175 lectures relate to all aspects of engineering design and practice. This includes the technical issues relating to the design process, as well as equally important aspects of engineering practice, such as ethical, environmental, economic, marketing, and intellectual property issues. As a major component of the EE course curriculum, EE 175 is continuously modernized and improved. For example, recently a new lecture on Environmental Issues was developed and added to the EE 175 curriculum. Other new or revised lecture topics include Intellectual Property, Engineering Ethics, Economics, and Marketing. Typically, 4-5 faculty instructors are involved in teaching EE 175, with additional faculty serving as advisors for the student projects. This arrangement exposes the students to design problems in many different disciplines of Electrical Engineering. Since students often choose to do their design projects in a faculty member's laboratory, the projects are often linked with state-of-the-art equipment. We recently introduced a unique interdisciplinary collaboration with the Music department faculty, whereby EE 175 students can focus their design projects on applications in music and sound technology.

The student's professional preparation can also benefit from involvement in professional engineering societies. Appendix II lists the professional engineering societies and other relevant student organizations that help students build professional skills and networks. The Appendix also describes the Career Center, whose services include assistance with resume preparation, interviewing skills, internships, and placement. The Career Center's mock interview service is conducted in conjunction with student professional societies, including the Society of Women Engineers and the IEEE. In 2005, companies that provided interviewers for this program were Fleetwood Enterprises, Kroger, and Raytheon. In 2006, participating companies were Ambryx Biotechnology, the City of Riverside, Fleetwood, Kroger, and Luminex.

B.5 Faculty

B.5.1 Faculty Composition, Growth and Workload

The Electrical Engineering faculty is a professionally active, diverse group whose activities and expertise are well-balanced across the four general instructional areas of the department: (1) nano materials, circuits and devices, (2) control and robotics, (3) intelligent systems, and (4) communications and signal processing. The current faculty size is 18.1[2] tenured/tenure-track professors. The department has hired nine faculty members since the last self-study; in addition, one faculty member's appointment in Electrical Engineering increased from 25% to 100%, for a total increase of 9.75 full-time equivalent (FTE) faculty appointments during the review period. This increase in FTE faculty is aligned with the Department's strategic plan to reach a target faculty size of 31 FTE faculty by 2010 in response to a growing undergraduate student body. Ongoing searches for faculty are strategically conducted to identify and attract outstanding faculty with a strong foundation in the basic EE sciences and research interests confluent with the department's strengths and towards emerging research in electrical engineering, including nanometer integrated circuits and systems; biomedical systems; radio frequency, microwave, and photonics; bio- and network control; and spintronics.

Overall, the department faculty comprises nine full professors, four associate professors, and six assistant professors; two faculty members are women. The standard teaching load for ladder-rank faculty is four courses per three-quarter academic year, the load for Assistant Professors is three courses per year, and faculty performing significant university service[3] also receive one course relief with the Dean's approval. All tenured and tenure-track faculty hold a Ph.D. in Electrical Engineering, and have degrees in fields as diverse as Physics, Mathematics, Computer Science, Materials Science, Metallurgical Engineering, Aerospace Engineering, Business Administration, and Electrical Engineering. In addition to the full-time faculty, highly qualified and motivated adjunct faculty from industry and lecturers participate in our undergraduate and graduate teaching to ensure sufficient personal interaction with students while enhancing the curriculum with their unique backgrounds and experience.

B.5.2 Faculty Involvement with Undergraduate Students

The department's aggressive approach to growing FTE faculty is due in part to a commitment to preserving a low student-to-faculty ratio as undergraduate enrollment grows. EE courses are generally capped at 30 students, allowing all undergraduate students to interact on a personal level with faculty. Enrollment in core required classes such as EE 1A/B, EE 100A/B, EE110A/B can be as high as 60-80 students; these classes require a lab component, which are led by teaching assistants and contain no more than 32 students per lab. All faculty hold regular office hours to meet with students on a drop-in basis. (It is interesting to note that one EE faculty member, Professor Beni, encouraged his students to submit questions to him via e-mail rather

[2] The 0.1 FTE reflects the appointment of a faculty member with a 90% Governor's appointment as Director of the California Council on Science and Technology.

[3] Significant university service appointments that currently receive relief of 1 course per year include department appointments as Department Chair, Graduate Program Advisor, and Undergraduate Program Advisor; Bourns College of Engineering appointments as Director of a major Center; and campus appointments to the Committee on Academic Personnel.

than simply visiting him in his office. His purpose in doing this was to build students' writing skills, since it is likely that as professionals they will have to work on physically dispersed teams and will communicate to a large extent by e-mail. Student response to this was sharply negative; there were many complaints to the department chair and the Student Affairs office that Professor Beni was not honoring his obligation to provide sufficient office hours.)

In the senior year, all students participate in EE 175A/B, the capstone course in Senior Design. This course series is comprised of 4-5 sections of 10-15 students, each led by faculty members from the department's four research areas; these sections provide ample opportunity for quality personal interaction with faculty, whose diverse backgrounds create a rich and varied pool of instructional expertise for the broad range of projects in this course. A recent department effort has also branched out to other areas of interest to students. For example, one section was offered in 2005-2006 led by a Music Department faculty member, who is currently serving as an EE cooperating professor.

Many opportunities exist for undergraduate students in Electrical Engineering to become directly involved in ongoing research in faculty members' laboratories. Several EE faculty members are recipients of funding from the National Science Foundation's Research Experience for Undergraduates (NSF-REU) program, which afford undergraduate students the unique opportunity to work directly with faculty in research. Professor Dumer is a past recipient of the award, Professor Tan is a recipient of the award for the 2005-2006 academic year, and Professor Balandin's recent award will establish a 10-week summer nanoscale research institute for undergraduate students beginning in Summer 2006. EE Professors Tan and Ozkan actively participate as Faculty Mentors for the University of California Leadership Excellence through Advanced Degrees (UC-LEADS) program, a two-year program of scientific research and graduate school preparation for disadvantaged students. Faculty Mentors in this program assist the student in designing a plan of research and enrichment activities fitted to the academic goals of the Scholar, which includes academic year research experience, paid summer research experience, and attendance/involvement at professional meetings.

All students are encouraged to meet with the department's industry Board of Advisors at the annual advisory board meeting to discuss preparation for engineering positions in the industrial sector. EE faculty also advise two student groups on campus: Professor Dumer advises the Institute of Electrical & Electronic Engineers and Professor Ozkan advises the Society of Women Engineers. These groups involve students in the meetings and activities of these national societies while allowing them to connect and collaborate with fellow students at the local and regional levels. Moreover, the department routinely engages student clubs in campus wide outreach activities, such as Industry Day, Engineering Day, and Chancellor's Receptions.

B.5.3 Faculty Competence to Cover All Curricular Areas

The Electrical Engineering faculty is a diverse group whose research activities fall within each of the four general instructional areas enumerated in Section B.5.1. Faculty involved in the research area of *nano materials, circuits and devices* focus on the theoretical, computational and experimental investigation of nanostructures and development of novel bio-, opto- and electronic materials, devices, and circuits, and MEMS; Professors Balandin, Korotkov, Lake, Liu, Ozkan, and Tan are involved in research and instruction in this area. Prof. Tan also conducts research and teaching in VLSI design. Faculty involved in the research area of *control and robotics* investigate theories and methodologies of modeling, identification and design of control systems, as well as the planning, analysis of motion, navigation, and control of autonomous vehicles and robotic systems; Professors Beni, Chen, Farrell and Hackwood are involved in research and instruction to this end; Professor Hackwood is a Governor's appointee as the Director of the California Council on Science and Technology. Professors Barth, Bhanu, Liang and Roy-Chowdhury conduct research and instruction in *intelligent systems*, developing image processing theories and tools for computer visualization, graphics, machine learning, pattern recognition, intelligent transportation systems, and intelligent vehicle technology; in addition, Professor Barth is the Director of the Center for Environmental Research and Technology, and Professor Bhanu is the Director of the Center for Research of Intelligent Systems, two of the Bourns College of Engineering's three major research centers. Finally, Professors Dumer, Hua, Lyubomirsky, Tuncel, and Xu conduct research and instruction in the area of *communication and signal processing*, investigating and developing communication and signal processing theories, algorithms and systems for wireless and network communications, video and multimedia technologies. These four major research areas, coupled with the program in Computer Engineering, cover all major areas of electrical engineering; furthermore, collaborative interdisciplinary lecturers and workshops with other departments facilitate undergraduate exploration of engineering applications in other fields.

The EE faculty's diversity of experience in both industry and academia expose students to a broad range of instructional and experimental approaches. The faculty analysis in Table I-4 evidence the broad educational backgrounds of the faculty and the high emphasis placed on service and active participation in professional societies; this can also be seen in greater detail in the curriculum vitae provided in Appendix I.C, which demonstrate the faculty's extensive involvement on top editorial boards, international program committees, and their recognition by national and international awards. These tables substantiate the capabilities of EE faculty to provide the highest quality instruction in all the general research areas, and also to guide student investigation of more specialized topics within these areas.

B.5.4 Faculty Currency in Their Fields

Faculty members have resources from initial complements, "various donors" funds, and contract and grant awards to travel to meetings and conferences in their disciplinary areas or in engineering education. Some additional funds are available from the College, the campus, and the Faculty Senate. These resources are sufficient to assure that professors are able to maintain currency in their fields.

B.5.5 UCR Scholarship of Teaching Series

The UCR Office of Instructional Development has established a Scholarship of Teaching lecture series for faculty and instructor to enhance the quality of teaching throughout the campus. Presentations highlight

- The effective use of current and emerging instructional methodologies and technologies.
- Strategies for the introduction of active learning, peer to peer learning, and collaborative approaches in teaching.

- Pedagogical approaches to enhance student engagement and optimize student learning outcomes.
- Effective approaches to teaching and learning in and outside of the classroom.
- The engagement of teaching community in the collaborative, scholarly examination of their practice as teachers.
- The development of assessment tools to measure student learning outcomes.
- The development of a campus culture of evidence regarding our academic programs.

Some lectures are presented by faculty or administrators from UCR, and some by outside presenters. Many deal with new teaching resources and technologies available for use at UCR. For a complete list of all topics presented in the 2005-2006 academic year, please see http://www.oid.ucr.edu/OIDSpeakerSeries.html.

B.6 Facilities

B.6.1 Classrooms

The assignment of classrooms for each course is made by a joint effort between the Student Affair Office of the Bourns College of Engineering and the Scheduling Office of the Registrar Office. The Student Affair Office requests for a room from the Scheduling Office providing the enrollment for the individual class. The centralized Scheduling Office then assigns a room in different buildings on campus with the best availability to accommodate the size of the class. Special request for additional lectures, tutorials, discussions, and examinations can be made by the instructor directly within the College of Engineering. The TA office in Engineering Building II sometimes can be used to hold additional tutorials with prior acknowledgment.

B.6.2 Laboratories

The Electrical Engineering program and the Bourns College of Engineering are established to provide our students extensive hands-on experience from their sophomore year through a mandatory sophomore-level laboratory class (EE 01LA) to a number of different laboratories required by the upper-division courses, including the senior design class (EE 175A,B). Depending on the area of study chosen by the students, they are required to enroll in different laboratory classes. All laboratories require and enhance students' teamwork, communication and technical skills. The courses also introduce the students to the equipment and software used in the laboratories, and provide them with opportunities to learn on state-of-the-art electronic equipment.

Since EE 01LA – Engineering Circuit Analysis I Laboratory – is a requirement for the Electrical Engineering program, all students are to complete the safety orientation session as part of the course.

Table 12 shows the student laboratory facilities in the EE department, as well as the corresponding courses that utilize each lab. In particular, there are four major laboratories:

1. Circuits and Control Systems Lab located in EBUII Room 121
2. Embedded Systems and Logic Design Lab in EBUII Room 125
3. Advanced Systems and Senior Design Lab in EBUII Room 126
4. Communication and Intelligence Systems Lab in EBUII Room 128

Recently, we added two new labs on Photonic Devices and Nano-Device Characterization, corresponding to the new courses EE160 and EE136, respectively.

Table 12. Laboratories utilized by EE courses.

Courses	121: Circuit & Control	125: Embedded Systems & Logic Design	126: Adv. Systems & Sr. Design	128: Comm & Intelligent Systems	137: Electronics & Proto-typing Shop	228: Nano Charact.	B234: Photonics Devices	234: Computer Lab
1AB 2	x							24 hr access
100 A/B	x							
105	x			x				
115 117				x				
120A		x						
128 134				x				
135 140				x				
132 144	x							
136						x		
141/146 152				x				
160							x	
175A/B		x	x	x	x	x		
ENG 10/ IEEE						x		

Graduate courses: 30
Undergraduate courses: 37
Discovery Seminars: 2-3
Summer courses: 4-5

These labs provide excellent educational and instructional opportunities to students during their academic years at the College. There are also two non-instructional laboratories in the EBUII building: the Electronics & Prototyping Shop at EBUII 137 and the Computer Lab at EBUII 234. The Electronics & Prototyping Shop provides and maintains all the equipments and accessories used in the laboratories. The Computer Lab provides a computing environment that allows the students to access to the Internet in doing research projects or to use a number of very powerful fully-licensed software when working on assignments.

All laboratories except 234 are located at the ground floor of EBUII building. They are opened during the assigned schedule with the supervision of the TAs or are accessible with permission from the technical staff. Each laboratory occupies an area of 900 sq. ft. equally and has 16 workstations each. The maximum capacity for each lab is 32 students with 2 students per workstation. Two different sections of labs are offered when the enrollment of the class exceeds the maximum allowable capacity in the lab.

The labs are equipped with oscilloscopes, digital multimeters, function generators, power supplies, and desktop computers, with a quantity of 16 each per lab. Each workstation has one set of the equipment listed above except for Lab 125, which only has power supplies and computers. Some fully-licensed and well-known software/tools are provided on the computers for students' use, such as Cadence, Orcad, PSpice, Matlab, and Codewarrier C Development. Students have an opportunity to gain the knowledge to utilize and manipulate the software in achieving the objectives for the certain courses. This experience is progressively reinforced from the sophomore year to graduation.

The majority of the equipment was purchased for approximately $270,000 in 1998 when the program started. An estimated amount of annual costs of maintenance and upgrades is calculated to be in the range of $3-10k. Although no major upgrades had been done on the equipment, they still function well and have a lifetime of about 20 years.

B.6.3 Information and Computing Resources

The integrated network in the Bourns College of Engineering offers one of the nation's most advanced computing environments to the faculty, staff and students of the College. The network provides ultra-performance workstations for educational purpose in course-related research and project.

The fully-integrated network maintains 189 desktop workstations in six computing labs that are open to all engineering students. All of these labs are accessible to students 24 hours a day, seven days a week. Windows XP, 2003 Server, Linux, Unix, and Solaris are all supported operating systems. It also allows the students to access many course-related applications and centralized personal folders, e-mails, printers, and other services on the network. People can also reach their personal servers or common shared folders on the network from any other workstation off campus.

The network operates on the TCP/IP protocol with a connecting speed ranging from 100 to 1000 mega-bit-per-second and some Power Over Ethernet (POE). All the switches in the building are connected at 1 gigabit fiber connection. Connection between the Bourns College of Engineering and Engineering II buildings are based on 10 gigabit fiber and 10 gigabit wide-area-network (WAN) link. Wireless Ethernet is available in student lounges, offices, labs, and other locations in the College of Engineering buildings.

The computing environment of the College is fully combined with a broader group of networks that tie the entire country and the globe together. The students of the Bourns College of Engineering have the privilege of taking advantage of the state-of-the-art technology in advancing their learning endeavor and research experience at the University.

B.6.4 Accommodating Future Growth

Bourns Hall is approximately 15 years old and provides more than 100,000 square feet of office, classroom, and wet laboratory space for the Bourns College of Engineering. Engineering Building II is one year old and has 98,177 assignable square feet of office, classroom, and dry lab space. These two buildings are ample to accommodate the College faculty, staff, and students at this time.

The University's plan calls for the opening of a Materials Science and Engineering Building in 2008 (Figure 18). This building is designed at 76,940 square feet, including laboratory, office, and classroom space. Laboratory facilities will include a larger clean room nanofabrication facility than the one currently available in the B-wing of Bourns Hall. The building site currently is a recreational field across the street from Bourns Hall.

Formal plans for Engineering III and Engineering IV are not yet in place. Engineering III could be ready for occupancy as early as 2012.

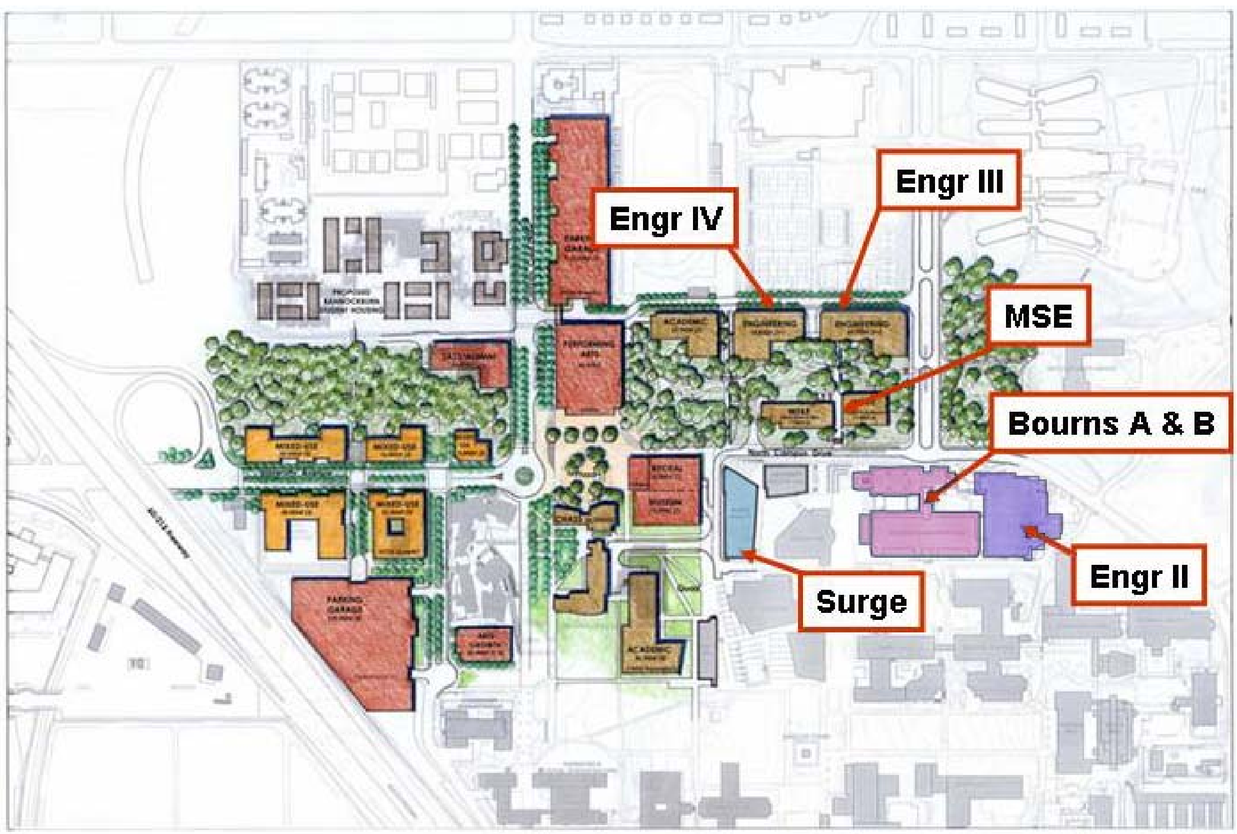


Figure 18. Locations of Bourns Hall (existing) and Engineering II (existing), with the planned Materials Science and Engineering (MSE) Building (2008) and future Engineering III and Engineering IV locations. Surge was the temporary home of the Computer Science and Engineering Department before Engineering II opened in the summer of 2005. The College now has no offices or labs in Surge.

B.7 Institutional Support and Financial Resources

B.7.1 Budget Processes

The University of California, Riverside has a multi-step budget development process. The major steps in the annual process are:

February:	Campus Budget Call Letter is distributed and meetings held with academic units to discuss faculty renewal models
March:	Comprehensive Planning Documents are submitted to the Executive Vice Chancellor
April:	Individual unit hearings with senior UCR management
May:	Input and feedback from Faculty Senate Committee on Planning and Budget to EVC
June:	Final unit budgets announced

In response to the February Budget Call Letter, the Dean's Office in the Bourns College of Engineering requests budget proposals from each academic department in the College. These proposals include undergraduate and graduate student projections, course load information, staffing requirements and needs for additional supply, travel, new equipment upgrades, and miscellaneous expenses. Any additional resources requested are presented in the context of departmental Five-Year Plans. In this way, departments demonstrate their progress in attaining Five-Year goals and request the resources required for the next year to maintain that progress. In most cases, departmental current year (Permanent) budgets are the starting points for the next fiscal year's budgets. UC Permanent Budget resources do not have expiration dates and are used to fund long-term commitments from the University. In addition to Permanent funds, departments can request Temporary funds from the Dean's Office either during the budget proposal cycle or during the fiscal year for exceptional (one-time) expenses. The Dean's Office evaluates annual departmental funding requests and submits a combined budget proposal from the College in late March to the executive vice chancellor's office. After the final College budget is announced in June, any additional resources approved are allocated to the departments beginning the start of the fiscal year, July 1st. Temporary funding requests approved during the fiscal year are allocated at the time of approval or are reimbursed to departments after expenses are incurred. Each department is responsible for monitoring its expenses and projected ending balances during the fiscal year.

B.7.2 Electrical Engineering Department Budget

The EE department operates on a budget of approximately $84,600 per fiscal year. This excludes salary and benefits for permanent employees (faculty, administrative and technical staff) and provisional academic personnel such as lecturers, teaching assistants and adjunct professors. Additional funds are requested and justified to the Dean on an as-needed basis. Currently, neither the department nor the College offer any scholarships, stipends, fellowships, gifts, etc. to undergraduate students, although scholarships are available from research centers (such as CE-CERT).

B.8 Program Criteria

The EE learning outcomes discussed above fully encompass the requirements of the ABET program criteria. The curriculum is designed, and continuously monitored, for achievement of the learning outcomes. Thus, the program requirements are met by completion of the foundation math, science, and engineering classes, humanities and social sciences classes, required EE course work, and advanced EE technical electives. A sample EE program is discussed in section B.2.4.

Appendix I

IA. Tabular Data for Program

TABLE I-1
COURSE REQUIREMENTS OF CURRICULUM
BASIC-LEVEL PROGRAM

Year; Semester or Quarter	Course (Department, Number, Title)	Category (Credit Hours)				
		Math & Basic Science	Engineering Topics*		Hum. & Soc. Sci.	Other
			Engrg Science	Engrg Design (✓)		
1; Fall	MATH 1A – First Year Calculus	4		( )		
	CHEM 1A – General Chemistry	4		( )		
	ENGL 1A – Beginning Composition			( )	4	
	General Elective– H&SS			( )	4	
1; Winter	MATH9B – First Year Calculus	4		( )		
	PHYS 40A – General Physics	5		( )		
	ENGL 1B – Intermediate Composition			( )	4	
1; Spring	MATH 9C – First Year Calculus	4		( )		
	PHYS 40B – General Physics	5		( )		
	ENGL 1C – Applied Intermediate Composition			( )	4	
2; Fall	MATH 46 – Intro. to Ordinary Diff. Equations	4		( )		
	PHYS 40C – General Physics	5		( )		
	EE 1A/1LA – Circuit Analysis I/Circuits Lab		4	(✓)		
2; Winter	MATH 10A – Calculus of Several Variables	4		( )		
	CS 10 – Intro to Computer Science			( )		4
	EE 1B – Circuit Analysis II		4	(✓)		
	General Elective – Biological Science	4		( )		
2; Spring	MATH 10B – Calculus of Several Variables	4		( )		
	CS 61– Assembly Language Programming			( )		4
	ME 10 – Statics		4	(✓)		
	General Elective – H&SS				4	

TABLE I-1 (Continued)
BASIC-LEVEL PROGRAM

Year; Semester or Quarte	Course (Department, Number, Title)	Category (Credit Hours)				
		Math & Basic Science	Engineering Topics* Engrg Science	Engineering Topics* Engrg Desig (✓)	Humanities & Social Sciences	Other
3; Fall	EE 110A – Signals & Systems		4	(✓)		
	EE 116 – Electromagnetics		4	(✓)		
	CS/EE 120A – Logic Design		5	(✓)		
	General Elective – H&SS			( )	4	
3; Winter	EE 100A – Electronic Circuits		4	(✓)		
	EE 110B – Signals & Systems		4	(✓)		
	EE 105 – Modeling & Simulation o Dynamic Systems		4	(✓)		
	General Elective – H&SS			( )	4	
3; Spring	CS/EE 120B – Embedded Systems		5	(✓)		
	EE 100B – Electronic Circuits		4	(✓)		
	EE 132 – Automatic Control		4	(✓)		
	General Elective – H&SS			( )	4	
4; Fall	EE 115 – Intro to Communication Systems		4	(✓)		
	EE 141 – Digital Signal Processing		4	(✓)		
	STAT 155/161 – Probability & Statistic for Engineers	4		( )		
	Technical Elective		4	( )		
4; Winter	EE 175A—Senior Design Project		4	(✓)		
	Technical Elective		4	( )		
	Technical Elective		4	( )		
	General Elective – H&SS			( )	4	
4; Spring	EE 175B—Senior Design Project		4	(✓)		
	Technical Elective		4	( )		
	Technical Elective		4	( )		
OVERALL TOTAL FOR DEGREE (EQUIVALENT SEMESTER CREDITS)*		34	57.3		24	5.3
PERCENT OF TOTAL		28	48		20	4
Must satisfy one set	Minimum semester credit hours	32	48		16	
	Minimum percentage	25	37.5		12.5	

TABLE I-2
Course/Section Summary 05F – 06S

Course No.	Title	No. of Sections offered in Current Year	Avg. Section Enrollment	Type of Class			
			Enrollment	Lecture	Lab.	Recit.	Other
EE 001A	Engineering Circuit Analysis I	3	41	X			
EE 01LA	Engineering Circuit Analysis I Lab	5	25		X		
EE 001B	Engineering Circuit Analysis II	2	32	X			
EE 001B	Engineering Circuit Analysis II	3	21		X		
EE 002	Electrical & Electronic Circuits	1	21	X	X		
EE 010	Introduction to Electrical Engineering	1	24	X			
EE 010	Introduction to Electrical Engineering	2	12		X		
EE 102	Analog Integrated Circuits	0	0	X	X		
EE 100A	Electronic Circuits	2	26	X			
EE 100A	Electronic Circuits	3	17		X		
EE 100B	Electronic Circuits	2	26	X			
EE 100B	Electronic Circuits	3	17		X		
EE 105	Modeling and Simulation of Dynamic Systems	1	51	X			
EE 105	Modeling and Simulation of Dynamic Systems	2	24		X		
EE 110A	Signals and Systems I	2	28	X			
EE 110A	Signals and Systems I	3	17		X		
EE 110B	Signals and Systems II	2	42	X			
EE 110B	Signals and Systems II	3	21		X		
EE 115	Introduction to Communication Systems	1	61	X			
EE 115	Introduction to Communication Systems	2	30		X		
EE 116	Engineering Electromagnetics	1	47	X			
EE 116	Engineering Electromagnetics	2	23		X		
EE 117	Electromagnetics II	1	30	X	X		
EE 120A	Logic Design	3	32	X			
EE 120A	Logic Design	5	19		X		
EE 120B	Introduction to Embedded Systems	3	38	X			
EE 120B	Introduction to Embedded Systems	6	18		X		
EE 128	Data Acquisition, Instrumentation & Control	1	40	X			

EE 128	Data Acquisition, Instrumentation & Control	2	20		X		
EE 132	Automatic Control	1	47	X			
EE 132	Automatic Control	2	23		X		
EE 133	Solid-State Electronics	1	53	X			
EE 133	Solid-State Electronics	2	26		X		
EE 134	Digital Integrated Circuit Layout and Design	1	47	X			
EE 134	Digital Integrated Circuit Layout and Design	2	23		X		
EE 135	Analog Integrated Circuit Layout and Design	1	32	X	X		
EE 136	Semiconductor Device Processing	1	30	X			
EE 136	Semiconductor Device Processing	2	15		X		
EE 137	Introduction to Semiconductor Optoelectronic Devices	0	0	X			Discussion
EE 140	Computer Visualization	1	5	X	X		
EE 141	Digital Signal Processing	1	77	X			
EE 141	Digital Signal Processing	3	26		X		
EE 143	Multimedia Technologies & Programming	0	0	X	X		
EE 144	Introduction to Robotics	8	8	X	X		
EE 146	Computer Vision	1	12	X	X		
EE 150	Digital Communications	1	13	X		X	
EE 151	Introduction to Digital Control	1	10	X	X		
EE 152	Image Processing	1	27	X	X		
EE 160	Fiber-Optic Communication Systems	1	14	X	X		
EE 175A	Senior Design Project	1	75	X			Consultation
EE 175A	Senior Design Project	4	18		X		
EE 175B	Senior Design Project	1	75	X			Consultation
EE 175B	Senior Design Project	4	19				Design & Proto-typing 100%
EE 190	Special Studies	2	2				Individual Activity
EE 191(E-Z)	Seminar in Electrical Engineering	0	0				Seminar
EE 194	Independent Reading	0	0				Extra Reading
EE 198I	Internship	1	1				Internship

Table I-3. Faculty Workload Summary (Fall 2006)

Faculty Member (Name)	FT or PT	Classes Taught (Course No./Credit Hrs.)	Total Activity Distribution: Teaching Term	Teaching Year	Research Term	Research Year	Other Term	Other Year	Other service (if applicable)
Balandin, Alexander	FT	None offered this quarter.	0						
Barth, Matt	FT	EE 128 (4 units)	35%	35%	30%	30%	35%	35%	Director, CE-CERT
Beni, Gerardo	FT	None offered this quarter.	0	50%	100%	50%	0	0	
Bhanu, Bir	FT	EE 240 (4 units)	35%	35%	30%	30%	35%	35%	Director, CRIS
Chen, Jie	FT	EE 110A (4 units)	35%	50%	65%	50%	0	0	
Dumer, Ilya	FT	EE 115 (4 units)	35%	50%	65%	50%	0	0	
Farrell, Jay	FT	None offered this quarter.	0	0	100%	50%	0	0	
Hackwood, Susan[1]	PT (10%)	N/A	0	0	10%	10%	90%	90%	See footnote
Hua, Yingbo	FT	EE 141 (4 units)	35%	50%	65%	50%	0	0	
Korotkov, Alexander	FT	EE 201 (4 units)	35%	50%	65%	50%	0	0	
Lake, Roger	FT	EE 208 (4 units), EE 259 (1 unit)	35%	35%	30%	30%	35%	35%	Department Chair
Liang, Ping	FT	EE 210 (4 units)	35%	50%	65%	50%	0	0	
Liu, Jianlin	FT	EE 133 (4 units)	35%	50%	65%	50%	0	0	
Lyubomirsky, Ilya	FT	None offered this quarter.	0	35%	65%	30%	35%	35%	ABET Coordinator
Ozkan, Mihri	FT	None offered this quarter.	0	50%	100%	50%	0	0	
Roy Chowdhury, Amit	FT	EE 241 (4 units)	35%	50%	65%	50%	0	0	
Tan, Xiang-Dong	FT	EE 120A (5 units)	35%	50%	65%	50%	0	0	
Tuncel, Ertem	FT	EE 250 (4 units)	35%	50%	65%	50%	0	0	
Xu, Zhengyuan	FT	EE 1A (4 units), EE 215 (4 units)	70%	50%	30%	50%	0	0	
El-Sherief, Hossny[2]	PT	None offered this quarter.	0	12%	0	0	100%	88%	See footnote
Fonoberov, Vladimir[2]	PT	EE 116 (4 units)	35%	35%	65%	65%	0	0	See footnote
Fu, Peilin[2]	PT	EE 1A (3 units), EE 1B (4 units), EE 100B (4 units)	100%	100%	0	0	0	0	See footnote
Giles, Dan[2]	PT	EE 10 (2 units)	25%	8%	0	0	75%	92%	See footnote
Parvin, Bahram[2]	PT	EE 260 (4 units)	35%	12%	0	0	65%	88%	See footnote

[1] 90% Governor's appointment as Director of the California Commission on Science and Technology.
[2] For all part-time Adjunct faculty and Lecturers, the percentages in the "Other" category represent time spent through their regular employment outside of the university

TABLE I-4 (a). FACULTY ANALYSIS - TENURED
Electrical Engineering Program

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned & Year	Years of Experience			State in which registered	Level of Activity (high, med, low, none) in:		
					Gov't./Industry Practice	Total Faculty	This Institution		Professional Society (Indicate Society)	Research	Consult/Smr. Work in Industry
Balandin, Alexander	Professor	FT	Ph.D.	University of Notre Dame, 1997	0	7	7	N/A	IEEE: Med. Amer.Physics Soc.: Med. Electrochem. Soc.: Med. Int'l. Thermoelec. Soc.: Med. ASEE: Med. SPIE: Med. MRS: Med.	High	Low
Barth, Matthew	Professor	FT	Ph.D.	UC Santa Barbara, 1989	1	11	11	N/A	IEEE: High Trans. Rsch. Board: High Air& Waste Mgmt. Assoc.: Med.	High	Low
Beni, Gerardo	Professor	FT	Ph.D.	UC Los Angeles, 1974	10	20	13	N/A	AAAS: Low Amer. Phys. Soc.: Low	Low	None
Bhanu, Bir	Professor	FT	Ph.D.	University of Southern California, 1981	8	16	14	N/A	IEEE: High AAAS: Med. Int. Assoc. Pattern Recog.: SPIE: Med. Assoc. Comp. Machinery: Med. Amer. Assoc. for Artificial Intell.: Med.	High	Med.
Chen, Jie	Professor	FT	Ph.D.	University of Michigan, 1990	0	12	12	N/A	IEEE: Med. Control Syst. Soc.: Med.	High	None
Dumer, Ilya	Professor	FT	Ph.D.	Institute for Problems of Information Transmission Russian Academy, 1981	7	10.5	10.5	N/A	IEEE: High	High	None
Farrell, Jay	Professor	FT	Ph.D.	University of Notre Dame, 1989	9.5	12	12	N/A	IEEE: High	High	Low
Hackwood, Susan	Professor	PT (10%)	Ph.D.	DeMontfort University, England, 1979	3	21	16	N/A	IEEE: Med.	Low	None
Hua, Yingbo	Professor	FT	Ph.D.	Syracuse Univ., 1988	0	5	5	N/A	IEEE: High	High	None

Korotkov, Alexander	Associate Professor	FT	Ph.D.	Moscow State Univ., 1991	0	6.5	6	N/A	IEEE: High Amer. Phys. Soc: Med. SPIE: High.	High	None
Lake, Roger	Associate Professor	FT	Ph.D.	Purdue University, 1992	8	6	6	N/A	IEEE: Med.	High	None
Liang, Ping	Associate Professor	FT	Ph.D.	University of Pittsburgh, 1987	0	18	14	N/A	IEEE: Med.	Med.	Med.

FACULTY ANALYSIS - UNTENURED

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned & Year	Years of Experience			State in which registered	Level of Activity (high, med, low, none) in:		
					Gov't./Industry Practice	Total Faculty	This Institution		Professional Society (Indicate Society)	Research	Consult/Smr. Work in Industry
Liu, Jianlin	Assistant Professor	FT	Ph.D.	UC Los Angeles, 2003	0	3	3	N/A	IEEE: Med. Amer. Phys. Soc.: High	High	None
Lyubomirsky, Ilya	Assistant Professor	FT	Ph.D.	Mass. Inst. Tech., 1999	4.5	3	3	N/A	IEEE: High Optical Soc. Amer.: Med.	High	None
Ozkan, Mihrimah	Assistant Professor	FT	Ph.D.	UC San Diego, 2001	3	5	5	N/A	IEEE: High Mater. Res. Soc.: High Optics Soc. Amer.: Med. Biomed. Engr. Soc.: Med. Int'l. Soc. BioMEMS & Biomed. Nanotech.: High	High	None
Roy Chowdhury, Amit	Assistant Professor	FT	Ph.D.	Univ. Maryland College Park, 2002	1	3	3	N/A	IEEE: High	High	None
Tan, Xiang-dong (Sheldon)	Assistant Professor	FT	Ph.D.	Univ. of Iowa, 1999	5.5	5	4	N/A	IEEE: High Assoc. Comp. Machinery: Med. ACM SIGDA: Med.	High	Low
Tuncel, Ertem	Assistant Professor	FT	Ph.D.	UC Santa Barbara, 2002	0	3	3	N/A	IEEE: High	Med.	None
Xu, Zhengyuan (Daniel)	Assistant Professor	FT	Ph.D.	Stevens Institute of Technology, 1999	5	7	7	N/A	IEEE: High	High	None

TABLE I-4 (b). ADJUNCT FACULTY & LECTURER ANALYSIS
Electrical Engineering Program

Name	Rank	FT or PT	Highest Degree	Institution from which Highest Degree Earned & Year	Years of Experience			State in which registered	Level of Activity (high, med, low, none) in:		
					Gov't./Industry Practice	Total Instruc-tional	This Institution		Professional Society (Indicate Society)	Research	Consult/Smr. Work in Industry
El-Sherief, Hossny	Adjunct Professor	PT	Ph.D.	McMaster University, Canada 1979	19	6	4	N/A	IEEE: level of activity unknown	Unknown	High (primary affiliation in industry)
Fonoberov, Vladimir	Lecturer	PT (33%)	Ph.D.	State University of Moldova, 2002	0	5	1.5	N/A	Amer. Phys. Soc.: Mater. Res. Soc.:	Med.	None
Fu, Peilin	Lecturer	FT	Ph.D.	Chinese University of Hong Kong, 2003	0	1.5	1.5	N/A	N/A	None	None
Giles, Dan	Lecturer	PT (25%)	A.A.	CSU Pomona, 1976	1	1.5	1.5	N/A	IEEE: Low Circuits and Syst. Soc.:	None	None
Parvin, Bahram	Adjunct Professor	PT	Ph.D.	Univ. Southern California, 1991	30	1.5	1.5	N/A	IEEE: High	Med.	High (primary affiliation in industry)

Table I-5. Support Expenditures
Bourns College of Engineering - Electrical Engineering

Fiscal Year	1 2004 (prior to previous year)	2 2005 (previous year)	3 2006 (current year)	4 2007 (year of visit)
Expenditure Category				
Operations[1] (not including staff)	303,749.99	306,598.50	269,637.97	
Travel[2]	51,698.34	78,142.45	83,256.13	
Equipment[3]				
Institutional Funds	394,013.10	403,941.63	33,333.57	
Grants and Gifts[4]	329,328.07	57,076.23	50,471.79	
Graduate Teaching Assistants	236,015.65	273,177.04	255,103.63	
Part-time Assistance[5]	15,259.17	21,077.05	31,672.32	

IB. Course Syllabi

IC. Faculty Curriculum Vitae

Appendix II

Table of Contents for Appendix II

IIA. Background Information Relative to the Institution

1. General Information

Name of institution: University of California, Riverside. (Legal name: The Regents of the University of California.)

Chief executive: Dr. France A. Córdova, Chancellor. 4148 Hinderaker Hall, University of California, Riverside, CA 92521.

Name of person submitting the completed questionnaire: Dr. Reza Abbaschian, Dean, Bourns College of Engineering, A342 Bourns Hall, University of California, Riverside, CA 92521.

2. Type of Control

The University of California, Riverside, is a publicly controlled institution of higher education and a non-profit 501(c)(3) corporation.

3. Regional or Institutional Accreditation

	Initial	**Recent**
American Chemical Society	1959	2004
Association of American Medical Colleges and American Medical Association	1977	2005
Commission on Teacher Credentialing	1959	1996 (next is expected in 2007-08)
Western Association of Schools and Colleges	1956	In progress through 2009
Graduate School of Education School Psychology Program	2004	2004
Graduate School of Management by AACSB International	2003	2003

4. Faculty and Students

Table II-1 presents faculty and student counts for the fall 2005 term. For full-time faculty, the table includes professors whose appointments are split between instruction and research (I&R) and organized research (OR). If I count only the I&R portion, we will end up with a large number of part-time faculty. UCR has a large component of agriculture-related faculty, paid by state OR funds. Many UCR faculty have split I&R and OR appointments. The OR piece only has research responsibilities.

Table II-1. Faculty and Student Count for Institution
School Year: 2005-06

	HEAD COUNT		FTE (see Note 2)	TOTAL STUDENT CREDIT HOURS
	FT	PT		
Tenure Track Faculty	608	2	609.0*	
Other Teaching Faculty (excluding student assistants)	136	105	189.0	
Student Teaching Assistants	0	744	325.0	
Undergraduate Students	14,128	443	14,351.7	207,440.5
Graduate Students	1,964	38	1,989.5	26,326.0
Professional Degree Students	49		49.0	1,275.0

1. Data should be provided here for the fall term immediately preceding the visit.

2. For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For undergraduate and graduate students, 1 FTE equals 15 credit-hours per term of institutional course work, meaning all courses--engineering, humanities and social sciences, etc. For faculty members, 1 FTE equals what your institution defines as a full-time load.

   *Includes total FTE of the faculty member (instruction and research).

5. Mission

UCR's mission statement is as follows: The University of California, Riverside, is a research university committed to the creation and transmission of knowledge at the highest level, and to the translation of that knowledge for the public good. Our comprehensive programs and services, excellent faculty and staff, and vibrant and attractive physical environment are designed to: provide a high quality learning environment for undergraduate and graduate students; advance human knowledge and accomplishment through research and scholarship; enhance the public good through community service and initiatives; seek preeminence among U.S. research universities, recognizing UCR's quality in every area.

Superimposed over this mission are seven strategic goals articulated by Chancellor France Córdova:

1. To enhance UCR's reputational rankings: UCR will have the profile of an AAU member university
2. To invest in areas of strength: UCR will be recognized for its distinction among all research universities in selected areas which exhibit quality and momentum

3. To expand opportunities for learning and personal growth for all students, undergraduate and graduate: UCR will become a campus of "first choice" for applicants, and students will have a successful experience at UCR
4. To reshape the curriculum: UCR will build on the diversity of its students and the distinction of its faculty, and connect the curriculum to the vision of UCR as an AAU institution
5. To diversify our faculty, staff and graduate population: UCR will be a preeminent research university that has diversity as one of its measures of distinctiveness
6. To build professional schools: UCR will offer expanded professional education in areas that respond to the needs of the state and region and that help to stimulate a knowledge-based economy
7. To forge closer ties with the community: UCR will organize and coordinate with others to achieve common goals for prosperity and sustainability of the Inland Empire through technology transfer, attraction and retention of highly skilled jobs and industries, and responsiveness to regional issues

The vision and mission of the Bourns College of Engineering is to become a nationally recognized leader in engineering research and education. Our mission is to:

1. Produce engineers with the educational foundation and the adaptive skills to serve rapidly evolving technology industries.
2. Conduct nationally recognized engineering research focused at providing a technical edge for the U.S.
3. Contribute to knowledge in both fundamental and applied areas of engineering.
4. Provide a diverse curricula that will instill our students with the imagination, talents, creativity and skills necessary for the varied and rapidly changing requirements of modern life and to enable them to serve in a wide variety of other fields that requires leadership, teamwork, decision making, and problem solving abilities.
5. Be a catalyst for industrial growth in the Inland Empire.

6. Institutional Support Units

This section describes support resources available specifically to engineering students or to all undergraduates at UCR. Section 6.A addresses computing resources at the campus, college, departmental, and lab levels. Section 6.B describes the Science Library. Section 6.C describes the Career Center and the Bourns College of Engineering's own placement programs. Section 6.D describes the Honors program, and Section 6.E describes the Learning Center.

6.A Computing

Computer facilities and services are available from several sources for use by the programs of The Marlan and Rosemary Bourns College of Engineering and its students, faculty, and staff:

1. Campus-wide Computing and Communications (C&C) unit, managed by a full-time professional staff.

2. The College, through its programs of Chemical/Environmental Engineering, Computer Science and Engineering, Electrical Engineering, and Mechanical Engineering, and its Research units.

Details of the facilities and their support follow:

Computing and Communications (C&C)

The C&C unit as a whole (which includes Academic Computing, Institutional Computing, Microcomputing, and Communications) is under the direction of an Associate Vice-Chancellor, who reports to the central administration. The Academic Computing, Microcomputing, and Communications sub-units have primary responsibility for providing network access and general computing facilities and services to the UC Riverside campus. They provide:

- Microcomputer facilities in labs at various campus locations, utilizing PCs and Macintosh computers. These may be used on a scheduled basis for campus courses, as well as on a drop-in basis. Access hours are posted and, during these times, lab assistance and software check-out are available.
- Access to the computers of the San Diego Supercomputing Center, available to all campus researchers, with the financial support of the National Science Foundation, through the Academic Computing sub-unit.
- Support and maintenance of the campus computer networks and world-wide Internet access via the CalREN2 regional gigabit network. All Bourns College of Engineering computing facilities have access to these services.
- On-campus wired and wireless connectivity. Most of the campus is “wired for wireless,” enabling portable computers to connect to the network. Additionally, the campus network backbone consists of 10 GB fiber-optic connections, with a minimum of 1 GB capacity to each building on campus. The campus has more than 500,000 feet of fiber-optic conduit, which enables the addition of fiber connectivity essentially on demand.
- Campus-wide site licensing for various software packages.
- Consultation on systems, statistical computing, microcomputing, and instructional technology.
- A microcomputing support group.

Computing and Communications, in conjunction with the UCR Office of Instructional Development, operates media and technology in the classrooms at UCR. All UCR classrooms are designed to Fundamental Classroom Standards established by the Classroom Technology Advisory Group. These standards are:

- Classrooms must contain the capability to present materials from a wide variety of sources, including (at a minimum) VHS video, DVD, a personal computer, and the Internet.
- Classrooms must contain a chalkboard or whiteboard that is available and viewable at the same time digital or analog presentations are underway.

- Classrooms must contain a combination of LCD projectors and/or lighting controls that allow students to take notes and view presentation material at the same time.
- Classrooms must be "self service" thus allowing instruction to occur without the aid of student operators and without the delivery of equipment.
- Based on the academic discipline, sound systems and data projection resolution requirements may drive certain classroom minimum standards.

All classrooms are equipped with a multimedia controller, maintained by Computing and Communications, for operation of a laptop computer, projector, and audio equipment. Internet connectivity is via wireless network. Each controller has a "Help" button for the instructor to use if there is a problem with the equipment. A help desk is staffed full time, and at least one field technician is available on campus during instructional hours. Either the help desk (working remotely) or the field technician (in the classroom) can quickly resolve any problem that occurs. In a survey (most recently conducted in 2005), 95.2% of instructors responded that UCR's available classroom technology either "Completely" or "Mostly" met their pedagogical needs.

UCR has just implemented "clicker" technology in its classrooms. Clickers (known also as Personal Response Systems or PRS) are an emerging technology that allows real-time interactions between the instructor and their students. The interactions are usually in the nature of queries by the instructor with students responding electronically to those queries. The student responses are digitally collected both as a group and individually and the information (data) reflects the individuals' and/or group's consensus to the queries. These data can be immediately displayed as visual feedback, not only to the instructor but also to the queried audience. Information obtained in this way can be manipulated pedagogically and administratively via statistical analysis of the queried data to support programmatic goals of a course, a department or a campus wide initiative.

In actual use on this campus this technology has been shown to:

- Increase attendance (sometimes dramatically)
- Coax participation from normally non-participative students
- Create a more engaging lecture environment
- Computing and Communications has partnered with several academic departments to pilot the use of this technology. After three successful pilot programs, C&C has now equipped all UCR General Assignment classrooms with the hardware and software necessary to utilize this technology.

This technology is new and just now being adopted by instructors. It could become an excellent resource for capturing data for measurement of course objectives and program outcomes in the future.

Computing and Communications has taken a lead role in providing high-performance computing in support of the campus research enterprise. Three programs are under development:

1. A centrally managed, standardized/dedicated cluster of processors, in which researchers pay an annual fee for essentially unlimited use.

2. A collaborative computational cluster, in which each PI can buy a certain amount of hardware, which Computing and Communications with manage. The PI has priority access to the equipment that he or she acquired, plus access to the entire cluster as available.
3. A high-performance computer. The campus (Computer Science and Engineering Department) has a proposal pending now for a Cray system.
4. Departmentally maintained clusters, centrally managed.

Computing and Communications competes in the regular campus budget process for the funding of its permanent staff positions and its equipment purchases. It is also the principal recipient of Instructional Use of Computing funds, which are allocated to the campus annually by the UC Office of the President for the operation, support, and maintenance of computing resources. Although there may be quotas assigned, the campus community is not charged for the bulk of these computing services. Research programs supported by grants are assessed recharges for computing time and consultation services.

While all of the above services and facilities are available to the general campus community, the supported computing labs tend to be crowded and in heavy demand, limiting accessibility except for scheduled lab periods. The programs in engineering make prescribed use of only one of them – a 35-station PC Laboratory in Mathematics (Sproul Hall 2225) used for Matlab computing assignments within a linear algebra course required in the Computer Science program. While it continues to maintain a cooperative relationship with the campus C&C unit, the College provides all of its own computing resources, and is dependent upon C&C only for intra-campus and Internet network access.

Bourns College of Engineering

The computing facilities used by the Bourns College of Engineering are owned and managed by the College and its sub-units. Commodity PCs are now the machines of choice for most of the computing tasks, including instruction, office work and network service. The research laboratories have a variety of workstations (Sun, DEC, SGI) appropriate for their specialized requirements.

Systems administration for the College is handled primarily within its component units. Each department has at least one full-time professional systems administrator and several part-time student assistants. These groups collaborate closely to manage and coordinate their own facilities as well as the integrated computing facilities of the College, such as the networking infrastructure. The systems staff for Chemical/Environmental and Mechanical Engineering also has responsibility for the administrative computing facilities for the Dean’s office and Student Affairs.

The Center for Research in Intelligent Systems (CRIS), one of the research units of the College of Engineering, promotes interdisciplinary research for developing computer systems that are flexible, adaptive, and intelligent. Its Visualization and Intelligent Systems Lab (VISLAB) computer facility employs one full time administrative assistant and one part-time system administrator.

The research unit CE-CERT (College of Engineering Center for Environmental Research and Technology) employs one full-time programmer/analyst and several part-time student assistants to perform computer system administration. Further, CE-CERT employs a full-time development engineer to assist staff and students with computer interfacing to analytical instruments and data acquisition hardware and software, in connection with laboratory experiments for some of the upper division engineering courses and student projects.

Listings and descriptions of the College computing facilities follow. While they are listed in various categories, they are all interconnected via local networks and routing hubs, and may be accessed from anywhere (including off-campus) provided that the user has an appropriate account authorization, and is using a secure shell.

College Networking Infrastructure

Bourns Hall houses the Department of Mechanical Engineering, the Department of Chemical and Environmental Engineering (including Bioengineering), and the Dean's Office. Engineering Building II opened in 2005 and houses the Department of Computer Science and Engineering and the Department of Electrical Engineering.

The buildings a have state-of-the-art cabling infrastructure which is designed around optical fiber connections between all thirteen wiring closets. Every lab and office has multiple connections to the network with enhanced category-5 unshielded twisted pair cabling; in addition multiple office and labs have optical fiber connections as well. Essentially every computer and printer belonging to the College (approximately 900 computers in total) is connected to the College's Ethernet-based network infrastructure. The core of the network consists of a pair of redundant Cisco Catalyst 6500 routers, each capable of forwarding 720 million packets per second. These connect to a combined distribution/access layer comprised of stacks of Cisco Catalyst 3750 switches, with a combined port count in excess of 2600 ports including gigabit and power over Ethernet ports. In addition to the wired networking ports, the campus 802.11 wireless network provides coverage to nearly all parts of the engineering buildings, and the rest of campus.

The core network for the College is connected to the UCR campus backbone through a pair of 10 gigabit fiber optic connections. The campus backbone has recently been updated with Cisco Catalyst 6500 enterprise switches, which provide network connections to more than 50 buildings. Off-campus networking is provided by 6 gigabit connections into the Cenic network.

Department of Computer Science and Engineering Computing Facilities

The Department of Computer Science and Engineering maintains servers and teaching labs to support CS, CE, and EE courses, as well as a number of service course in the computing area.

Servers are primarily rack mount 1U servers with between 1 and 8 GB of RAM, and processors that range between 2.4-3.0 GHz Intel Xeons, to 2.0 GHz dual core Opterons. These servers are connected to UPS to provide clean power and provision for graceful shutdown in an emergency, and are monitored 24/7 for network availability and service provision. All of them are remotely accessible via protocols supported by their operating systems and are additionally manageable via remote console. These servers run a variety of operating systems and provide a range of services as noted below.

There are 3 additional storage servers: 1 FAS 250 Network Appliances Filer with 1 TB of disk space, used to store critical files, and two RAID units running with capacities of 6.4 and 4.0 TB respectively.

Servers running CentOS Linux provide web, email (IMAP and POP), FTP, SQL database, DNS, DHCP, authentication, printing, centralized system logging, rdate, and disk backup services. Quarterly backups are maintained offsite.

Servers running Windows Server 2003 provide domain services and remote login capability via terminal services for instructional purposes. Out of seven servers, two are domain controllers with mirrored root drives.

A 4-way 2.0 GHz Opteron Compute Server with 8 GB of RAM running CentOS Linux provides a complement of free Unix software utilities for software development, productivity, etc, as well as remote desktop services using the NX protocol. There are two secondary compute servers with roughly half the computational resources of the primary server.

Except for the Linux compute servers and public Windows 2003 terminal servers, only system administrators may log in to the other Windows and Linux servers. Any CS student or student taking a CS service course may login (over the network) to the compute servers, either via SSH, or using the NX protocol.

The Computer Science and Engineering Department has seven instructional labs. All but one (in EBU II, room 226) are reserved at least some portion of hours during the weekdays for scheduled labs associated with all lower and upper division Computer Science classes or service courses. All students taking CS courses have 24 hour, 7 day access to the CS computing labs.

Instructional labs are located in EBU II, rooms 127, 129, 132, 133, 135, 136, and 226. PCs in these labs run Linux as their local operating system and access Windows applications via Terminal Services. A full range of free software is provided under the Linux operating system, as well as proprietary software for specific courses such as Maya and Renderman for graphics courses and Xilinx, Cadence, and Synopsys software for embedded systems courses. Windows Terminal servers provide access to software such as Aldec Active HDL for embedded systems courses and Microsoft Visual Studio 2005 for programming courses. Labs are equipped with 24 PCs and an HP networked laser jet printer.

Department of Chemical and Environmental Engineering Computing Facilities

Major computing resources for the Department of Chemical and Environmental Engineering are summarized below. The new Bioengineering program currently shares these resources but will develop its own as it evolves into a free-standing department.

- **Student Lab - Bourns Hall B255**. This is a general-purpose student lab containing about 35 PCs running Windows XP. A variety of software is available for word processing, spreadsheets, mathematics, computer aided drafting (CAD), engineering applications, and Internet access. Students can access the Unix servers to read e-mail and run large computing jobs. The lab also contains a laser printer and a color flatbed scanner. Access to the room is provided 24 hours a day, 7 days a week through card access.

- **Research**. A number of PCs and Unix workstations are in use by researchers and faculty for a variety of purposes, including interfacing with such equipment as a gas chromatograph and a spectrophotometer. Software such as LabView is used for data acquisition and process control.
- **Server machines for Chemical/Environmental and Mechanical Engineering - Bourns Hall A344.** A variety of servers ranging from Single to Quad Processor Intel Pentiums, as well as Sun SPARCs, and a NetApp are utilized. Operating systems used include Windows 2003, Sun Solaris, and FreeBSD. Their functions include:
    - Compute Servers for general purpose applications such as e-mail, MatLab, and printing.
    - File servers for the storage of user data files
    - E-mail and user authentication servers
    - Web server
    - Backup server
    - Card access server
    - Log server

Department of Electrical Engineering Computing Resources

The integrated network in the Bourns College of Engineering offers one of the nation's most advanced computing environments to the faculty, staff and students of the College. The network provides ultra-performance workstations for educational purpose in course-related research and project.

The fully-integrated network maintains 189 desktop workstations in 6 computing labs that are open to all engineering students. All of these labs are accessible to students 24 hours a day, 7 days a week. Windows XP, 2003 Server, Linux, Unix, and Solaris are all supported operating systems. It also allows the students to access many course-related applications and centralized personal folders, e-mails, printers, and other services on the network. People can also reach their personal servers or common shared folders on the network from any other workstation off campus.

The network operates on the TCP/IP protocol with a connecting speed ranging from 100 to 1000 mega-bit-per-second and some Power Over Ethernet (POE). All the switches in the building are connected at 1 gigabit fiber connection. Connection between the Bourns College of Engineering and Engineering Unit II buildings are based on 10 gigabit fiber and 10 gigabit wide-area-network (WAN) link. Wireless Ethernet is available in student lounges, offices, labs, and other locations in the College of Engineering buildings.

The computing environment of the College is fully combined with a broader group of networks that ties the entire country and the globe together. The students of the Bourns College of

Engineering have the privilege of taking advantage of the state-of-the-art technology in advancing their learning endeavor and research experience at the University.

The Electrical Engineering Department also operates six laboratories for student use:

- Engineering II Room 121: Circuit & Control Systems.
- Engineering II Room 125: Embedded Systems & Logic Design.
- Engineering II Room 126: Advanced Systems & Senior Design.
- Engineering II Room 128: Communication & Intelligent Systems.
- Engineering II Room 137: Electronics & Prototyping Shop.
- Engineering II Room 234: Computer Lab.

The labs are equipped with oscilloscopes, digital multimeters, function generators, power supplies, and desktop computers, with a quantity of 16 each per lab. Each workstation has one set of the equipment listed above except for Lab 125 which only has power supplies and computers. Some fully-licensed and well-known software/tools are provided on the computers for students' use, such as Cadence, Orcad, PSpice, Matlab, and Codewarrier C Development. Students have an opportunity to gain the knowledge to utilize and manipulate the software in achieving the objectives for the certain courses.

The majority of the equipment was purchased for approximately $270,000 in 1998 when the program started. An estimated amount of annual costs of maintenance and upgrades is calculated to be in the range of $3-10k. Although no major upgrades had been done on the equipments, they still function well and have a projected lifetime of about 20 years.

Department of Mechanical Engineering Computing Resources

Major Mechanical Engineering computing resources are as follows:

- **Student Lab – Bourns Hall B207.** This is a general-purpose student lab containing about 35 PCs running Windows XP. A variety of software is available for word processing, spreadsheets, mathematics, computer aided drafting (CAD), engineering applications, and Internet access. Students can access the Unix servers to read e-mail and run large computing jobs. The lab also contains a laser printer and a color flatbed scanner. Access to the room is provided 24 hours a day, 7 days a week through card access.

- **Student Lab – Bourns Hall B238.** This is virtually identical to the Student Lab in Bourns Hall B207 described immediately above.

- **Student Lab - Bourns Hall B213AA.** This lab contains 10 PCs at lab benches all running Windows XP. The bench machines include a hardware data acquisition (daq) board. The daq board, along with LabView software, allows the machines to interface with data collection and control hardware for use in lab experiments. A laser printer is also provided.

- **Research.** Various PCs and Unix workstations are available for use by researchers and faculty, and are used for such computing tasks as model simulation.

Also, as noted above, the Department shares administrative and research server resources with Chemical and Environmental Engineering.

Research Centers

This section describes relevant computing resources of the College's interdisciplinary research centers. While the major purpose of these centers is in support of research, we encourage undergraduates to become involved in research as a way of encouraging retention of engineering students to the bachelor's degree and encouraging them to pursue higher degrees.

The Center for Research in Intelligent Systems (CRIS) promotes interdisciplinary research for developing computer systems that are flexible, adaptive and intelligent. The ultimate goal of the Center is the research and development of autonomous/semiautonomous systems with sensing capabilities that are able to communicate and interact with other intelligent (biological and artificial) systems. These intelligent systems will be able to perform tasks that require understanding of the environment through knowledge, learning, reasoning and planning. Advancements in each of the many enabling technologies required represents a major challenge and will have great impact in a wide range of applications, such as autonomous navigation, manufacturing, robotics, photo-interpretation, space exploration, document understanding, remote sensing, human-computer interaction, environmental monitoring, image communication, digital libraries, data mining, management, economics and health care.

CRIS involves seven laboratories and an interdisciplinary team of faculty members from seven departments (Electrical Engineering, Computer Science, Psychology, Economics, Statistics, Mathematics and Management). More recently, new collaborations have developed with UCR's Biology and Botany/Plant Sciences faculty. The collaborations encourage greater in-depth understanding and broader perspectives than is frequently possible within a single department. CRIS will advance education and research goals of the university through an interdisciplinary graduate program and collaborative research in the intelligent systems area.

The principal CRIS facility is the Visualization and Intelligent Systems Laboratory (VISLab). VISLab occupies approximately 3,000 square feet of modern laboratory facilities. The VISLab is involved in research in the key areas of artificial intelligence, learning and image understanding techniques with application to image exploitation, image data management and autonomous systems.

1. **General Purpose Equipment:** 12 SUN workstations (6 Ultra2s, 4 Ultra1s, 2 Sparc20s) with a total of 4 terabytes of disk space for image storage and processing, 2 SGI workstations (Octane, Indigo), 5 Macintosh computers and 10 Window/NT based computers and associated equipment.
2. **Special Hardware for Image Processing and Computer Vision:** VITec and ITI Image Processors, Media 100xs video production equipment; infrared, laser and video cameras. An outdoor Videoweb laboratory (NSF sponsored program, 2006) is under development that will have a wireless network of about 80 video cameras and other nonimaging sensors. This laboratory will also serve as resource for massive data collection.

3. **Database and GIS Related Software:** Informix Universal Server with text, image, video and geodetic datablades; VIRAGE content-based visual information retrieval package, ESRI Arc/Info Geographic Information System and related GIS Tools.
4. **Modeling, Image Processing, Image Understanding and Learning Related Software Packages:** XPATCH and XPATCH-ES SAR object and scene modelers; PRISM infrared signature modeler; BRL; Matlab Toolboxes for signal processing, image processing, neural networks and optimization. KHOROS image analysis and processing; RADIUS development environment; IUE image understanding environment; KBVision computer vision and image processing; AVS graphics/image processing/visualization; Obvius; Genesis and various UNIX/MAC/PC applications and programming support packages. The laboratory also has a large library of software developed during prior work on image segmentation, feature extraction, target and object recognition, learning and image databases.

The College of Engineering Center for Environmental Research and Technology (CE-CERT) specializes on research in air quality and energy efficiency, particularly as these issues pertain to transportation. CE-CERT is largely self-supported by external contracts and grants and by an endowment. CE-CERT is a recognized leader in the development of experimental capabilities in vehicle exhaust measurement and analysis and tropospheric chemistry. The major experimental labs (light-duty vehicle emissions, heavy-duty vehicle emissions, gas-phase atmospheric chemistry, aerosol-phase atmospheric chemistry, and renewable fuels development) all have integrated computerized data collection systems. Because CE-CERT's research in these areas has regulatory implications, laboratories and procedures have been designed to satisfy the U.S. Environmental Protection Agency's requirements for Quality Assurance and Control.

Two groups specialize in modeling and, therefore, rely heavily on computing resources. The Transportation Systems Research Group operates systems for second-by-second collection of data on a vehicle's operations, and a network of Sun workstations for modeling of vehicle emissions as a function of operating conditions and parameters (known as modal emissions modeling). The Environmental Modeling Group operates regional-scale models of atmospheric fate and transport, including CAMx, MM5, and CMAQ. A large computing cluster (30-50 nodes) and data storage system with a redundant array of independent disks (RAID) is on-site at CE-CERT to support the group's modeling and training activities, which include operation of the Western Regional Modeling Center under contract with the Western Governors' Association.

Computing Services Available to Assist the Students and the Faculty

The campus Computing and Communications unit, with its professional staff, maintains the UC Riverside campus network and its Internet connections. The Marlan and Rosemary Bourns College of Engineering, with its professional computing staff and student assistants, provides full time system support to the students, faculty, and staff in The College.

The College has orientation sessions in the Unix computing labs for incoming students at the beginning of each academic year. For Computer Science students and others taking beginning Computer Science classes, such orientations are built into the initial laboratory sessions.

Accessibility of Computer Facilities to Students and Faculty

All students, faculty, and staff of The College have individual account access to one or more of the College's computing systems, as do all students in service courses offered by the College. All College of Engineering majors are given accounts on the College NFS network when they enter as freshmen or transfers, and those accounts are permanent for the duration of the students' tenure. This gives them unlimited access to these facilities, depending upon their major. Accounts grant access to the appropriate servers and lab machines, as well as to the Internet. Account files are stored centrally, on the servers, and are available seamlessly from each lab machine. Generally, the compute servers are accessible from anywhere on or off campus, via a secure shell. Accounts for students in service courses do not permit general access to the other computing facilities of The College, and they expire when the course has been completed. College systems personnel manage the creation and deletion of quarterly class accounts. They also maintain and update the records for the "permanent" accounts.

The individual password-protected computer accounts are provided subject to rules of usage, privacy, and permission for system monitoring. These are posted in the computing facilities, appear on screens at login, and are acknowledged by user signature when each account is issued.

Computer usage is automatically monitored by the operating systems of the various networked machines.

Physical access to the Bourns Hall and Engineering II general computing facilities is available 24 hours a day, 7 days a week, through an electronic card-key entry system. Appropriate access permits are coded into each card, depending upon the owner's status, major and course registration. Alternately, 24 hour access to the networked facilities is available via a secure shell from other campus locations, and from off-campus locations via modems.

The PCs in the special purpose labs are available only during regular laboratory sessions or scheduled open lab periods.

Students majoring in or taking courses in the College of Engineering are not charged for access to the computing facilities of The College. For other students, the campus facilities operated by C&C are available free of charge.

The salaries of the professional systems administrators and their student assistants are funded from the annual permanent budget of The College.

Funds for the initial purchase of the computing equipment for The College came from the moveable equipment funds allocated for equipping the new Engineering building. Funds for maintenance and replacement, as well operating expenses, for these computing facilities are now included in the annual budget for The College.

6.B Library

Engineering collections are housed in the Science Library. The Science Library has a seating capacity of 1,500 including individual carrels, computer labs and group study rooms. The library offers 60 computers for students to use in their research and another 32 computers used for information literacy instruction. The library also provides both wired and wireless access to the internet from students' laptop computers.

Current Library hours are:
Monday-Thursday 8:00am – Midnight
Friday 8:00am to 5:00pm
Saturday 10:00am to 5:00pm and Sunday 1:00pm to Midnight.

The Science Library has a professional staff of 7 librarians, all of whom provide reference assistance to engineering students, faculty and staff. Of these librarians, one has subject responsibility for engineering and can help students, faculty and staff with more in depth questions. The Engineering Librarian also conducts tutorials and classes on engineering information topics, and maintains Web pages and path-finders to assist engineering students, faculty and staff in finding the information they need.

The Science Library offers a full range of reference services, including walk-up, telephone, and electronic mail reference services as well as reference by appointment. The Science Library reference desk is staffed 60 hours per week when school is in session and 40 hours per week during inter-session periods. In addition to these standard services, engineering students can get additional reference help from the Engineering Librarian. The Engineering Librarian is available for extended consultation on Senior Design or other research projects. Phone and in-person services are available 9 a.m.-8 p.m. Monday-Thursday, 9 a.m.-5 p.m. on Friday and 1 p.m.-5 p.m. on Saturday and Sunday. A chat reference consortium with the other UC libraries, currently being piloted, has the potential to extend the reference hours to 9 p.m. nightly.

Incoming freshman typically get a library orientation session in their introductory classes. They might also have additional information literacy instruction in classes that require outside research, such as senior design classes. One-on-one or group tutorials are available for any research topic that might be desired and helpful.

Library Collections

Books and Journals

Engineering books are acquired as part of the Science Library's approval plan, ordered from catalogs or suggested by students, faculty and staff. Recently, the library has begun to purchase e-books for engineering and currently maintains a collection of more than 500 electronic books. The library currently subscribes to 121 engineering journals in print, and UCR students have access to more than 1,800 journals online. UCR has access, for example, to all of the journals and proceedings of both IEEE and ACM. Faculty, staff and students may suggest new monographs, journals or other media to be purchased by the library.

Journal Databases Available to Students
UC Riverside students have access to a number of journal databases to assist them in their research in engineering and in other areas of study. The California Digital Library has licensed, across all of the UC schools, INSPEC, Compendex and the Web of Science as well as SciFinder Scholar for chemistry and chemical engineering and Biosis or MEDLINE for biotechnological literature. UCR also licenses Water Resources Abstracts locally.

Other Collections
The Science Library maintains a collection of videotapes applicable engineering in the Media Library. The Media Library has viewing stations and viewing rooms and will check video materials out to instructors to use in their classes.

The following table provides statistical information about UCR's libraries.

	CURRENT COLLECTION RESOURCES	
	Books	Periodicals
Entire Institutional Library	(Volumes) 2,305,526	(Titles) 23,783
Engineering and Computer Science	63,669	121 (+1819 online)

LIBRARY EXPENDITURES*

	2003-2004	2004-2005	2005-2006
Expenditures for Engineering (Total)	$114,317	$126,736	$130,255
Books	$37,000	$48,000	$55,956
Periodicals	$75,517	$75,736	$72,091
E-Book Packages	$1,800	$3,000	$2,208

*All figures are approximate and do not include the large amount of electronic materials that we receive through consortial arrangements with other University of California Schools.

6.C Career Center

The main volume of the Self-Study describes the College's Professional Development Milestones program. This program is designed to work in conjunction with UCR's Career Center to help students prepare for jobs or higher academic pursuits after completion of the bachelor's degree. Services include resume writing workshops, mock interviews, job fairs, and meetings with representatives of individual companies throughout the year.

The College and the Career Center encourage undergraduates to have at least one internship during the summer or during the school year. Internships can be taken for pay and/or for course credit. The for-credit option designates the internship as Engineering 180. It requires a faculty member to sign off on the internship experience as relevant to the student's career development. The faculty member also assigns a parallel project to the student; ideally, this should be something based on the student's work during the internship, or requiring unique resources available at the internship site. The faculty member's grade of the student project serves as the grade for the Engineering 180 course. The employer has no involvement in grading the student.

For every internship, we request that both the student and the employer establish a Learning Agreement. This sets forth the objectives for the internship and asks both the student and the employer, separately, to review the outcomes of the internship at the end of the period. We also encourage the employer to have an end-of-internship meeting with the student to review strengths and weaknesses. The Learning Agreement and review forms are reproduced on the following pages.

The Career Center's mock interview service is conducted in conjunction with student professional societies, including the Society of Women Engineers and the IEEE. In 2005, companies that provided interviewers for this program were Fleetwood Enterprises, Kroger, and Raytheon. In 2006, participating companies were Ambryx Biotechnology, the City of Riverside, Fleetwood, Kroger, and Luminex.

Academic Internship Program Learning Agreement

For students who are **not seeking academic credit**

Complete and return to: Academic Internship Program, Veitch Student Center, NW Wing
Riverside, CA 92521-0211 (951) 827-3631 Fax (951) 827-2447
To Be Submitted Preferably Within 10 Days of Start Date

Please type or print with ink.

STUDENT INFO

Student's ID Number:	Major:	
Name:	Class Level:	
Address:		
City:	State:	Zip:
Local Phone: ( ) Permanent Phone: ( )	e-mail:	

EMPLOYER INFO

Agency Name:		
Address:		
City:	State:	Zip:
Name of Supervisor:	Phone: ( )	
Check one: ( ) Internship ( ) Co-op	Quarter: ( ) Fall ( ) Winter ( ) Spring ( ) Summer	
Duration of Agreement: From ____________ To ____________	Hours/Week:	Salary:

POSITION INFO

INTERNSHIP PROPOSAL: (Include learning objectives of the internship, duties, responsibilities, and nature of work to be performed)

REQUIRED SIGNATURES

Student Signature	Date	Site Supervisor Signature	Date	Internship Coordinator	Date

Evaluation of Student Intern

Student / Employer Information	
Student:	Student ID#:
Agency/Firm:	
Supervisor:	Title:
Internship Period: From ________________________ To _________________________	

Supervisor: Please complete the following evaluation of your intern/co-op student utilizing the rating scale indicated below. Note any qualifications under "comments" that may clarify or elaborate your ratings on particular indicators. Return evaluation to:

Career Center, AIP
Veitch Student Center, N.W. Wing, University of California
Riverside CA 92521-0211 • (951) 827-3631 • Fax (951) 827-2447

1-Superior • 2-More than Satisfactory • 3-Satisfactory • 4-Improvement Needed • 5-Unsatisfactory • N/A

Rating of Student's Performance	***Comments***
___ Accepts and follows directions	______________________
___ Works as a team member	______________________
___ Student is self-starting on work projects	______________________
___ Organizes and completes projects on schedule	______________________
___ Amount of work produced	______________________
___ Demonstrates interest in career field	______________________
___ Written communication	______________________
___ Oral communication	______________________
___ Analytical ability	______________________
___ Research performance in relation to project subject matter	______________________
___ Decision making and recommendation ability	______________________
___ Overall evaluation of student's performance	______________________

Additional Comments:

This report has been discussed with the student intern: ______Yes_____No
NOTE: University policy allows interns to review their internship evaluation.

Signature:_______________________________________ Date:_____________________________

Student Evaluation of Internship Experience

Student / Employer Information

Student Name: ____________ Title of Position:	Student ID#:
Agency/Firm:	
Supervisor:	Title:
Internship Period: From ____________	To ____________

The objective of the Academic Internship Program (AIP) is to provide students with a meaningful learning experience through means of practical work experience relating to their academic studies or career interests. Please note your perceptions and reactions below. Please return evaluation, prior to end of work period, to:

Career Center, AIP
Veitch Student Center, NW Wing, University of California
Riverside CA 92521-0211 (951) 827-3631 • Fax (951) 827-2447

Evaluation

1-Excellent **2-Good** **3-Average** **4-Marginal** **5-Unsatisfactory**

	1	2	3	4	5
Orientation to the position	☐	☐	☐	☐	☐
Task and activities training	☐	☐	☐	☐	☐
Quality of tasks and activities	☐	☐	☐	☐	☐
Communication with supervisor	☐	☐	☐	☐	☐
Acceptance by co-workers	☐	☐	☐	☐	☐
Educational value	☐	☐	☐	☐	☐
Career exploration	☐	☐	☐	☐	☐
Physical environment of the internship	☐	☐	☐	☐	☐
Overall rating	☐	☐	☐	☐	☐

Please attach a brief written statement (one to two paragraphs) describing your internship experience in relation to your academic pursuits and career interests. Would you recommend this internship experience to other students?
If applicable, indicate any comments or suggestions you feel are important for program improvements. Could we use your name and/or excerpts from your evaluation to promote the internship program? Please circle YES or NO. Thank You.

Signature: ____________________ Date: ____________________

6.D Honors Program

The University Honors Program (UHP) was established in 1989. It is divided into two key components: the Lower Division Program and the Upper Division Program. Other very important aspects of the program are Personal Growth and Community Service.

Participation in the Lower Division Honors Program is by application. Admission requires that an incoming freshman have a minimum cumulative high school grade-point average of 3.5, SAT scores in the 90th percentile, and an excellent high school record of both scholarship and service. Students with SAT scores below 90th percentile can apply and their application will be considered by the UHP Committee. Students with GPAs below 3.5 will not be considered for the University Honors Program.

All Honors first-year students must complete the First Year Learning Contract each quarter. The contract requires students to meet with the Lower Division Coordinator and the Peer Mentor three times each during Fall quarter, as well as meet with their academic advisor. In addition, students must complete 10 hours of community service and personal growth, attend seminars, and attend a Career Services Orientation.

The Sophomore Applied Learning Component is an opportunity for excellent UCR freshmen to join the UHP at the end of their first year. Applications to the Sophomore Applied Learning Component are accepted only from current first-year freshmen and only during spring quarter. Qualified students will be invited to apply via their campus e-mail account. Applicants must have cumulative UCR GPAs of 3.5 or above. Students who complete all elements of the Applied Learning Component will receive a certificate and a letter from the Director of the University Honors Program, and will have this achievement noted on their official University transcript. Other benefits include recognition in the Commencement book as completing Sophomore Honors. Additional rewards include smaller interactive courses and Honors housing.

To complete the requirements for Lower Division University Honors, a student must take a minimum of four 4-unit Honors courses over two years in addition to the introductory ethics course in the Fall quarter of the first year and the HNPG 10A and 10B series in Winter and Spring quarters. Students must maintain a cumulative GPA of 3.2 or higher to remain in good standing in the Honors program, and must achieve a B or above in all Honors courses.

Students who have completed the Lower Division program may apply to the Upper Division Honors Program. Transfer students with excellent academic records after their first quarter here also may apply. Students who have not participated in Lower Division Honors may apply or be nominated by a faculty member for Upper Division. The distinction of Upper Division is awarded upon graduation to students who complete an approved thesis project and maintain an overall major GPA and cumulative GPA of 3.5 or higher. The thesis tests students' intellectual initiative and provides the opportunity to look ahead to the challenges of careers and graduate or professional school. The experience of working carefully and closely with faculty mentors on a significant project is profound and deeply rewarding. The honors designation appears on the official transcript.

Honors students by nature are high achievers academically. They are self-directed learners and exhibit a wide range of interests. They are traditionally active participants in all aspects of campus life. To assist Honors students in establishing personal direction and a well rounded personal array of experiences, all UHP students are asked to engage in activities leading toward personal growth. Honors students are also asked to become involved in and contributors to the campus or the community. For their Personal Growth experiences, many students choose to become members of student clubs and organizations, take music and art lessons, enroll in classes through the Recreation Center, or participate in study groups through the Learning Center.

The Community Service requirement can be fulfilled through organized charitable efforts conducted by UHP, Staff Assembly, or other organizations.

6.E Learning Center

The Learning Center is a team of educators, counselors, and advanced students who provide a variety of services to help students succeed in their college classes. The Learning Center is for all students who are not satisfied with their current grades and/or academic performance. The center regularly sees first-year students (freshman and transfer) and graduate students, students on academic probation and those on the Dean's List. Any student who wants help can get it, and almost all services are free.

Major services include tutoring, placement testing, and organization of study groups. Another service, GradTrack, is designed to encourage and assist UCR undergraduates who are thinking about going to graduate or professional schools. While services are available to all interested students, GradTrack's special mission is to help underrepresented minority students, low-income and first-generation college students, and other students who have not traditionally aspired to post-baccalaureate education. GradTrack services include faculty mentoring, workshops, individual counseling, and test preparations for CBEST, GMAT, GRE, LSAT, and MCAT.

The Learning Center also is a point of access for peer-to-peer and professional mentoring and counseling, financial aid assistance, and study skills development.

The Learning Center offers a Computer Lab with 29 terminals featuring Microsoft Office software and Internet accessibility. The Computer Lab is also equipped with two disabled-accessible computers, one capable of accessing Dragon Naturally Speaking, Jaws, and Zoom Text. Use of the lab is free, except for a small charge for printing documents.

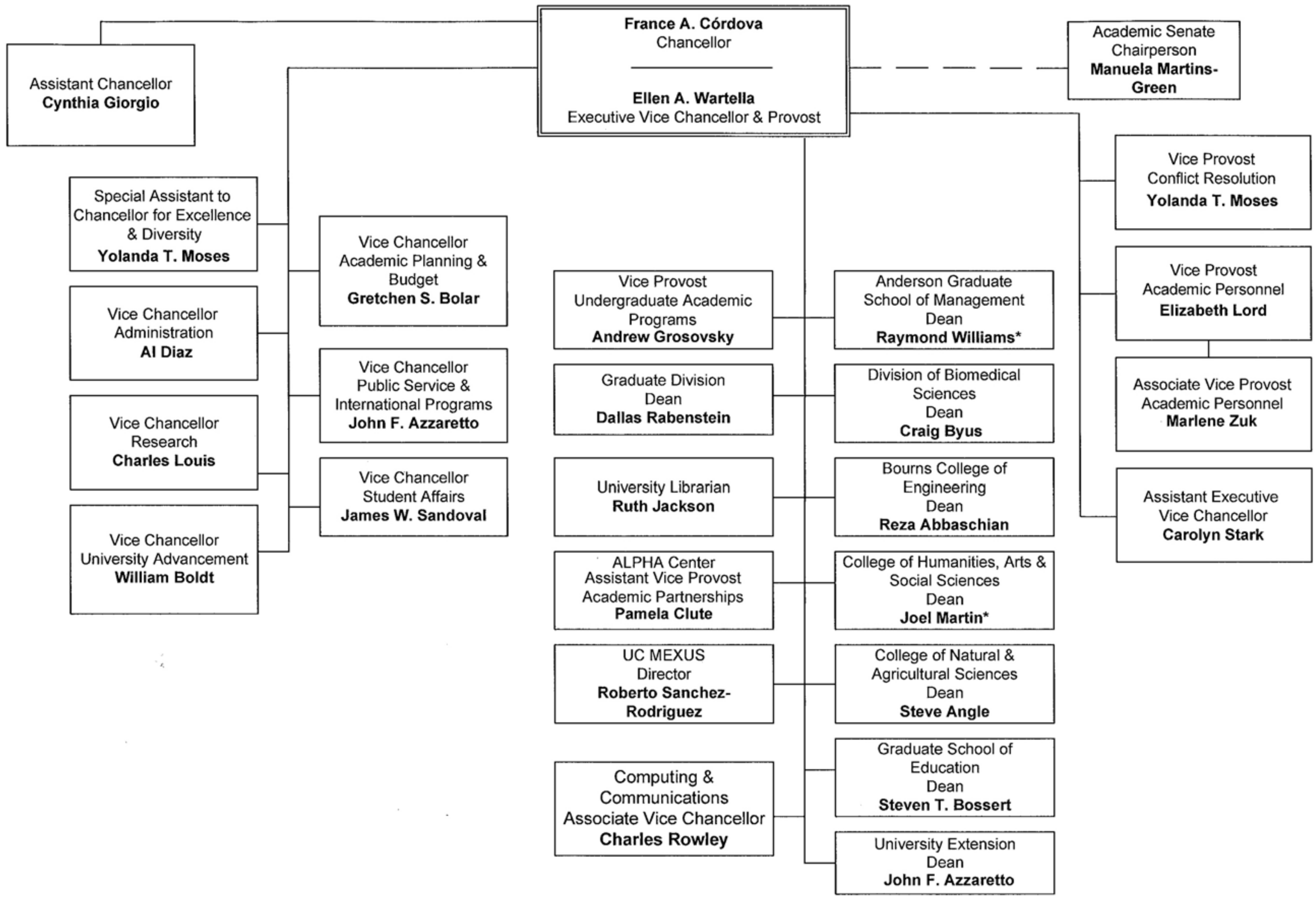
IIB. Background Information Relative to the Engineering Unit

1. Engineering Educational Unit

Provide an organizational chart showing the position of the engineering unit within the institution, listing each official by title, e.g., academic vice president, dean of college of engineering, etc., and label as Table II-2, *Organizational Chart*.

The organizational chart is provided on the following page.

Table II-2. Campus Organizational Chart.



*Interim

Describe the engineering educational unit, listing those departments, divisions, programs, etc., which teach engineering subjects, conduct engineering research, or perform other engineering educational activities.

The Bourns College of Engineering consists of four departments (Chemical and Environmental Engineering, Computer Science and Engineering, Electrical Engineering, Mechanical Engineering) and four research centers, offering the following degrees. A fifth department, Bioengineering, will become independent of Chemical and Environmental Engineering in the fall of 2006.

Degree	Title	Established/Effective Dates
BS	Bioengineering	Fall 2005
BS	Chemical Engineering: Concentration in Biochemical Engineering	Established fall 1986, first freshmen admitted fall 1990; effective as of fall 2002
BS	Chemical Engineering: Concentration in Biochemistry	Established fall 1986, first freshmen admitted fall 1990; effective through 2001-02 academic year
BS	Chemical Engineering: Concentration in Bioengineering	Effective beginning fall 2003
BS	Chemical Engineering: Concentration in Chemical Engineering	Effective beginning fall 2002
BS	Chemical Engineering: Concentration in Chemistry	Established 1986; first freshmen admitted fall 1990; effective through the 2001-02 academic year
BS	Computer Engineering	Established fall 1999
BS	Computer Science	Established fall 1992
BS	Electrical Engineering	Established fall 1986; first freshmen admitted fall 1989
BS	Environmental Engineering: Concentration in Water Pollution Control	Established fall 1986; first freshmen admitted fall 1990
BS	Information Systems	Established fall 2001
BS	Mechanical Engineering	Established fall 1990; first freshmen admitted fall 1994
MS	Chemical & Environmental Engineering	Established fall 1998
MS	Computer Science	Established fall 1999
MS	Electrical Engineering	Established fall 1999
MS	Mechanical Engineering	Established fall 2001
Ph.D.	Chemical & Environmental Engineering	Established fall 2003
Ph.D.	Computer Science	Established fall 1991
Ph.D.	Electrical Engineering	Established fall 1999
Ph.D.	Mechanical Engineering	Established fall 2001

Give the name and title of the administrative head of the principal education unit and other administrative unit(s).

- Dean: Reza Abbaschian.
- Associate Dean, Graduate Affairs and Research: Mark R. Matsumoto.
- Associate Dean, Undergraduate Affairs: C.V. Ravishankar.
- Associate Dean, Finance and Administration: D. Patrick Hartney.
- Chair, Department of Chemical and Environmental Engineering: Marc Deshusses.
- Chair, Department of Computer Science and Engineering: Thomas H. Payne.
- Chair, Department of Electrical Engineering: Jie Chen. (As of July 1, 2006, Dr. Chen will be succeeded by Dr. Roger Lake.)
- Interim Chair, Department of Mechanical Engineering: Mark R. Matsumoto.
- Director, Center for Research in Intelligent Systems: Bir Bhanu.
- Director, Center for Nanoscale Science and Engineering: Robert C. Haddon.
- Interim Director, College of Engineering-Center for Environmental Research and Technology: Matthew J. Barth.
- Director, Center for Bioengineering: Jerome S. Schultz.

If all engineering programs do not come under a single administrative head, describe the other administrative unit(s) offering programs leading to a degree in engineering, and provide separate data where applicable. Include other units in Table II-2, Organizational Chart.

Not applicable.

Provide a copy of the engineering education unit mission statement.

Section IIA.5 presents the mission statement for the campus and for the Bourns College of Engineering. The Bourns College of Engineering mission statement is repeated here:

The vision and mission of the Bourns College of Engineering is to become a nationally recognized leader in engineering research and education. Our mission is to:

6. Produce engineers with the educational foundation and the adaptive skills to serve rapidly evolving technology industries.
7. Conduct nationally recognized engineering research focused at providing a technical edge for the U.S.
8. Contribute to knowledge in both fundamental and applied areas of engineering.
9. Provide diverse curricula that will instill our students with the imagination, talents, creativity and skills necessary for the varied and rapidly changing requirements of modern life and to enable them to serve in a wide variety of other fields that requires leadership, teamwork, decision making, and problem solving abilities.
10. Be a catalyst for industrial growth in the Inland Empire.

2. Programs Offered and Degrees Granted

List the full titles of all degrees in engineering--undergraduate, graduate, and professional--granted by the institution. If there are differences in the degrees awarded for completion of co-op programs, these should be clearly indicated. (see Table II-3 (Parts 1 and 2))

The undergraduate degree programs are listed below. For additional information, see Table II-3.

- BS, Bioengineering
- BS, Chemical Engineering, Conc. in Biochemical Engineering
- BS, Chemical Engineering, Conc. in Biochemistry
- BS, Chemical Engineering, Conc. in Bioengineering
- BS, Chemical Engineering, Conc. in Chemical Engineering
- BS, Chemical Engineering, Conc. in Chemistry
- BS, Computer Engineering
- BS, Computer Science
- BS, Electrical Engineering
- BS, Environmental Engineering, Conc. in Water Pollution Control
- BS, Environmental Engineering, Conc. in Air Pollution Control
- BS, Information Systems
- BS, Mechanical Engineering

Table II-3 appears on the following pages.

Table II-3 (Part 1). Engineering Programs Offered

Program Title (bachelor's degrees only)[1]	Modes Offered[2]				Nominal Years to Complete	Administrative Head	Administrative Unit or Units (e.g. Dept.) Exercising Budgetary Control	Submitted for Evaluation[3]		Offered, Not Submitted for Evaluation[4]	
	Day	Co-op	Off Campus	Alternative Mode				Now Accred.	Not Now Accred.	Now Accred.	Not Now Accred.
1.BS, Bioengineering	x				4	J.S. Schultz	Bioengineering **(a)**				x
2. BS, Chemical Engineering Conc. in Biochemical Engineering	x				4	M. Deshusses	Chem. & Env. Engr.	x			
3. BS, Chemical Engineering Conc. in Biochemistry	x				4	M. Deshusses	Chem. & Env. Engr.	x			
4. BS, Chemical Engineering Conc. in Bioengineering	x				4	M. Deshusses	Chem. & Env. Engr.	x			
5. BS, Chemical Engineering Conc. in Chemical Engineering	x				4	M. Deshusses	Chem. & Env. Engr.	x			
6. BS, Chemical Engineering Conc. in Chemistry	x				4	M. Deshusses	Chem. & Env. Engr.	x			
7. BS, Computer Engineering	x				4	J. Chen T. Payne	Electrical Engineering Comp. Sci & Engr.	x			
8. BS, Computer Science	x				4	T. Payne	Comp. Sci & Engr.		x		
9. BS, Electrical Engineering	x				4	J. Chen	Electrical Engineering	x			
10. BS, Environmental Engineering Conc. in Water Pollution Control	x				4	M. Deshusses	Chem. & Env. Engr.	x			

11. BS, Environmental Engineering Conc. in Air Pollution Control	x					M. Deshusses	Chem.& Env. Engr.	x			
12. BS, Information Systems	x				4	T. Payne	Comp. Sci & Engr.				x
13. BS, Mechanical Engineering	x				4	S. Mahalingam	Mechanical Engineering	x			

(a) New department as of 2006 as an offshoot of the Chemical & Environmental Engineering Department.

Table II-3 (Part 2). Degrees Awarded and Transcript Designations

Program Title[1]	Modes Offered[2]				Name of Degree Awarded[3]	Designation on Transcript[4]
	Day	Co-op	Off Campus	Alternative Mode		
Bioengineering	x				BS, Bioengineering	BS, Bioengineering
Chemical Engineering	x				BS, Chemical Engineering Conc. in Biochemical Engineering	BS, Chemical Engineering Conc. in Biochemical Engineering
Chemical Engineering	x				BS, Chemical Engineering Conc. in Biochemistry	BS, Chemical Engineering Conc. in Biochemistry
Chemical Engineering	x				BS, Chemical Engineering Conc. in Bioengineering	BS, Chemical Engineering Conc. in Bioengineering
Chemical Engineering	x				BS, Chemical Engineering Conc. in Chemical Engineering	BS, Chemical Engineering Conc. in Chemical Engineering
Chemical Engineering	x				BS, Chemical Engineering Conc. in Chemistry	BS, Chemical Engineering Conc. in Chemistry
Computer Engineering	x				BS, Computer Engineering	BS, Computer Engineering
Computer Science	x				BS, Computer Science	BS, Computer Science
Electrical Engineering	x				BS, Electrical Engineering	BS, Electrical Engineering
Environmental Engineering	x				BS, Environmental Engineering Conc. in Water Pollution Control	BS, Environmental Engineering Conc. in Water Pollution Control
Information Systems	x				BS, Information Systems	BS, Information Systems
Mechanical Engineering	x				BS, Mechanical Engineering	BS, Mechanical Engineering

3. Information Regarding Administrators

Furnish current summary *curriculum vitae* for the administrative head of the engineering educational unit(s) and any associates or assistants who have faculty status or are in responsible charge of a major service unit such as student counseling center, co-op coordination, etc. The summary *curriculum vitae* may be provided in any format but must be limited to one page.

One-page biographical sketches for administrators and department chairs are provided on the following pages.

Reza Abbaschian
Dean, Bourns College of Engineering
Professor of Mechanical Engineering
A342 Bourns Hall, University of California, Riverside, CA 92521 (951) 827-6374 rabba@engr.ucr.edu

Professional Preparation

University of Tehran, Iran	Mining Engineering	B.S., 1965
Michigan Technological University	Metallurgical Engineering	M.S., 1968
University of California, Berkeley	Materials Science and Engineering	Ph.D., 1971

Appointments

2005-present. University of California, Riverside. Dean of the Bourns College of Engineering and Professor of Mechanical Engineering.

1980-2005. University of Florida, Gainesville. Vladimir A. Grodsky Professor of Materials Science and Engineering (February 2000-September 2005). Chairman, Department of Materials Science and Engineering (1987-2002). Acting Chairman, Department of Materials Science and Engineering (1986-1987). Professor (1983-2005), Associate Professor (1980-1983). Provided leadership for the department to move up in ranking to top 10 in the nation according to *U.S. News & World Report*. Expanded the department by adding 16 faculty members, bringing the total to 32. Increased enrollment to 232 graduate students and 110 upper-division undergraduates, with 130 in the Ph.D. program (the largest MSE department in America). Actively promoted diversity: 40 women, 16 African-Americans, 14 Asian-Americans, and 5 Hispanics among the U.S. graduate students.

Summer 1981. NASA Space Processing Laboratory, Marshall Space Flight Center, Huntsville, AL. Visiting Scientist.

March-December 1980. Massachusetts Institute of Technology. Visiting Scientist.

1972-1980. School of Engineering (formerly Pahlavi University), Shiraz, Iran. Associate Professor (1974-1980), Assistant Professor (1972-1974). Chairman, Department of Materials Science and Engineering (1974-1976).

1978-1978. University of Illinois, Urbana. Visiting Associate Professor, Department of Metallurgy and Mining Engineering (sabbatical leave).

1968-1971. University of California, Berkeley. Research Assistant and Post-graduate Research Assistant, Department of Materials Science and Engineering.

Summer 1967. US Steel Corporation, Gary, IN. Research Analyst.

Selected Synergistic Activities

President of ASM International, the nation's largest materials association (installed September 26, 2005). Fellow of ASM since 1992.

2003 ASEE Donald E. Marlowe Award in recognition of "creative and distinguished administrative leadership in engineering and engineering technology education."

Fellow of The Minerals, Metals, & Materials Society, March 2000: the highest award bestowed by TMS to no more than 100 members. TMS Leadership Award for "outstanding leadership in the fields of metallurgy and materials," 1999. TMS Educator Award for "outstanding educator, leader, researcher and inventor who provides a modern standard for today's academician," 1998.

Council on Academic Freedom, Faculty Quality & Faculty Welfare, 2004-present.

Mark R. Matsumoto
Interim Dean, Bourns College of Engineering
A342 Bourns Hall, University of California, Riverside, CA 92521-0425 matsumot@engr.ucr.edu

Professional Preparation

University of California, Irvine	Civil Engineering	B.S., 1977
University of California, Davis	Environmental Engineering	M.S., 1980
University of California, Davis	Environmental Engineering	Ph.D., 1982

Appointments

1994-present. University of California, Riverside. Interim Dean (July 2004-Sept. 2005 and January-June 2002). Associate Dean, Research and Graduate Studies, Bourns College of Engineering, July 1999-present. Professor of Environmental Engineering, 1994-present. Chair, Department of Chemical and Environmental Engineering, 1994-2000.

1983-1994. State University of New York Buffalo, Department of Civil Engineering. Assistant Professor (1983-89), Associate Professor (1989-94).

1978-82. University of California, Davis, Department of Civil Engineering. Research Assistant (1978-79), Postgraduate Research Engineer (1979-81), Assoc. Development Engineer (1981-82).

Synergistic Activities

- Reviewer, *Journal of Environmental Engineering, Water Environment Research, Water Research, Journal of Soil and Sediment Contamination, Journal of Hazardous Materials, Journal of Environmental Quality*, U.S. EPA Small Business Innovative Research Program.
- Editorial Board, *Advances in Environmental Research*.
- Consultant: Orange County Sanitation District, Energy Resource Institute.
- Invited Workshop Contributor: 2002 International Containment Conference Workshop sponsored by U.S. EPA and DoE, and DuPont Corporation.

Chinya V. Ravishankar
Professor of Computer Science and Engineering
Associate Dean, Undergraduate Affairs
A342 Bourns Hall, University of California, Riverside, CA 92521 ravi@engr.ucr.edu (951) 827-5318

Professional Preparation

Indian Institute of Technology, Bombay	Chemical Engineering	B.Tech, 1975
University of Wisconsin-Madison	Computer Sciences	M.S., 1986
University of Wisconsin-Madison	Computer Sciences	Ph.D., 1987

Appointments

1999-present. University of California, Riverside. Professor, Department of Computer Science and Engineering. Associate Dean, Undergraduate Affairs, 2005-present.

1986-1999. University of Michigan, Ann Arbor. Research Scientist (1996-1999), EECS Department and the Information Technology Division. Associate Research Scientist (1991-1996), EECS Department and Information Technology Division. Assistant Professor (1986-1991), Electrical Engineering and Computer Sciences Department.

Synergistic Activities

• Associate Editor, IEEE Transactions on Knowledge and Data Engineering, IEEE Press.
• Program Committee, ACMSIGMOD'99, International Conference on Management of Data, Philadelphia,
PA, May 1999.
• Program Committee, ACM First International Conference on Data Warehousing and On-Line Analytical Processing, Washington D.C., November 7, 1998.
• Program Committee, Ninth International Conference on Scientific and Statistical Databases, 1997.
• Program Committee, Fifth International Symposium on Large Spatial Databases, 1997.
• Program Committee, Tenth International Conference on Distributed Computing Systems, 1990.
• Reviewer for IEEE Transactions on Software Engineering, IEEE Transactions on Parallel & Distributed Systems, IEEE Transactions on Computers, IEEE Transactions on Knowledge & Data Engineering, and numerous other journals and conferences. Also, reviewer for National Science Foundation, and the National Sciences and Engineering Research Council of Canada.

Marc A. Deshusses

Professor and Chairman, Department of Chemical and Environmental Engineering
A242 Bourns Hall, University of California, Riverside, CA 92521 (951) 827-2477 mdeshuss@engr.ucr.edu

Professional Preparation

Swiss Federal Inst. of Technology, Lausanne	Chemical Engineering	1990
Swiss Federal Inst. of Technology, Zurich	Technical Sciences	Ph.D., 1994
Swiss Federal Inst. of Technology, Zurich	Biochemistry	Postdoctoral, May-July 1994

Appointments

1994-present. University of California, Riverside. Professor and Chair, Department of Chemical and Environmental Engineering (July 2004-present). Associate Professor (2001-2004). Assistant Professor (1994-2001). Faculty member, Environmental Toxicology Graduate Program (1996-present). Faculty member, Microbiology Graduate Program (1997-present).

Synergistic Activities

Memberships: American Chemical Society, American Institute of Chemical Engineers, Air and Waste Management Association, Water Environment Federation, External Advisory Committee, NASA Purdue Advanced Life Support Center (by invitation).

Editorial/Professional: Editorial Board, *Journal of Industrial Microbiology & Biotechnology* [99-02; 03-present]; Editorial Board, *Applied Biochemistry and Biotechnology* [03-present]. Reviewer, *Environmental Science and Technology, Biotechnology and Bioengineering, Chemical Engineering Science, Journal of Environmental Engineering, Environmental Catalysis, Journal of the Air & Waste Management Association.*

Leader for ABET accreditation efforts for both Chemical Engineering and Environmental Engineering Programs [00 - 02] (resulted in 6 years accreditation for both programs).

1997/98 Bourns College of Engineering Outstanding Teaching Award.

Thomas H. Payne
Associate Professor and Chair, Computer Science and Engineering
351 Engineering Building II, Riverside, CA 92521 (951) 827-2244 thp@cs.ucr.edu

Professional Preparation

Marquette University	Mathematics	B.S., 1964
University of Notre Dame	Mathematics	M.S., Ph.D., 1967

Appointments

1967-present. University of California, Riverside. Department of Computer Science and Engineering. Assistant Professor (1967-73). Associate Professor (1973-present). Research area: Efficient implementation of programming language features related to operating systems, such as concurrency, protection, dynamic binding.

Synergistic Activities

Awards and Honors:
- T.J. Watson Memorial Scholarship
- NASA Traineeship

Memberships:
- Sigma Xi
- Association for Symbolic Logic
- Association for Computing Machinery (ACM)
- Mathematics Association of America
- American Mathematical Society

Consulting:
- Consultant for a number of R&D companies in California

Jie Chen
Professor and Chair, Department of Electrical Engineering
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Professional Preparation

Northwestern Polytechnic Univ., China	Aerospace Engineering	B.S., 1982
University of Michigan	Electrical Engineering	M.S.E., 1987
University of Michigan	Mathematics	M.A., 1987
University of Michigan	Electrical Engineering	Ph.D., 1990

Appointments

1991-1993. Georgia Institute of Technology, Atlanta. Research Fellow.

1994-present. University of California, Riverside. Assistant Professor (1994-1997). Associate Professor 1997-1999). Professor (1999-present).

Synergistic Activities

Professional Societies
- IEEE
- IEEE Control Systems Society

Honors and Awards
- Best Paper Presentation Award, 1993 American Control Conference, San Francisco, CA, June 1993
- Adjunct Professor, by invitation, Northwestern Polytechnic University, China, 1994 – Present
- UCR Regents Fellowship Award, UCR, 1995
- National Science Foundation Career Award, 1996
- SICE International Award, 2004
- Guest Professor, Zhejiang University, China, 1997 – present
- Visiting Fellow, Tokyo Institute of Technology, Tokyo, Japan, July 2000
- Visiting Associate Professor, Hong Kong University of Science and Technology, Hong Kong, P.R. China, January - June 2000
- Guest Professor, Dalian Institute of Technology, Dalian, P.R. China, 8/2001 – present
- Visiting Fellow, School of Quantitative Methods and Mathematical Sciences, University of Western Sydney, Penrith, Australia, May-June, 2004.
- Adjunct Professor, Harbin Institute of Technology-Shenzhen Graduate School, Shenzhen, P.R. China, since April 2004.

Publishing
- Founding Editor-in-Chief, *Journal of Control Science and Engineering*, since April 2006.
- Guest Editor, *IEEE Control Systems Magazine*, since August 2005.
- Associate Editor, *Automatica*, since March 2004.
- Associate Editor, *Journal of Control Theory and Applications*, since March 2004.
- Guest Editor, *IEEE Transactions on Automatic Control*, August 2001--August 2003.
- Associate Editor, *IEEE Transactions on Automatic Control*, January 1997--December 2000.

Bir Bhanu

Professor of Electrical Engineering and Director, Center for Research in Intelligent Systems

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Professional Preparation

Massachusetts Inst. of Technology, RLE	Electrical Engr./Computer Sci.	S.M., 1977
Massachusetts Inst. of Technology, RLE	Electrical Engr./Computer Sci	E.E., 1977
University of Southern California	Electrical Engineering	Ph.D., 1981
University of California, Irvine	Business	MBA, 1984

Appointments

1991-present. University of California, Riverside. Professor of Electrical Engineering and Computer Science and Engineering. Director, Center for Research in Intelligent Systems (1998-present). Director, Visualization Laboratory (1991-present). Founded Electrical Engineering Department at UCR and served as its first Chair (1991-1994).

1986-1991. Honeywell Inc. Senior Honeywell Fellow.

1981-1991. University of Utah. Associate Professor of Computer Science. Leave of absence for the academic year 1986-1987.

1981-1984. Ford Aerospace & Communications Corp. Engineering Specialist.

1980-1981. INRIA, Rocquencourt, France. Research Fellow.

1978. IBM Research Laboratory, San Jose, CA. Academic Associate, Computer Science Department.

Synergistic Activities

1. Eleven U.S. and International Patents (plus four in process) and over 250 reviewed publications, including over 90 Journal Papers, in Computer Vision, Pattern Recognition and Learning. Co-author of books on Computational Learning for Adaptive Computer Vision (Springer 2005), Dynamic Sensor Fusion (SPIE 2005), Computational Algorithms for Fingerprint Recognition (Kluwer 2003), and Co-Editor of book on Computer Vision Beyond The Visible Spectrum, (Springer 2004).
2. Fellow – IEEE, AAAS, IAPR and SPIE for contributions in computer vision, pattern recognition, learning, and education. Senior Honeywell Fellow – Honeywell Inc. Worked on biological imaging at USC Medical School, USC Cancer Research Center (Dr. Marsh and Dr. Tokes) and USC Image Processing Institute. Published papers on biological image segmentation, motion understanding (including a book) and 2D/3D object recognition.
3. Won two outstanding paper awards from Pattern Recognition Society 1989, 1998. Won various awards for research/technical excellence and team efforts from College of Engineering -UCR, Honeywell and IBM. Served as associate editor/guest editor of various IEEE Transactions (Pattern Analysis and Machine Intelligence; Image Processing; Systems, Man and Cybernetics; Robotics and Automation) and several other journals in Computer Vision, Pattern Recognition and Robotics.
4. Chair, IEEE Conference on Computer Vision and Pattern Recognition 1996, DARPA Image Understanding Workshop 1994, IEEE Workshop on Applications of Computer Vision 1992, 2000, Program Chair, IEEE Workshop on Computer Vision Beyond The Visible Spectrum, 1999-2001, Chair, IEEE Workshop on Learning in Computer Vision and Pattern Recognition, 2003-04, Program Committee member of many conferences in Computer Vision and Pattern Recognition, Human Motion and Video Computing.

Robert C. Haddon
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Professional Preparation

Melbourne University, Australia	Chemistry	B. Sc. (Hon), 1966
Pennsylvania State University	Organic Chemistry	Ph. D., 1971
University of Texas at Austin	Organic Chemistry	1972-1973

Appointments

2000-present. University of California, Riverside. Distinguished Professor of Chemistry and Chemical and Environmental Engineering. Director of the Center for Nanoscale Science and Engineering.

1999-present. Carbon Solutions, Inc. Founder and President.

1998-2000. Director, NSF MRSEC Advanced Carbon Materials Center.

1998. CarboLex, Inc. Co-founder and Vice President.

1997-2000. University of Kentucky, Professor of Chemistry and Physics.

1976-97. Bell Telephone Laboratories (AT&T, Lucent Technologies).

1973-76. Australian National University, Queen Elizabeth II Fellow.

Synergistic Activities

Service on the Editorial Advisory Boards of Advanced Materials, J. Amer. Chem. Soc., Chemical Physics Letters, Molecular Crystals and Liquid Crystals and Organizer of the Advanced Materials and Nanotechnology Subdivision of I&EC.

Founder and Chair of the Advanced Materials and Nanotechnology Subdivision of I&EC.

Matthew J. Barth

Associate Professor of Electrical Engineering

Associate Director, Center for Environmental Research and Technology

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Professional Preparation

University of Colorado, Boulder	Electrical Engineering	B.S., 1984
University of California, Santa Barbara	Electrical Engineering	M.S., 1986
University of Tokyo, Japan	Research Student, Sys Engr.	1986-87
University of California, Santa Barbara	Electrical Engineering	Ph.D., 1990

Appointments

1991-present. Assistant then Associate Professor of Electrical Engineering; also Director of Transportation Systems and Vehicle Technology Research, University of California, Riverside, Bourns College of Engineering-Center for Environmental Research and Technology.

1989-91. Visiting Researcher, Department of Systems Engineering, Faculty of Engineering Science, Osaka University, Japan.

1985-89. Graduate Research Assistant, Electrical Engineering and Center for Robotic Systems in Microelectronics, University of California, Santa Barbara.

1985-86. Member of the Technical Staff, Advanced Technology Division, General Research Corporation, Santa Barbara, CA.

1979-84. Undergraduate Research Assistant, Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder.

Research Areas of Interest

Intelligent Transportation Systems, Transportation/Emissions Simulation and Modeling, Vehicle Activity Analysis, Electric Vehicle Technology, Robotics, Computer Vision, and Advanced Sensing and Control.

Jerome S. Schultz
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Professional Preparation

Columbia University, NY	Chemical Engineering	B.S., 1954
Columbia University, NY	Chemical Engineering	M.S., 1956
University of Wisconsin	Biochemistry and Chemical Engineering	Ph.D., 1958

Appointments

January 2004. University of California, Riverside. Distinguished Professor of Bioengineering, Department of Chemical and Environmental Engineering.

2001-2002. NASA-Ames Research Center, Division of Fundamental Biology. On leave from University of Pittsburgh, assisted in the development of a strategic plan to integrate biotechnology, nanotechnology, and information technology.

1987-2003. University of Pittsburgh. Chairman, Department of Bioengineering (1998-2002). Distinguished Service Professor of Engineering. Professor of Bioengineering. Professor of Chemical Engineering. Professor of Medicine.

1985-87. National Science Foundation. Deputy Director, Division of Cross-Disciplinary Research. Section Head, Emerging Engineering Systems.

1984. University of Maryland and National Institute for Standards and Technology (NIST). Director of Development, Center for Advanced Research in Biotechnology.

1964-87. University of Michigan. Chairman, Department of Chemical Engineering. Professor of Chemical Engineering.

1983. University of North Carolina, Chapel Hill. Visiting professor on sabbatical from Michigan.

1971-72. University of Nijimegen, Holland. Guest Professor of Physiology.

1958-64. Lederle Laboratories. Group Leader, Biochemical Research. Research and Development Engineer.

Synergistic Activities

- Chairman, Panel to Review International Biosensing Research Trends; Sponsors: NIH, NSF, 2002- .
- Editor in Chief, Biotechnology Progress – 1991-Present.
- NIH Study Sections, 1984-1988, 2004.
- President, American Institute for Medical and Biological Engineering – 1995.
- Member National Academy of Engineering – 1994.

4. Supporting Academic Departments

Table II-4 provides information about supporting academic departments for all academic-supporting units that provide any required portion of the instruction for engineering students in the programs being evaluated.

Table II-4. Supporting Academic Departments
For Academic Year: 2005-06 (October 2005)

Department or Unit	Full-time Faculty Head Count[1]	Part-time Faculty Head Count[2]	FTE Faculty[3]	Teaching Assistants	
				Head Count	FTE
Biochemistry	14	1	14.46	7	3.50
Biology	19	0	19.00	29	13.75
Chemistry	24	1	24.58	71	33.75
English	72	5	74.33	57	28.50
Environmental Sciences	23	0	23.00	5	2.50
Mathematics	36	9	40.13	56	23.62
Physics	30	2	30.90	40	18.00
Statistics	10	0	10.00	19	7.50

Provide data for all academic supporting units, e.g., Mathematics, Physics, Chemistry, English, Computer Science, etc., that provide any portion of the instruction required by the institution for engineering students.

1. the number of full-time faculty members (tenure track plus other teaching faculty, as classified in Table I) exclusive of teaching assistants.
2. the number of part-time, adjunct, or visiting teaching faculty members, exclusive of teaching assistants.
3. the sum of column 1 plus FTE** of column 2.

** For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For faculty members, 1 FTE equals what your institution defines as a full-time load.

5. Engineering Finances

Provide information about the support expenditures of the engineering unit, report the expenditures for support functions of the engineering educational unit(s) as a whole. The information is to be supplied for each of the three most current fiscal years. For the fiscal year of the visit, provide the budgeted amounts. If it is not possible to provide final budget figures in the report, they should be provided before or at the time of the visit. (see Table II-5)

Table II-5. Support Expenditures
Bourns College of Engineering including Centers and Programs

	1	2	3	4
	2004	2005	2006	2007
Fiscal Year	(prior to previous year)	(previous year)	(current year)	(year of visit)
Operations[1] (not including staff)	1,068,902.67	2,351,722.98	1,911,896.81	
Travel[2]	216,908.39	333,904.33	337,479.84	
* Equipment[3]				
Institutional Funds	1,206,725.57	739,788.62	780,736.96	
Grants and Gifts[4]	1,631,077.95	5,222,613.10	1,866,320.00	
Graduate Teaching Assistants	1,292,254.68	1,358,217.51	1,625,272.82	
Part-time Assistance[5] (other than teaching)	230,240.04	294,862.30	315,086.23	

* Based on University Policy, Equipment purchases of less than $5,000 (per item), not charged to the Equipment Budget Category-BC60

Notes
1. General operating expenses to be included here.
2. Institutionally sponsored, excluding special program grants.
3. Major equipment, excluding equipment primarily used for research. Note that the expenditures under “Equipment” should total the expenditures for Equipment. If they don’t, please explain.
4. Including special (not part of institution’s annual appropriation) non-recurring equipment purchase programs.
5. Do not include graduate teaching and research assistant or permanent part-time personnel.

6. Engineering Personnel and Policies

a. Personnel

Provide the number of personnel, both full-time and part-time, for the entire engineering unit and for each program being evaluated. (see Table II-6)

Table II-6 is presented below and is based on the following inputs and definitions:

Departments and groups covered:
- Chemical and Environmental Engineering Department
- Computer Sciences & Engineering Department
- Computer Engineering Program
- Electrical Engineering Department
- Mechanical Engineering Department
- Dean's Office (including Development Office, Student Affairs, & MESA)
- Center for Environmental Research and Technology (CE-CERT)
- Center for Nanoscience & Engineering (CNSE)
- Center for Research in Intelligent Systems (CRIS)

Administrative personnel:
- Dean and Associate Deans (Mark Matsumoto and Chinya Ravishankar counted as .50 FTE each)

Faculty:
- All faculty (excludes the Dean and Associate Deans' 50% appointments)

Other faculty excluding student assistants:
- Lecturers
- Adjunct Professors
- Professional Research Series (visiting and non-visiting titles)
- Postgraduates/Visiting Postdoctoral Researchers
- Junior Specialists
- Readers

Student teaching assistants:
- All graduate teaching assistants.

Student research assistants:
- All graduate research assistants.

Technicians/specialists:
- Development Engineers
- Programmer Analysts
- Staff Research Associates

- Laboratory Helpers and Assistants
- Physical Plant Superintendents

Office/clerical employees:

- Senior Analyst (Dean's Executive Assistant-E. Montoya)
- Assistant Analysts and Analysts
- Student Affairs Officers III (L. O'Neill) & Student Affairs Officers I & II
- Computer Resource Spec. II
- Student Assistants I & II

Other:

- Assistant Deans
- Directors & Managers (Functional Area)
- Admin/Coord/Officer (Functional Area)
- Specialist (Functional Area)
- Deputy Director (CE-CERT)
- Management Service Officers (MSOs)
- Administrative Specialist (N. Jahr)
- Prin. & Senior Administrative Analysts
- Student Affairs Officers III & IV (Asst. Director & Director of MESA)
- Senior Writer

Table II-6. Personnel and Students
Bourns College of Engineering

	HEAD COUNT		FTE	RATIO TO FACULTY
	FT	PT		
Administrative	1	2	2.00	
Faculty (tenure-track)	65	4	66.60	
Other Faculty (excluding student Assistants)	29	30	40.98	
Student Teaching Assistants (Grad Only)	17	88	61.00	0.9159
Student Research Assistants (Grad Only)	9	141	79.50	1.1937
Technicians/Specialists	35	8	38.50	0.5781
Office/Clerical Employees	29	105	52.57	0.7893
Others	20	5	22.46	0.3372

Undergraduate Student Enrollment	1251	23	1,262.50	18.9565
Graduate Student Enrollment	300	23	311.50	4.6772

Table II-6. Personnel and Students
Chemical and Environmental Engineering

NOTE: The Department of Chemical and Environmental Engineering supports two degree programs: Chemical Engineering and Environmental Engineering. (The department also has served as an administrative structure for a new Bioengineering Department, which is being established as of Fall 2006.) Faculty and staff are assigned to the department, not to the degree program.

	HEAD COUNT		FTE`	RATIO TO FACULTY
	FT	PT		
Administrative				
Faculty (tenure-track)	12	2	13.00	
Other Faculty (excluding student Assistants)	7	3	9.45	
Student Teaching Assistants	0	11	5.50	0.42
Student Research Assistants		19	9.50	0.73
Technicians/Specialists	3	2	4.62	0.36
Office/Clerical Employees	5	13	6.92	0.53
Others	1		1.00	0.08

Undergraduate Student Enrollment	162	1	162.50	12.50
Graduate Student Enrollment	57	5	59.50	4.58

Table II-6. Personnel and Students
Computer Science and Engineering

	HEAD COUNT		FTE	RATIO TO FACULTY
	FT	PT		
Administrative				
Faculty (tenure-track)	23	1	23.50	
Other Faculty (excluding student Assistants)	3	5	4.16	
Student Teaching Assistants	12	45	34.50	1.47
Student Research Assistants	3	44	25.00	1.06
Technicians/Specialists	2		2.00	0.09
Office/Clerical Employees	3	13	6.81	0.20
Others	1		1.00	0.04

Undergraduate Student Enrollment	316	14	323.00	13.74
Graduate Student Enrollment	133	6	136.00	5.79

Table II-6. Personnel and Students
Computer Engineering

NOTE: Computer Engineering is a degree program, not a department. It is supported jointly by the Department of Computer Science and Engineering and the Department of Electrical Engineering. It has no dedicated faculty or staff.

	HEAD COUNT		FTE`	RATIO TO FACULTY
	FT	PT		
Administrative				
Faculty (tenure-track)				
Other Faculty (excluding student Assistants)				
Student Teaching Assistants				
Student Research Assistants				
Technicians/Specialists				
Office/Clerical Employees				
Others				

Undergraduate Student Enrollment	160	1	160.50	
Graduate Student Enrollment				

Table II-6. Personnel and Students
Electrical Engineering

	HEAD COUNT		FTE	RATIO TO FACULTY
	FT	PT		
Administrative				
Faculty (tenure-track)	18	1	18.10	
Other Faculty (excluding student Assistants)	5	5	7.01	
Student Teaching Assistants	5	12	11.00	0.61
Student Research Assistants		25	12.50	0.69
Technicians/Specialists	2	1	2.50	0.14
Office/Clerical Employees	3	4	4.03	0.22
Others	1		1.00	0.06
Undergraduate Student Enrollment	190	3	191.50	10.58
Graduate Student Enrollment	76	8	80.00	4.42

Table II-6. Personnel and Students
Mechanical Engineering

	HEAD COUNT		FTE	RATIO TO FACULTY
	FT	PT		
Administrative				
Faculty (tenure-track)	12		12.00	
Other Faculty (excluding student Assistants)	2	8	4.05	
Student Teaching Assistants		20	10.00	0.83
Student Research Assistants		20	10.00	0.83
Technicians/Specialists	2	1	2.17	0.18
Office/Clerical Employees	2	9	4.08	0.34
Others	1		1.00	0.08

Undergraduate Student Enrollment	285	4	287.00	23.92
Graduate Student Enrollment	34	4	36.00	3.00

Table II-6. Personnel and Students
Undeclared Engineering Majors

NOTE: There is no "undeclared" department or degree in engineering. Data here are presented for the sake of completeness in the calculations of ratios per student enrolled.

	HEAD COUNT		FTE	RATIO TO FACULTY
	FT	PT		
Administrative				
Faculty (tenure-track)				
Other Faculty (excluding student Assistants)				
Student Teaching Assistants				
Student Research Assistants				
Technicians/Specialists				
Office/Clerical Employees				
Others[5]				

Undergraduate Student Enrollment	138	0	138.00	
Graduate Student Enrollment				

b. Faculty Salaries, Benefits, and Other Policies

Briefly summarize the promotion and tenure system and the processes used to determine faculty salaries. Faculty salary data may be provided at the option of the institution. (see Table II-7)

Merit, Promotion, and Tenure Process

The University of California utilizes a rank and step system as a basis for its merit, promotion, and tenure process for its Professorial series (see the UC *Academic Personnel Manual*, http://www.ucop.edu/acadadv/acadpers/apm/). At each consideration for a merit increase, promotion, and tenure a faculty evaluation file is prepared and reviewed at multiple administrative levels – department faculty, department chair, dean, campus Academic Senate, and Provost and Chancellor. Each reviewing body makes a recommendation for merit increase, promotion, or tenure, to the Provost and Chancellor for their final decisions.

Reviewing bodies which advise on actions concerning appointees in the Professor and corresponding series, are instructed to use the following criteria for appointment, promotion and appraisal.

The review committee is to judge the candidate with respect to the proposed rank and duties, considering the record of the candidate's performance in (1) teaching, (2) research and other creative work, (3) professional activity, and (4) University and public service. Mentoring and advising of students or new faculty members is encouraged and given recognition in the teaching or service categories of academic personnel actions. In evaluating the candidate's qualifications within these areas, the review committee exercises reasonable flexibility, balancing, when the case requires, heavier commitments and responsibilities in another. The review committee must judge whether the candidate is engaging in a program of work that is both sound and productive.

As the University enters new fields of endeavor and refocuses its ongoing activities, cases will arise in which the proper work of faculty members departs markedly from established academic patterns. In such cases, the review committees must take exceptional care to apply the criteria with sufficient flexibility. However, flexibility does not entail a relaxation of high standards. **Superior intellectual attainment, as evidenced both in teaching and in research or other creative achievement, is an indispensable qualification for appointment or promotion to tenure positions.** Insistence upon this standard for holders of the professorship is necessary for maintenance of the quality of the University as an institution dedicated to the discovery and transmission of knowledge. Consideration should be given to changes in emphasis and interest that may occur in an academic career.

In teaching, clearly demonstrated evidence of high quality in teaching is an essential criterion for appointment, advancement, or promotion. It is the responsibility of the department chair to submit meaningful statements, accompanied by evidence, of the candidate's teaching effectiveness at lower-division, upper-division, and graduate levels of instruction. More than one kind of evidence should accompany each file.

In the area of research there should be evidence that the candidate is continuously and effectively engaged in creative activity of high quality and significance. Publications in research and other creative accomplishment should be evaluated, not merely enumerated. The quality of publication outlets and impact of the research in the field are important factors.

System of Rank and Step

A. The "step" of an appointee is indicated by a Roman numeral after the rank, e.g., Assistant professor, Step II; Associate Professor, Step II; Professor, Step II. The step is *not* part of the title or the rank. It is an indicator of the stage of merit advancement of and individual within a rank. Salary guidelines are associated with specific ranks and steps.

B. Years at rank and step for appointees are recorded in their individual salary history records as follows:

   1. An academic-year (9-month) appointee who has served at least two full quarters or one full semester in any fiscal year (July 1 through June 30) receives one year of credit at rank and step.

   2. An academic-year (9-month) appointee who has served just one quarter in any fiscal year (July 1 through June 30) does not receive credit for that year at rank and step.

   3. A fiscal-year (11-month) appointee who is appointed during the period July 1 through January 1 receives one year's credit at rank and step.

   4. A fiscal-year (11-month) appointee who is appointed during the period January 2 through June 30 does not receive credit for that year at rank and step.

Normal Periods of Service

A. *Instructor*: Service in the rank of Instructor is limited to two years.

B. *Assistant Professor*: The total period of University service with the title Assistant Professor, or with this and certain other titles, shall not exceed eight years. There are six possible steps with the Assistant Professor rank. The normal period of service at a given step in this rank is two years. Only Assistant Professor, Steps II through IV are normally used. A faculty member must be at Assistant Professor Step IV or higher to be considered for tenure. Steps V and VI are used in exceptional situations and with proper justification (e.g. faculty members initial appointment is at Step III, has progressed steadily and has a few years remaining at rank before mandatory tenure review in the seventh year at rank).

C. *Associate Professor:* Faculty members with tenure must be appointed at the rank of Associate Professor or Professor. There are five possible steps with the Associate Professor rank. The normal total period of service in the rank of Associate Professor is six years. The normal period of service for Associate Professor, Steps I through III is two years. Steps IV and V may be used in exceptional situations and with proper justification. Service at Associate Professor, Step IV, will normally be partly or entirely in lieu of service at

Professor, Step I, for which the normal period of service is three years if such service. The situation for Associate Professor, Step V, and Professor, Step II, is exactly analogous to that for Associate Professor, Step IV and Professor, Step I.

D. *Professor*: There are nine possible steps with the Professor rank. The normal period of service is three years for Professor, Steps I through IV. Service at Step V may be of indefinite duration. Advancement to Professor, Step VI usually does not occur after less than three years of service at Step V and is granted on evidence of great scholarly distinction and national or international recognition, highly meritorious service, and evidence of excellent University teaching. Service at Professor, Step VI and higher, may be of indefinite duration. Advancement from Professor, Step VI to the next step usually does not occur after less than three years of service and is only granted on evidence of continuing great distinction, national or international recognition, highly meritorious service and excellent teaching performance.

Advancement to an above-scale salary is reserved for scholars and teachers of the highest distinction whose work has been internationally recognized and acclaimed and whose teaching performance is excellent. Except in rare and compelling cases, advancement will not occur after less than four years at Step IX. Moreover, mere length of service and continued good performance at Step IX is not a justification for further salary advancement.

There must be a demonstration of additional merit and distinction beyond the performance on which advancement to Step IX was based. A further merit increase in salary for a person already serving at an above-scale salary level must be justified by new evidence of merit and distinction. Continued good service is not an adequate justification. Intervals between such salary increases may be indefinite, and only in the most superior cases where there is strong and compelling evidence will increase at intervals shorter than four years be approved.

Off-Scale Salaries

When properly justified, appointment or advancement to a position with an off-scale salary may be approved in exceptional situations, for example, when necessary to meet competitive conditions. A salary for an appointee at a certain rank and step is designated as off-scale if the salary is not that associated with the given rank and step in the published salary scale for the relevant title series.

The Chancellor in consultation with the appropriate committee(s) of the Division of the Academic Senate, and the appropriate Vice President develops local procedures for the implementation of the off-scale policy. Such procedures shall include the criteria for appointment or advancement to a position with an off-scale salary, as well as for an appointee's continuation with an off-scale salary or return to an on-scale salary. When an individual is placed on an off-scale salary, the appointee must be notified of this action and the authorization plus any limitation shall be noted on the appropriate campus approval document.

Table II-7. University of California Systemwide Faculty Salary Scales for Business, Management, and Engineering (not including off-scale amounts)

Rank	Step	Years at Step	Annual	Monthly
Assistant Professor	I	2	$61,600	$5,133.33
	II	2	64,700	5,391.67
	III	2	67,900	5,658.33
	IV	2	71,500	5,958.33
	V	2	74,600	6,216.67
	VI	2	77,300	6,441.67
Associate Professor	I	2	74,700	6,225,00
	II	2	77,400	6,450.00
	III	2	80,500	6,708.33
	IV	3	82,800	6,900.00
	V	3	85,400	7,116.67
Professor	I	3	82,900	6,908.33
	II	3	85,500	7,125.00
	III	3	90,900	7,575.00
	IV	3	97,400	8,116.67
	V	-	104,800	8,733.33
	VI	-	113,000	9,416.67
	VII	-	121,000	10,083.33
	VIII	-	130,200	10,850.00
	IX	-	141,500	11,791.67

* Last updated October 2004.

c. Faculty Workload

Describe the faculty workload policy for the engineering unit. Define what constitutes a full-time load.

The faculty workload components are defined by the review criteria for merit advancement, promotion, and tenure.

A central pervasive mission of the University of California as well as the Bourns College of Engineering is discovering and advancing knowledge. Thus, a significant portion of a faculty member's time is to be spent on research. Faculty members are expected to engage in meaningful research that contributes to the advancement of knowledge in both fundamental and applied areas of engineering, provides a technical edge for the U.S., and serves as a catalyst for industrial growth in the Inland Empire region of California. This requires faculty members to be highly active in identifying relevant research foci; establishing a network of collaborators and industrial partners; seeking extramural funding to support his/her research efforts; assembling a talented group of undergraduates, graduate students, and post-doctoral researchers; and disseminating their findings at conferences, invited seminars, peer-reviewed publications, and technical reports. Research and professional service are closely aligned. Through his/her research efforts, a faculty member has numerous opportunities to provide professional service.

The nominal faculty teaching workload in The Marlan and Rosemary Bourns College of Engineering is four quarter lecture courses per academic year. Junior faculty will teach fewer courses when possible. Faculty members with a significant service load, e.g. department chair, are also given a lower teaching load. In addition to lecture courses, faculty members are expected to mentor graduate students and undergraduates as part of their individual research endeavors.

Beyond the teaching, research, and professional service components, each faculty member is expected to contribute to the well-being of the department, college, and campus via service. Service opportunities consist of regular and irregular responsibilities. Regular responsibilities include service on department (e.g. faculty search, undergraduate studies, graduate studies) college-wide (e.g. Executive Committee, student club advisor), and Academic Senate committees (e.g. Committee on Educational Policy, Committee on Academic Personnel, etc.). Irregular responsibilities include service at various events such as open house, undergraduate recruitment events, community college workshops, science fair judging, MESA events, etc.

d. Supervision of Part-time Faculty

Describe the policy for the supervision and evaluation of part-time faculty personnel.

Part-time faculty, lecturers, are interviewed and carefully screened before being hired. Within Southern California, there are many well-qualified individuals willing to teach part-time. All lecturers are supervised by a regular faculty member and undergo the same course evaluation process that ladder-rank faculty members undergo. Lecturers are provided with a prescribed syllabus and often with course notes. They are entitled to office space and are expected to hold office hours with students.

7. Engineering Enrollment and Degree Data

Provide enrollment and degree statistics for the engineering educational unit as a whole and for each program being evaluated for the current and preceding five (5) academic years. (see Table II-8)

Table II-8. Engineering Enrollment and Degree Data

Engineering education unit as a whole: (numbers include IS, Freshmen and Transfers)

Year	AY	FT/ PT	Enrollment Year					Total UG	Total Grad	Degrees Conferred*			
			1st	2nd	3rd	4th	5th**			BS	MS	PhD	Other
Current	2005	FT	423	237	264	348	2	1274	291	243	108	36	
		PT											
1	2004	FT	547	300	259	411		1517	302	239	27	6	
		PT											
2	2003	FT	512	354	333	455		1654	270	237	19	4	
		PT											
3	2002	FT	594	384	320	451		1749	208	182	20	0	
		PT											
4	2001	FT	666	282	275	393		1616	179	124	16	1	
		PT											
5	2000 ***	FT	529	199	256	287		1272	144	84	7	1	
		PT											

* Total number of bachelor's degrees conferred will not add up to the sum of the number of degrees conferred per program on the department-level tables below because the College of Engineering also awards bachelor's degrees in the Information Systems program, which is not undergoing accreditation review this year.

** Student status is recorded by standing (e.g., freshman, sophomore), not by year, so accurate data for fifth-year undergraduates are unavailable.

*** 2000 has one Limited student. Thus, the total disagrees with the enrollment year numbers total by 1.

Chemical and Environmental Engineering (combined)

(Total for both freshmen and transfers, CHEN and ENEN)

Year	AY	FT/ PT	Enrollment Year					Total UG	Total Grad	Degrees Conferred			
			1st	2nd	3rd	4th	5th			BS	MS	PhD	Other
Current	2005	FT	52	28	37	37		154	55	43	5	5	
		PT											
1	2004	FT	88	16	18	31		153	53	17	5	3	
		PT											
2	2003	FT	35	19	23	31		108	48	52	6	0	
		PT											
3	2002	FT	33	24	18	30		105	36	13	4	0	
		PT											
4	2001	FT	41	14	13	28		96	26	13	1	0	
		PT											
5	2000	FT	27	8	13	22		70	19	12			
		PT											

Computer Engineering

(No graduate program, includes freshmen and transfer)

Year	AY	FT/ PT	Enrollment Year					Total UG	Total Grad	Degrees Conferred			
			1st	2nd	3rd	4th	5th			BS	MS	PhD	Other
Current	2005	FT	66	20	44	32		162		24			
		PT											
1	2004	FT	79	48	31	48		206		20			
		PT											
2	2003	FT	72	62	45	45		224		9			
		PT											
3	2002	FT	95	72	32	25		224		6			
		PT											
4	2001	FT	107	39	19	15		180		3			
		PT											
5	2000	FT	79	14	10	14		117		2			
		PT											

Computer Science

(Includes Freshmen and Transfer)

Year	AY	FT/ PT	Enrollment Year					Total UG	Total Grad	Degrees Conferred			
			1st	2nd	3rd	4th	5th			BS	MS	PhD	Other
Current	2005	FT	61	60	40	119	2	282	124	80	25	8	
		PT											
1	2004	FT	76	69	88	165		398	141	138	22	3	
		PT											
2	2003	FT	122	128	147	240		637	131	115	13	4	
		PT											
3	2002	FT	196	155	181	279		811	103	112	16	0	
		PT											
4	2001	FT	239	155	195	251		840	88	71	15	1	
		PT											
5	2000	FT	227	125	167	176		695	79	44	7	1	
		PT											

Electrical Engineering

(Includes Freshmen and Transfer)

Year	AY	FT/ PT	Enrollment Year					Total UG	Total Grad	Degrees Conferred*I			
			1st	2nd	3rd	4th	5th			BS	MS	PhD	Other
Current	2005	FT	51	34	38	71		194	77	48	72	19	
		PT											
1	2004	FT	51	35	46	68		200	71	29			
		PT											
2	2003	FT	45	28	52	55		180	68	32			
		PT											
3	2002	FT	43	36	27	55		161	51	26			
		PT											
4	2001	FT	46	23	20	54		143	57	24			
		PT											
5	2000	FT	37	22	34	39		132	46	16			
		PT											

* The numbers indicated under MS and PhD are the total numbers from 2000 to 2005. Breakdown numbers per year were unavailable.

Mechanical Engineering

Program: MCEN (includes Freshmen and Transfer)

Year	AY	FT/ PT	Enrollment Year					Total UG	Total Grad	Degrees Conferred			
			1st	2nd	3rd	4th	5th			BS	MS	PhD	Other
Current	2005	FT	112	58	47	68		285	35	22	6	4	
		PT											
1	2004	FT	112	73	47	53		285	37	22			
		PT											
2	2003	FT	132	62	41	50		285	23	26			
		PT											
3	2002	FT	129	39	35	39		242	18	24			
		PT											
4	2001	FT	79	26	22	41		168	8	13			
		PT											
5	2000	FT	49	20	25	30		124	0	10			
		PT											

8. Definition of Credit Unit

The EAC assumes that one semester or quarter credit hour normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. If other standards are used by this institution, the differences should be indicated.

Policies at the University of California, Riverside, correspond to these definitions. An academic year consists of three 10-week quarters, or 30 weeks.

9. Admission and Graduation Requirements, Basic Programs

Data and information presented in this section should apply to all programs listed under "Programs Offered and Degrees Granted" as being part of the engineering educational unit. If there are exceptions for any of the programs being submitted for evaluation, note them here and describe each one specifically in the Self-Study Report under "Program Modes" for the program in question.

A. Admission of Students

1. Describe the general criteria and procedures for admitting students to engineering programs.

UCR seeks to recruit and retain an academically strong student body that has demonstrated the rigorous preparation needed for admission to a major research institution and reflects the diversity of our state and region. Admission to UCR requires (1) satisfaction of the University of California minimum admission requirements and (2) selection by UCR according to the principles of Comprehensive Review, as determined by the UCR faculty.

Meeting UC minimum admission requirements will not guarantee admission to UCR. Applicants who seek to increase their likelihood for admission should strive for achievement well beyond UC minimum requirements. Final determination of admission will be made within the context of campus enrollment goals.

There are three paths to satisfying the university's minimum admission requirements for freshman students: Eligibility in the Statewide Context, Eligibility in the Local Context, and Eligibility by Examination Alone.

1. Eligibility in Statewide Context

This is the path by which most students attain UC eligibility. To be eligible in the statewide context, students must satisfy the subject, scholarship, and examination requirements described below.

Subject Requirement Students must complete or have validated 15 units of high school courses to fulfill the subject requirement. At least 7 of those 15 units must be taken or validated in the last two years of high school. (A unit is equal to an academic year or two semesters of study.) This sequence of courses, called the "a-g" Subject Requirement, is as follows:

A. History/Social Sciences .... 2 years
B. English.. 4 years
C. Mathematics .... 3 years required, 4 years recommended
D. Laboratory Science .... 2 years required, 3 years recommended
E. Language other than English.. 2 years required, 3 years recommended
F. Visual and Performing Arts .... 1 year
G. College Preparatory Electives.. 1 year

The University will accept only those "a-g" courses that appear on the official UC Certified Course List for the California high school the student attended. The UC-certified course list is available at www.ucop.edu/doorways/list.

Scholarship Requirement The Scholarship Requirement defines the grade point average (GPA) students must attain in the "a-g" subjects and the scores from the SAT Reasoning Test (or ACT Assessment plus Writing) and SAT Subject Tests that must be earned to be eligible for admission to the university. Students qualifying for admission in the statewide context must present an "a-g" GPA and test score total that meets the criteria on the Eligibility Index in this section.

Honors Courses The university assigns extra points for up to four yearlong university-certified honors level, Advanced Placement, and/or UC-designated International Baccalaureate courses taken in grades 10, 11, and 12: A=5 points, B=4 points, C=3 points. College-level courses in the "a-g" college preparatory subjects that are transferable to the university are also assigned honors grade points. A maximum of two yearlong courses taken in grade 10 are assigned honors points. Grades of D are not assigned extra honors points. (Extra points will be awarded to 10th graders only when they take honors courses that have been certified by the university as honors-level courses.) Acceptable honors-level courses include Advanced Placement courses, specific Standard Level and all Higher Level International Baccalaureate courses, and college courses that are transferable to the university.

Examination Requirement Students must submit the following test scores taken no later than December of the senior year:

- Either the SAT Reasoning Test or the ACT Assessment plus Writing. The critical reading, mathematics, and writing scores on the SAT Reasoning Test must be from the same sitting. Students must report each test score from the ACT Assessment plus Writing and the composite score.
- Two SAT Subject Tests in two different areas: history/social studies, English (literature only), mathematics (Level 2 only), science, or languages.

2. Eligibility in the Local Context

Under the Eligibility in the Local Context (ELC) path, the top 4% of students at each participating California high school are designated UC eligible and guaranteed admission to one of UC's nine general campuses, though not necessarily at their first-choice campus.

To be considered for ELC, a student must complete 11 specific units of the subject requirement by the end of the junior year. The 11 units include 1 unit of history/social science, 3 units of

English, 3 units of mathematics, 1 unit of laboratory science, 1 unit of language other than English, and 2 units chosen from among the other subject requirements. With the assistance of each participating high school, the university will identify the top four percent of students on the basis of GPA in the required course work.

The university notifies ELC students of their status at the beginning of their senior year. A student designated UC eligible through ELC must submit the UC undergraduate application during the November filing period and complete remaining eligibility requirements by appropriate deadlines — including the subject and examination requirements — to be considered fully eligible.

3. Eligibility by Examination Alone

To qualify for Eligibility by Examination, students must satisfy the same examination requirement as students who are eligible in the statewide context. That is, students must complete the ACT Assessment plus Writing or the SAT Reasoning Test, and two SAT Subject Tests. Students must achieve a test score total, calculated according to the UC Eligibility Index, of at least 3450 (nonresidents must present a total of 3550 or higher). Additionally, students who take the SAT Reasoning Test must score at least 580 on each of its three components; students who take the ACT Assessment plus Writing must score at least 25 in mathematics, science, reading and English/writing. All students qualifying by this path must score at least 580 on each of their two SAT Subject Tests.

Students may not qualify for Eligibility by Examination if they have completed a transferable college course in any academic subject covered by the SAT Subject Tests. An applicant who is currently attending high school may qualify for admission to the university by examination alone without completing a high school program.

High School Proficiency Examination If a student does not have a high school diploma, the university will accept the Certificate of Proficiency awarded by the State Board of Education upon successful completion of the California High School Proficiency Examination. The university also will accept proficiency examinations from other states, or the General Education Development (GED) Certificate, in place of a diploma. However, a student must still meet the subject, scholarship and examination requirements.

Nonresidents of California

Two paths to UC eligibility exist for nonresidents at the freshman level. The first is the same as described under Eligibility in the Statewide Context and the second is the same as described under Eligibility by Examination Alone, with the following exception:

Scholarship Requirement Students whose GPA is 3.40 or above satisfy the minimum scholarship requirement if they achieve the test score total indicated in the Eligibility Index under Nonresidents.

In addition to the general UC admissions requirements, the Bourns College of Engineering includes the following criteria:

Algebra..2 years
Plane Geometry..1 year
Trigonometry (often contained in Precalculus or Algebra II, strongly suggested) ....1-2 years
Chemistry or Physics, with laboratory (preferably both) ....1 year

2. Provide a history of admission standards for freshmen showing admission standards for students enrolled in engineering programs directly from high school for the current and last five academic years. (see **Table II-9)**

Table II-9 below provides this information.

Table II-9. History of Admissions Standards for Freshmen.

Academic Year	Composite ACT		Composite SAT		Percentile Rank in High School		Number of New Students Enrolled
	MIN*	AVG*	MIN*	AVG	MIN*	AVG*	
2005				1109			292
2004				1096			452
2003				1109			316
2002				1107			414
2001				1103			510
2000				1085			416

* Data not available.

3. Describe how advanced placement course credits are evaluated from programs not accredited by the EAC either at this institution or elsewhere.

As noted earlier, the University assigns extra points for up to four yearlong university-certified honors level, Advanced Placement, and/or UC-designated International Baccalaureate courses taken in grades 10, 11, and 12: A=5 points, B=4 points, C=3 points. College-level courses in the "a-g" college preparatory subjects that are transferable to the university are also assigned honors grade points. A maximum of two yearlong courses taken in grade 10 are assigned honors points. Grades of D are not assigned extra honors points. (Extra points will be awarded to 10th graders only when they take honors courses that have been certified by the university as honors-level courses.) Acceptable honors-level courses include Advanced Placement courses, specific Standard Level and all Higher Level International Baccalaureate courses, and college courses that are transferable to the university.

4. Describe special admission requirements for entry into the upper division or professional programs in the engineering educational unit.

None.

5. Describe the policies regarding admission of transfer students from other institutions to the engineering programs and how these policies are enforced. List such special requirements as minimum grade-point average and course requirements. Describe any general articulation agreements with other

institutions. If the transfer of "D" grades is permitted, explain the circumstances in which this occurs.

Transfer students must meet the following criteria and complete the courses listed below as required for the major you wish to pursue.

General Requirements for All Transfer Admits:

- A cumulative GPA of at least 2.80.
- A GPA of 2.5 or more in a minimum of 2 sequences, excluding English Composition, such as Math 9A, 9B, 9C, or Phys 40A, 40B, 40C.
- Completion of the following course sequences prior to enrollment:
    - One year of college level English Composition (English 1A, 1B, 1C)
    - One year of single variable calculus (Math 9A, 9B, 9C)

Additional Major-Specific Requirements to be completed prior to transfer:

Bioengineering Major (BIEN). The following courses must be completed before enrollment:

- two courses in general chemistry with labs (Chem 1A, 1B)
- one course in introduction to cellular and molecular biology with lab (Biol 5A/LA)

A minimum of THREE (3) additional approved courses from the list below:

- one course in introduction to organismal biology (Biol 5B)
- one course in introduction to evolution and ecology (Biol 5C)
- one course in general chemistry with lab (Chem 1C)
- three courses in calculus based physics with labs (Phys 40A, 40B, 40C)

Chemical Engineering Major (CHEN). The following course(s) *must* be completed prior to enrollment:

- two courses in general chemistry with labs (Chem 1A, 1B)
- one course in calculus based physics with lab (Phys 40A)

A minimum of THREE (3) additional approved courses from the list below:

- one course in general chemistry with lab (Chem 1C)
- one course in introduction to cellular and molecular biology with lab (Biol 5A/LA)
- two courses in organic chemistry with labs (Chem 112A, 112B)
- two courses in calculus based physics with labs (Phys 40B, 40C)

Computer Engineering Major (CEN). The following course(s) *must* be completed prior to enrollment:

- one course in computer programming (CS 10)
- one course in object oriented programming (CS 12)
- one course in calculus based physics with lab (Phys 40A)

A minimum of THREE (3) additional approved courses from the list below:

- two courses in calculus based physics with labs (Phys 40B, 40C)
- one course in introduction to discrete structures (CS/Math 11)
- one course in machine organization and assembly language programming (CS 61)
- one course in engineering circuit analysis I with lab (EE 1A/LA*)

Computer Science Major (ENCS). The following course(s) *must* be completed prior to enrollment:

- one course in computer programming (CS 10)
- one course in object oriented programming (CS 12)
- one course in calculus based physics with lab (Phys 40A)

A minimum of THREE (3) additional approved courses from the list below:

- two courses in calculus based physics with labs (Phys 40B, 40C)
- one course in data structures (CS 14)
- one course in machine organization and assembly language programming (CS 61)
- one course in introduction to discrete structures (CS/Math 11)
- one course in calculus of several variables I (Math 10A)

Electrical Engineering Major (ELEN). The following course(s) *must* be completed prior to enrollment:

- one course in computer programming (CS 10)
- one course in machine organization and assembly language programming (CS 61)
- one course in calculus based physics with lab (Phys 40A)

A minimum of THREE (3) additional approved courses from the list below:

- two courses in calculus based physics with labs (Phys 40B, 40C)
- one course in introduction to ordinary differential equations (Math 46)
- one course in calculus of several variables I (Math 10A)
- one course in engineering circuit analysis I with lab (EE 1A/LA*)
- one course in engineering circuit analysis II (EE 1B)

Environmental Engineering Major (ENEN). The following course(s) *must* be completed prior to enrollment:

- two courses in general chemistry with labs (Chem 1A, B)
- one course in calculus based physics with lab (Phys 40A)

A minimum of THREE (3) additional approved courses from the list below:

- one course in general chemistry with lab (Chem 1C)
- two courses in organic chemistry with labs (Chem 112A, 112B)
- one course in introduction to cellular and molecular biology with lab (Biol 5A/LA)

two courses in calculus based physics with labs (Phys 40B, 40C)

Information Systems Major (IS). The following course(s) *must* be completed prior to enrollment:

- two courses in principles of accounting I, II (BSAD 20A, 20B)
- one course in computer programming (CS 10)

A minimum of THREE (3) additional approved courses from the list below:

- one course in introduction to discrete structures (CS/Math 11)
- one course in object oriented programming (CS 12)
- one course in data structures (CS 14)
- one course in machine organization and assembly language programming (CS 61)
- one course in introduction to macroeconomics (ECON 2)

- one course in introduction to microeconomics (ECON 3)

Mechanical Engineering Major (MCEN). The following course(s) *must* be completed prior to enrollment:

- one course in calculus based physics with lab (Phys 40A)
- two courses in general chemistry with labs (Chem 1A, 1B)

A minimum of THREE (3) additional approved courses from the list below:

- two courses in calculus based physics with labs (Phys 40B, 40C)
- one course in engineering circuit analysis I with lab (EE 1A/LA*)
- one course in introduction to mechanical engineering-problem solving/computation (ME 1C*)
- one course in engineering graphics with computer applications (ME 9)
- one course in statics (ME 10*)
- one course in introduction to engineering computation (ME 18*)

Note: Courses marked with an asterisk (*) are typically not offered at community colleges, but can be taken at UCR during the summer session prior to enrollment.

Highly Recommended Courses for Each Major: In addition to the required coursework above, applicants are strongly encouraged to complete all the recommended courses below prior to enrollment, although they are <u>not required</u> for Transfer Admission. Completing this coursework prior to enrollment at UCR is critical to maintaining normal progress in the upper-division engineering curriculum and to finishing all degree requirements within two years of enrollment at UC Riverside (provided a full-time study load is maintained at UCR).

The most competitive applicants will have completed most of the recommended major preparation courses.

The recommended courses for each major in the Bourns College of Engineering are as follows.

Recommended Courses	BCoE Engineering Major							
	Bio. Engr. (BIEN)	Chem. Engr. (CHEN)	Comp. Engr. (CEN)	Comp. Sci. (ENCS)	Elect. Engr. (ELEN)	Env. Engr. (ENEN)	Info. Syst. (IS)	Mech. Engr. (ME)
Biology	5B, 5C	5A/LA [1] 5B, 5C [2]				5A/LA		
Chemistry	1C, 112A, 112B, 112C	1C, 112A, 112B, 112C			1A	1C, 112A, 112B		
Comp. Sci.	10	10	14, 61, 11†	14, 61, 11†		10	12, 14, 61, 11†	
Economics							2, 3	
Electrical Engr.			1A/LA*, 1B*		1A/LA*, 1B*			
Math	10A, 46	10A, 10B, 46	10A, 10B, 46, 11†	10A, 11†	10A, 10B, 46	10A, 10B, 46	10A, 11†	10A, 10B, 46
Mech. Engr.					10	10		1C*, 9, 10*, 18*
Physics	40A, 40B, 40C	40B, 40C	40B, 40C	40B, 40C	40B, 40C	40B, 40C		40B, 40C
Biology elective[3]			2, 3, or 5A/LA	2, 3, or 5A/LA	2, 3, or 5A/LA		2, 3, or 5A/LA	
Hum. & Soc. Sciences**	2 courses	3 courses	3 courses	3 courses	2 courses	4 courses	5 courses	3 courses

Notes:

* These courses are typically *NOT* offered at the community college, but can be taken at UCR during the summer session prior to enrollment.

** Prior to enrollment at UCR, a student can take the indicated number of courses in the Humanities and Social Science areas to fulfill breadth requirements for the Bourns College of Engineering. Students can visit http://www.engr.ucr.edu/studentaffairs/policies/breadth.shtml for an explanation of breadth course requirements and for a complete list of approved breadth courses for the Bourns College of Engineering.

† Computer Science 11 is equivalent to Math 11.

Articulation

The state of California has in place a Master Plan for higher education which recognizes a special role for the community colleges in the state as feeder institutions into the institutions of higher education that are part of the University of California and the California State systems. A series of course articulation agreements form the backbone of this relationship.

Course articulations under the Master Plan are in the form of a series of written agreements developed between two institutions to accept and use a specific course that has been completed on a sending campus to meet a specific course requirement on a receiving campus. Faculty in each discipline review courses to determine comparable content and approve all agreements. The agreements authorize the acceptance of one course "in lieu of" another for transferring students. Articulated courses are not to be construed as "equivalent," but rather as comparable courses, i.e., the content is such that similar outcomes are assured and advancement to the next level of

[1] Biology 5A/LA is required for all Chemical Engineering concentrations
[2] Biology 5B, 5C is required for only the bioengineering concentration within the Chemical Engineering major.
[3] Students can choose to take Biology 2, 3, or 5A/LA to satisfy the biology elective requirement for majors in the Bourns College of Engineering.

instruction is appropriate. Course articulation helps smooth transition and progression through the educational system in California through the transfer of students from one campus to another. It provides a link between faculties, campuses, and segments. Articulation promotes “unity” in the educational system and contributes substantially to the additional three goals stated in the renewed Master Plan, July 1987: “Equity, quality, and efficiency.” The implementation of a course articulation mechanism as a part of the transfer function is required to be an institutional priority in support of the total transfer function.

The transfer process is facilitated through a statewide course numbering system for courses called the California Articulation Number (CAN) system. The foundation of the CAN system is discipline-based bilateral articulation agreements. Courses in the system are lower division major preparation core courses and support courses. Inter-segmental faculty committees have created succinct course descriptions in 35 disciplines currently in CAN. This activity has promoted communication and the spirit of cooperation. The descriptions are reviewed by faculty on four-year campuses on two and four year cycles to insure currency and appropriateness of courses for major preparation.

Quality control and the integrity of the CAN System are maintained by an annual review of the courses that have been identified, articulated, and qualified to meet the criteria. This review is facilitated on each campus by an articulation officer who works with the faculty. The CAN System, based on course-to-course articulation, simplifies the identification of transferable lower division major preparation courses. It can be used with a high degree of confidence by students, faculty, and staff.

UC Riverside, and the Bourns College of Engineering have an extensive series of articulation agreements in place with community colleges and other institutions in California, all available online at the website http://www.assist.org. The design of the web interface makes it very easy for students, counselors, and faculty to query the database of articulation agreements and to quickly identify correspondences between courses.

The articulation agreement between feeder institutions in California and various programs in our college are available at http://www.assist.org.

6. Provide a history of transfer engineering student statistics. (see **Table II-10**)

Table II-10. History of Transfer Engineering Students

A. Total Students

Academic Year	Number of Transfer Students Enrolled
2005	35
2004	35
2003	59
2002	58
2001	102
2000	103

B. Chemical Engineering

Academic Year	Number of Transfer Students Enrolled
2005	4
2004	4
2003	4
2002	2
2001	4
2000	3

C. Computer Engineering

Academic Year	Number of Transfer Students Enrolled
2005	2
2004	1
2003	1
2002	4
2001	3
2000	5

D. Computer Science

Academic Year	Number of Transfer Students Enrolled
2005	11
2004	17
2003	31
2002	38
2001	87
2000	85

E. Electrical Engineering

Academic Year	Number of Transfer Students Enrolled
2005	12
2004	9
2003	14
2002	7
2001	3
2000	7

F. Environmental Engineering

Academic Year	Number of Transfer Students Enrolled
2005	3
2004	0
2003	1
2002	0
2001	1
2000	0

G. Mechanical Engineering

Academic Year	Number of Transfer Students Enrolled
2005	3
2004	2
2003	7
2002	3
2001	4
2000	3

B. Requirements for Graduation

1. Describe the process used at the college and/or university levels to certify that graduation requirements complying with EAC criteria have been met by each graduate. Provide a sample of any work sheet or check-off sheet used for this purpose.

The graduation requirements are the combination of University, college, and major requirements particular to the degree being sought by an individual. ABET requirements are folded into the college and major requirements of each undergraduate engineering degree offered by the College. In the creation of each degree, ABET criteria were carefully considered so as to make certain that the specific curricular requirements of each discipline, as well as the categories of math and basic science, engineering topics, and humanities and social sciences, would be satisfied. As established majors are updated, the curricular criteria of ABET continue to be incorporated. The breadth, or college, requirements of the Bourns College of Engineering receive the same treatment in their modification, as well.

By satisfaction of all degree requirements, a student can be assured of satisfaction of ABET requirements as well. The primary tool used in verifying the completion of all graduation requirements is the electronic degree audit of the campus student information system. This computerized degree check compares the course work of an individual student to the Senate-approved, ABET-compatible degree requirements as printed in the *General Catalog* of the institution. The audit is an electronic representation of the degree requirements printed in the *Catalog*, and is maintained annually by the Associate Registrar to reflect any approved degree changes or additions. As in the *Catalog*, the audit includes University, college, and major requirements. It goes beyond this, however, and also identifies the courses which apply toward the satisfaction of each requirement. The audit identifies requirements which have been satisfied and which are still to be completed, allowing for satisfaction of both single course requirements as well as requirements which have a range of acceptable options. This comprehensive approach alleviates the need for separate paper tracking sheets and reduces the human error factor. As such, hardcopy tracking of graduation requirements is no longer done.

Once students file their Applications for Graduation (normally three weeks prior to the beginning of the graduation quarter), the Student Affairs Officer performs a preliminary degree check to assess completion of all University, College, major, and ABET requirements.

Students also have access to their own degree audit via a secure web interface. Bourns College of Engineering students are especially adept at utilizing this tool to assess their own degree progress. The audit takes the place of the preliminary as well as the final degree check that were formerly performed manually. As such, hardcopy tracking of graduation requirements is no longer done.

Upon receipt of final grades, a final degree check is performed, and students are cleared to graduate if they have satisfied all listed requirements. If the requirements are not satisfied, the student is notified by the Registrar's Office and asked to contact their College Office.

UC Riverside is on the quarter system, with three academic quarters to the year. Each quarter consist of ten weeks of instruction and one week for final examinations. The value assigned to a course is determined at the rate of one unit for every three hours of student work required each week. The typical course carries four quarter units of credit.

The cooperative work/study (co-op) mode is not available in the engineering programs at UC Riverside.

The undergraduate programs in the Marlan and Rosemary Bourns College of Engineering are offered only in the traditional day-time mode.

2. **If modes other than traditional on-campus instruction are employed in any programs, the additional modes of instruction should be listed and described in relation to the applicable programs. The institutional and/or engineering unit policies under which the alternate modes are offered should be summarized.**

Not applicable.

3. Indicate the grade-point average required for graduation. If there are differences in requirements among the regular and alternative program modes, please explain.

All undergraduates must maintain a 2.0 in their cumulative GPA and a 2.0 GPA in their major. The cumulative GPA is only that earned in the University of California system. No other grades are included. The major GPA is defined individually for each engineering discipline, but generally includes the upper-division course work in the major, including the technical electives (even if in a related discipline). Grades below 2.0 may be balanced by grades sufficiently above 2.0 to achieve the desired average, except in English Composition, which permits no grades below C-.

10. Non-academic Support Units

Provide information about units that support only the engineering academic programs.

10 A. Undergraduate Research Program

In 1998, the Boyer Commission of the Carnegie Commission on Higher Education issued a report critical of research universities for not providing undergraduates with "maximal opportunities for intellectual and creative development." Partly in response, the University of California has targeted undergraduate research opportunities as a key mechanism for improving undergraduate education. The Bourns College of Engineering in 2002 created a new position, Director of Undergraduate Research, to organize and maintain a program of undergraduate research opportunities via research assistant opportunities in faculty labs and interdisciplinary centers, summer research experience at other institutions, and summer internships.

The UC perspective is that undergraduate students benefit by pursuing their baccalaureate education at a research university as opposed to a teaching university or a liberal arts college. Students who are immersed in the process of knowledge creation understand and appreciate the culture of research. In that context, we encourage undergraduate research as a means to:

1. Develop in undergraduates an enthusiasm for and ability to do research.
2. Increase availability of undergraduate research experiences.
3. Increase faculty interaction with students outside the classroom.

This program works closely with the Vice Chancellor for Research program to encourage undergraduates to participate in research during the academic year and/or during the summer. Students are provided with meaningful research opportunities in which they work under the supervision of faculty, postdoctoral associates, and graduate students. (This helps build teaching skills among postdocs and graduate students while contributing to the undergraduate's education and skills.) Depending on the lab and the project, undergraduates sometimes create their own individual projects to pursue, and sometimes participate in a larger research effort. We encourage our students to prepare papers and posters on their experiences for the Southern California Conference on Undergraduate Research (SCCUR) and other events that accept research presentations by undergraduates. SCCUR typically attracts more than 1,000 undergraduates each year from throughout Southern California; UCR was the host of the November 2005 event (see photos).

UCR was the host of the Southern California Conference on Undergraduate Research in November 2005. The event attracted more than 1,000 undergraduates, who gave talks or exhibited posters on their research experiences and findings.

In addition to contributing to retention and advancement, research opportunities open a window to the teaching of ethics. Students learn about the context and consequences of their research while working on projects. Additionally, those who work on projects that involve human or animal subjects must go through our Institutional Review Board training, and they gain experience with the process of establishing and abiding by ethical research protocols. As engineering research continues to blur the line between humans, other organisms, and machines, this will be an increasingly important type of experience for our students to have.

10 B. CE-CERT Research Advancement Program (RAP)

The College of Engineering-Center for Environmental Research and Technology (CE-CERT) has an endowment set aside to support undergraduate student researchers in its laboratories. Historically, we have used these funds to (1) help recruit desirable students as freshmen, thus assuring them of a meaningful freshman research experience and a source of income; (2) leverage Federal funding on research projects that require cost sharing, thus providing one or more undergraduate students with the opportunity to work alongside faculty, graduate students, and staff researchers on Government-supported research projects; and (3) leverage other recruitment incentives and support mechanisms, such as Regents Fellows scholarships.

RAP supports five to eight students per year, in one-year increments of $5,000 each. Typically, a student who starts on a RAP fellowship as a freshman advances to a paid position on another research project later. However, there is no rule requiring that RAP support only freshmen.

All student researchers at CE-CERT, whether supported by RAP or other funds, are encouraged to prepare posters and papers on their work. Since 2003, CE-CERT has conducted an annual undergraduate research conference to highlight its undergraduates' work, named after benefactor

Jim Guthrie. The list of presentations from the most recent event, October 2005, is provided below to give an example of the types of work undergraduates are doing at CE-CERT.

Student Name	Presentation Title
Andrés Aguirre	Flowability Study of Wood-Coal Mixtures
Ahn Vu	Computer Vision Application Using Orthogonal Omni-Directional Cameras
Anthony Oyatayo (Mech. Eng.); Luis A. Gonzalez-Argueta (Elect. Engr.)	Wireless Sensor Networks for Machinery Monitoring Case Study: Application to Gear Systems
Jordan Barta	The Study of Hot Gas Cleanup from the Hydrogasification of High Sulfur Content Feedstock
Christopher Salam	Using the Packed-Bed Column Technique to Quantify and Analyze Bacterial Adhesion
Megan Nix	Electrochemically Functionalized Single-Walled Carbon Nanotube Gas Sensor
Marie Donnelly	Production of Energetic Gases from Commingled Coal and Wood Slurries Using Hydrogasification and Steam Pyrolysis

CE-CERT also supports many capstone Senior Design Projects for College of Engineering students in all disciplines. It should be noted that the Interim Director of CE-CERT, Dr. Matthew Barth, also is the Senior Design coordinator for the Electrical Engineering Department.

10 C. Student Organizations

UCR's rich cultural diversity provides an excellent environment for supporting graduate students from underrepresented groups. The College of Engineering hosts student chapters of numerous professional societies built around technical specialties and ethnic backgrounds. These include:

- Air and Waste Management Association (AWMA).
- American Institute of Chemical Engineering (AIChE).
- American Society of Mechanical Engineers (ASME).
- Association for Computing Machinery (ACM).
- Institute of Electrical and Electronic Engineers (IEEE).
- Linux Users Group (LUG).
- National Society of Black Engineers (NSBE).
- Society of Automotive Engineers (SAE).
- Society of Hispanic Professional Engineers (SHPE).
- Society of Women Engineers (SWE).
- Tau Beta Pi.

Additionally, at the campuswide level, organizations and programs include the African Student Programs; Chicano Student Programs; Native American Student Programs; Asian Pacific Student Programs; Women's Resource Center; Education Opportunity Program/Student Affirmative Action; the Mathematics, Engineering and Science Achievement (MESA) Engineering Program; and the Minority Career Development Program.

These organizations provide an affinity network of graduate and undergraduate students for the Fellows. They hold regular meetings, often with guests speakers from industry or other academic institutions, and thus help the members develop professional contacts that can lead to internships, postdoctoral fellowships, and full-time jobs.

Appendix III Additional Auxiliary Materials
IIIA 2004 Memo on Senior Exit Survey Analysis and Improvement Actions

DEPARTMENT OF ELECTRICAL ENGINEERING
(909) 787-2423
(909) 787-2425 FAX

March 19, 2004

To: Faculty
Department of Electrical Engineering
University of California at Riverside

From: Undergraduate Committee
A.A.B

Senior Exit Survey Study and Recommended Improvements

The Senior Exit Survey for EE and CE programs has been distributed to EE faculty in electronic form. The faculty members were invited to carefully study the results of the survey and provide feedback. The EE undergraduate committee chair was tasked to collect all the faculty responses.

On March 19, 2004, the EE Undergraduate Committee met to discuss the EE and CE Senior Exit Survey results. The committee members noted generally very positive outcome of the surveys and high rank given to UCR by students. Particular attention has been paid to the questions in the survey, where UCR received lower mean than the mean of the comparative group. For EE program, two such questions have been identified: Q38 Skill Development – Degree that engineering education enhances ability to: Analyze and interpret data; and Q43 Skill Development – Degree that engineering education enhances ability to: Understand the impact of engineering solutions in a global/social context.

The committee recommended the following actions for the curriculum improvement.

1. Ask each faculty to review their course materials and consider how they can stress analysis and interpretation of data. Based on this, consider if homework and exam problems need reformulation. In some cases, introduction of problems formulated in such a way that the solution requires analysis of data presented in the form of tables or real-life experimental curves can be useful.
2. Make sure that the impact of engineering solutions in a global/social context is discussed in existing courses, particularly in EE175 Senior Engineering Design.
3. Introduce a new undergraduate course Individual Internship in Electrical Engineering with required final report. Make it a requirement for students to comment on the impact of engineering in a global/social context in the final report for this individual course.
4. Task the EE Undergraduate Committee chair to inform the EE faculty about this decision and collect the feedback for the next year assessment and preparations for the ABET2000 visit.

UNIVERSITY OF CALIFORNIA RIVERSIDE – Interdepartmental Use

IIIB Instructor Sign-On Example

EE116 Engineering Electromagnetics

Improvement Actions Identified after Fall 2003 Course Offering

Based on the assessment of students performance in this class, which included grades, evaluations, and other measurements (see EE assessment process), the following improvements were recommended for the next offering of this course.

1. Increase engineering design content in this course.
2. Introduce new problems (or reformulate existing ones) to improve students' ability to analyze and interpret data (see students feedback in the Senior Exit Survey).

Instructor Signature:

Instructor Name: Alexander A. Balandin 12/20/03

Comments on the Actions Taken During Fall 2004 Course Offering

The following recommendations have been implemented during the Fall 2004 course offering.

1. Two problems were added and one reformulated in order to emphasize the design content in this course. The issue was also addressed during the lectures.
2. The issue has been address during the lectures. The Senior Exit Survey analysis indicates that students ranked higher their ability to analyze and interpret data.

Instructor Signature:

Instructor Name: Alexander A. Balandin 12/22/04

IIIC Complete Syllabus for EE175A/B

Bourns College of Engineering, University of California, Riverside

EE-175: Senior Design Project

Winter and Spring 2006

Class

Lecture:	Wednesdays	2:10PM-3:00PM	GEOL 1408
Lab:	to be arranged with section professor		

Instructors:

Professor Matthew Barth	barth@ee.ucr.edu	EBU-II 342	827-2992
Professor Gerardo Beni	beni@ee.ucr.edu	EBU-II 321	827-6317
Professor Amit Roy Chowdhury	amitrc@ee.ucr.edu	EBU-II 322	827-7886
Professor Yingbo Hua	yhua@ee.ucr.edu	EBU-II 432	827-2853
Professor Ilya Lyubomirsky	ilyubomi@ee.ucr.edu	EBU-II 431	827-7701
Professor Mihri Ozkan	mihri@ee.ucr.edu	EBU-II 436	827-2900
Professor Sheldon Tan	stan@ee.ucr.edu	EBU-II 424	827-5143

Prerequisites

Senior standing in Electrical Engineering.

Objectives

The Senior Design Project is the culmination of course work in the bachelor's degree program in electrical engineering. In this comprehensive two-quarter course, students are expected to apply the concepts and theories of electrical engineering to a novel research project. A written report, giving details of the project and test results, and an oral presentation giving the details of the project, will be required to complete this course satisfactorily.

Credits and Hours

Eight quarter units of engineering design credit will be granted for the completed project. It is expected that approximately twelve hours of laboratory (or field) work will be required weekly for satisfactory completion of the project. The design value of these units has been accounted for in the total number of required science and design units necessary for graduation.

Weekly Class Meetings

The entire class of EE 175A and EE 175B will meet once each week for one hour. These meetings are intended to provide instruction in topics common to all design projects (engineering economics, ethics, etc.). They may include brief presentations by each team, aimed at improving technical presentation skills. Lectures will be provided by the instructors and some outside contacts. These meetings are mandatory and are for your benefit (15% of grade). In addition, it is expected that each project team meet with their faculty supervisor on a weekly basis to go over the details of the project.

Project Participants

Projects will be completed in small teams with shared responsibility. If the team option is elected, each student will be held responsible for a distinct component of the total team effort. Team projects will be sufficiently more complex than individual projects so as to allow for an appropriate workload for all team members.

Project Elements

The senior design projects will include proposal and report writing, design, development of software/ hardware, and testing of electrical engineering devices or systems. Remember that this is a design course and students must define a ***design*** project, not a research, nor an evaluation or fabrication project. It is rather a balanced approach to culminate the many of the elements stated above.

Each design project must include the following components:

1. ***A Clear Technical Problem Statement***—before proceeding beyond this step, each group should be certain that it has affirmative answers to the following questions:
   - *Is the problem solvable within two quarters?*
   - *Does the group have the expertise to complete the design, prototype, and testing?*
   - *Does the group have access to the financing for the prototype?*
   - *Does the group have access to the required test equipment?*
   - *Is this a design problem (not research, nor fabrication)?*
   - *Is the project significant enough to be worthy of eight credits (12 hours/week/person)?*

2. ***A Quantitative Performance Specification***—this describes quantitatively what goals or objectives (i.e., specifications) you plan to achieve.

3. ***Quantitative Analysis for Possible Design Solutions***—after this analysis, one solution should be chosen and further developed.

4. ***Detailed Quantitative Design***—each component of the selected solution approach should be carefully designed.

5. ***Construction of a Prototype***—as necessary, a system prototype (or component prototype) should be developed.

6. ***Development of a Test Plan***—after you have developed your project, how do you plan to test it to see if it meets the specifications you previously defined?

7. ***Evaluation of the Prototype Solution***—how well did your final design meet the specifications?

Each design must consider realistic constraints on prototyping and manufacturing costs, and per item consumer cost and pricing, as well as safety, reliability, aesthetics, ethics, and other possible social impacts of the design.

Project Topics

Projects will be carried out in four different sections corresponding to the main electrical engineering areas taught at UCR. Each section will have a "section professor" (i.e., faculty supervisor) as designated below. Possible project topics are obtained from the section professor. In addition, joint projects with the mechanical engineering department are possible.

Electrical Engineering Area	Section Professor	Topics
Nano-Materials, Devices and Circuits (NMDC)	Mihri Ozkan	***Solarium Environment and Solar Cell Development***—Students will build an environmental test chamber (i.e., Solarium) that is capable of simulated sunlight at different intensities. The students will then fabricate organic solar cells and subsequently characterize these designs in the environmental test chamber.
Intelligent Systems (IS)	Matthew Barth	***Autonomous Vehicles***—a variety of projects are offered focusing on various aspects of autonomous vehicle operation. Projects can span different platforms and applications, all the way from small micro-robots to larger electric vehicles. Projects will focus on sensors, vehicle control, navigation techniques, and integration. Example projects include micro-mouse, sumo robots, intelligent ground vehicle, and autonomous neighborhood electric vehicles.
Controls and Robotics (CR) (& Sensing)	Gerardo Beni and Amit Roy Chowdhury	***Controls and Systems***—Students will work on various control, systems, and multi-media projects. Some projects will be offered with colleagues from the UCR music/performance department. ***Image Processing***—Other projects include face recognition, video based digital map design, and the synthesis of human activities using learned dynamical models.
Communications and Signal Processing (CSP)	Yingbo Hua and Ilya Lyubomirsky and Sheldon Tan	***Ad Hoc Communication Networks***—Projects include building and testing a network of three or more wireless nodes that can communicate with each other. Students will search and buy commercially available wireless transceivers, and then design, develop, and implement communication protocols into the

		network. Students will demonstrate that their network can indeed perform communications among its nodes without assistance from any established base station. ***Communication electronic design***—Projects include designing optical wavelength locking sub-system(s) for semiconductor DFB lasers; developing high-speed analog/digital electronics for a 10 Gb/s duobinary communications receiver; and designing an optical phase stabilization sub-system using fiber optics, analog electronics, and feedback principles. ***Signal Processing for VLSI***—projects include designing signal-processing algorithms for a variety of VLSI systems.

Deliverables and Grading

Each project will have the following deliverables:

1. ***Oral Design Review***—this is at the end of the first quarter. The group presents the results of items 1-4 above and a bill of materials with costs. (15% of grade)
2. ***Laboratory Notebook and Weekly Reports***—the student teams will need to maintain a laboratory notebook for the duration of their projects and submit written weekly reports. This notebook and reports will be inspected at weekly meetings and graded for content. (15% of grade)
3. ***Written final report***—this is due during finals week of the Spring quarter. It should contain one section for each of the seven items listed above; a bill of materials; the realistic constraint analysis; and any schematics, block diagrams, or other figures/pictures needed to describe the end product fully. Further details on the final report will be provided at a later date. (30% of grade)
4. ***Final Design Presentation and Demonstration***—the outline should be similar to that of the final report, but organized to cover the most important aspects within the time constraints. (25% of grade)

Grading will be based on the deliverables described above. Grading will be determined by all of the section professors conferring on each project and student. Please note that grades are assigned to an individual, not to a project.

Steps in Selecting a Project

Upon reviewing the topic areas, students should invoke the following steps to select a project, and sign the corresponding senior design contract (next page), in order to "officially" register for the course.

Step - 0: Prepare a brief academic resume, which describes your specific technical strengths and general background in less than two pages. It is very important that you make a case for yourself as why you should be doing a specific project. This step is more or less like applying for a job, and therefore this resume is the first draft of your future resume that opens a door for you. Then follow one of the following Steps 1A to 1C, depending on your situation.

Step - 1A: Make an appointment to meet and talk to the section professors with whom you wish to work, and see whether they are willing to recommend you for their projects. At a minimum you should talk to two (preferably three) professors.

Step - 1B: If you have an industrial project in mind that meets the requirements stated above, then you still need to talk to an EE175 section professor. This professor must approve and supervise the project. Alternatively:

Step - 1C: If none of the above projects appeals to you, but you have your own ideas, then you must lobby for that idea with a section professor. This approach requires additional effort, but is doable if it is planned in advance.

Step - 2: Identify one or possibly two of your classmates who have similar interests and want to work with you on the same project and have gone through the same steps as you did. Discuss the project among team members and achieve a consistent project idea.

Step - 3: Make a brief written proposal to the section professor that includes your resume, your classmate(s) resume(s) if applicable, the title of the project, and a brief description. Also have at least two more project titles in this proposal as your second and third choices. Please note that every effort will be made to match you with your best choices, although in certain instances changes may be required. In that case you will be notified promptly.

Step – 4: Once the projects are verbally approved by the section professors, each student team is to fill out a project contract available on the class web site. Be sure to fill out every section, sign it, and turn it in to your section professor.

Approximate Class Schedule

Date	Event	Lecturer	Lecture Content
1/11	Lecture 01	MB	Introduction, course outline, preliminary issues, expectations
1/18	Lecture 02	YH	Introduction to the design process, teamwork, laboratory notebooks, specification process, evaluation criteria
1/25	Lecture 03	DG	printed circuit board design, layout, and fabrication
2/1	Lecture 04	MM	Library techniques: literature and information search
2/8	Lecture 05	GB	Methodologies and approaches; block diagrams, analyses of solutions
2/15	Lecture 06	MB	Project management II: organization, teamwork, scheduling, budgeting, etc.
2/22	Lecture 07	GB	Career strategies, resumes
3/1	Lecture 08	IL	Intellectual Property
3/8	Lecture 09	MO	Technical writing – Phase I (reporting techniques)
3/15	Lecture 10	MO	How to give oral presentations, preparing for the design review

final:	Design Review	All	
4/5	Lecture 11	MO	Environmental Issues
4/12	Lecture 12	MB	Design review results and mid-course progress check + other topics
4/19	Lecture 13	GB	Engineering ethics
4/26	Lecture 14	IL	Developing a test plan, collecting data, and evaluation
5/3	Lecture 15	MO	Technical writing - Phase II: (conference, journal, book, … manuscripts)
5/10	Lecture 16	GB	Engineering economics
5/17	Lecture 17	GB	Marketing engineering products
5/24	Lecture 18	YH	Preparation for the final presentation
5/31	Lecture 19	MO	Multi-international engineering projects
6/7	Lecture 20	MB	Entrepreneurial and venture capital
6/8, 9	Final Presentations		

Lecturer code: **DG** – Dan Giles, **MO** – Mihri Ozkan, **MB** – Matthew Barth, **GB** – Gerardo Beni, **YH** – Yingbo Hua, **IL** – Ilya Lyubomirsky

IIID Essay Topics in English 1B (Spring 2006)

First Essay, English 1B

Please choose one of the topics below and write an essay of approximately two pages (or as close as you can manage) during class time. It is less important to finish the essay than it is to have a good introduction, a strong thesis statement, and clear support. Take your time and work on good sentences, solid connections, and clear reasoning. Finally, choose your topic carefully, as you will be working on it for some time to come. Please do your best, but also realize that perfection is not expected in the time allotted.

1.) Rousseau claims that each individual owes a certain duty to the state. Why? What does the state do for the individual that makes her owe allegiance to it? *Taking this point of Rousseau's into account*, to what extent do you feel that you owe duty to the state? When would that duty become void, in other words, what would the state have to do to give you reason to legitimately disobey? How does this relate to Rousseau's point about the social contract? Write a carefully reasoned essay that first explains Rousseau's point of view and then discusses it in relation to modern society, your own experience, or whatever example or examples you can think of that support your ideas.

2.) Machiavelli makes several different claims about how a prince should lead. Consider his three most important ideas and relate them to a modern politician or politicians of your choice. To what extent can this person or persons be termed "Machiavellian?" Finally, and most importantly, do you think this kind of behavior is really necessary for a politician's success? (It truly does not matter to me where you stand on this, so long as you engage the question seriously).

3.) There are those who argue that modern technology has substantially improved the lives of people. However, others point to the gradual destruction of the environment, overpopulation, and so on to argue that modern technology is more of a curse to the world than a help. Lao-Tzu argues that the world is sacred and so "cannot be improved." How are all of these ideas related? Be sure to explain what Lao-Tzu seems to mean by his statement and relate it to the question of technology (the use of machines and science to control the environment) as well as offering your own opinion on the subject.

4.) Compare and contrast Machiavelli's views on the purpose of government with those of Rousseau. They do seem to agree on some important issues, so it would be a good idea not to assume a total opposition. However, their views on human nature and other things do have significant differences as well. The trick is to write a balanced essay that assesses where they have either significant strengths or weaknesses and to explain why as clearly as possible. Try to use either hypothetical or historical (actual) examples to explain and / or support your ideas.