Program Self-Study Report
for Review of Engineering Programs
<u>Using Engineering Criteria 2000</u>

Bachelor of Science Degree in
Mechanical Engineering

Submitted by
California State University, Los Angeles

to the
Engineering Accreditation Commission

Date: July 1, 2006

Participating Society Members

American Academy of Environmental Engineers
American Congress on Surveying and Mapping
American Institute of Aeronautics and Astronautics
American Institute of Chemical Engineers
American Nuclear Society
American Society of Agricultural Engineers
American Society of Civil Engineers
American Society for Engineering Education
American Society of Heating, Refrigerating, and Air-Conditioning Engineers
American Society of Mechanical Engineers
Institute of Electrical and Electronics Engineers
Institute of Industrial Engineers
ISA - The International Society for Measurement and Control
National Council of Examiners for Engineering and Surveying
The Minerals, Metals, and Materials Society
National Institute of Ceramic Engineers
National Society of Professional Engineers
Society of Automotive Engineers
Society of Manufacturing Engineers
Society for Mining, Metallurgy, and Exploration
Society of Naval Architects and Marine Engineers
Society of Petroleum Engineers
The Minerals, Metals, and Materials Society

Affiliate Society Members

American Institute of Mining, Metallurgical, and Petroleum Engineers
American Consulting Engineers Council
American Society of Safety Engineers
Materials Research Society
Society of Plastics Engineers

Cognizant Technical Society Members

American Society of Industrial Hygiene
American Society for Quality

Table of Contents

Appendix I – Additional Information

Appendix II - Institutional Profile

(Note: Appendix II is included as a separate bound document)

Program Self-Study Report
for Mechanical Engineering

A. Background Information

1. Degree Title

Bachelor of Science in Mechanical Engineering

2. Program Modes

The mode of instruction is on-campus, classroom instruction with the University and the Department operating on a year-round quarter system. Each quarter is eleven weeks long, including one week for final examinations. Instruction is offered from 8:00 a.m. to 10:00 p.m., and no distinction is made between full-time, part-time, day, evening, or summer quarter in the content, mode of instruction, or faculty utilization. To maintain their continuing student status, students must register for at least two quarters out of the previous sequence of four quarters.

Most undergraduate lecture classes have an enrollment limit of 25 students. Based on the space and equipment available, the enrollment in laboratory classes is limited to 16. In project and independent study courses, faculty work individually with the students.

3. Actions to Correct Previous Shortcomings

The only concern noted in the final statement from the last ABET/EAC General Review was related to Criterion 4, Professional Component:

> *This criterion specifies that the major design experience incorporate realistic constraints "that include most of the following considerations: economic; environmental, sustainability, manufacturability; ethical; health and safety; social; and political." It was not apparent from the materials presented for evaluation that majority of these elements were considered. The EAC recommends reevaluation of the mechanical engineering capstone design experience to ensure that the requirements of this criterion are implemented.*

To address this concern, the department has modified the senior design sequence, ME 497A, B, C, which is the mechanical engineering capstone experience. Since 2005-2006 AY, every fall the department invites a member of the Industry Advisory Board to present a case study in ME 497A. The list of the IAB members and their curriculum vitas are included in Appendix I. The case study is carefully selected to incorporate and highlight the realistic constraints identified in ABET Criterion 4 and the presentation is in an interactive format to inspire discussion with audiance participation. In Fall 2005 for example, Mr. Hector Gomez of Northrop Grumman presented a spacecraft separation case study to the ME 497A class of 2006. The synopsis for this case and the date of the class meeting can be found in the ME 497A course file. The synopsis, which was handed out in the class explicitly outlines under separate headings requirements, technical, cost scheduling, environmental, safety, regulatory, and ethical issues of the case. In addition, to ensure that the students have methodically considered realistic constraints with a heightened awareness, it is required that the senior design project final report submitted by each student team include a checklist that indicates how design constraints are addressed in the project .

The department is a pioneer in adopting the multi-quarter sequence format for the capstone design course, ME 497A,B,C to make certain students receive a major and meaningful design experience in their last year of residency. The series has been taught by the same faculty member, Professor Hsia since its inception which has resulted in consistency and repeated cycles of assessments and improvements. The majority of the projects undertaken by students are conceived and sponsored by either industry or by one of the CSULA sponsored research projects and represent real world situations. In most cases a prototype is built to further enhance the experience. As such, these projects inevitably incorporate most of the constraints delineated in Criterion 4.

Prior to the senior design, each mechanical engineering student takes the required course ENGR 301, Ethics and Professionalism. This course is designed to heighten the awareness of engineering students and expose them to the ethical, societal, political, and ecological impacts of the engineering practice.

The final statement also noted an institutional concern:

> *Examination of course materials and review of transcripts in all programs showed that many students appeared to take courses without completing published prerequisite courses. Further analysis led to several explanations, including: a prerequisite course taken at another institution; repeating a course long after the original course was taken, thus making it appear that a prerequisite course was not taken in the proper sequence; course instructors allowing students to take courses without prerequisites; and software that allowed students to enroll in a course after a student failed or withdrew from a prerequisite course. Discussions with college faculty and staff led to the observation that the process and the software for checking prerequisites have been modified to eliminate concerns of the type cited here. In spite of these changes, several faculty members stated that they were not aware of these problems or the steps taken to eliminate them. Thus, steps should be taken to ensure that corrective actions are in place and working as initiated. In addition, faculty should be informed of the problem and actions taken to ensure that students take courses in the proper sequence.*

The challenge of controlling prerequisites is most persistent due to the large number of transfer students the college caters to. The faculty members are keenly aware of this problem as it is a concern that is often discussed in department meetings and effective measures to respond are debated. Steps have been taken to ensure that incidents cited above will not occur. These include a new policy, as of 2001, that requires written approval by the advisor and the department chair when a prerequisite is met by a course other than the one normally required, or when a prerequisite is waived based on confirmation of a student's prerequisite knowledge. There have been departmental meetings that focus on the problem and the corrective actions taken. The enhanced online enrollment software, People Soft, provides some measure of control by preventing students from enrolling in a course after failing or withdrawing from a prerequisite course. In addition, the department has conducted a judicious and careful review with the objective of streamlining of the prerequisites and facilitating timely progression towards degree. The updated Department Brochure for the B.S. degree in Mechanical Engineering specifies the new prerequisites. In addition all course syllabi must specifically state the prerequisites for the course. In addition, each student's compliance with prerequisites is more diligently examined when they enroll in ME 497A and B, which serve as gate keeping courses. If a student does not meet prerequisites for ME 497A, he/she will have to wait until next fall to join the sequence. Students are adequately and clearly warned about the consequence of reaching ME 497A and not meeting its prerequiste early on through the initial and subsequent advisements, prominent posting of the prerequisites and requirements for ME 497A in the department information window, and by emphasizing it in the department undergraduate brochure. The prerequisites for ME 497 are: ME 103, Introduction to Mechanical Design, ME 323, Machine Design I. The co-requisites are: ENGR 300, Engineering Economic Analysis, ME 310, Mechanical Engineering Writing Laboratory, ME 306, Heat Transfer I, and ME 327, Manufacturing Processes. The department believes this latter policy which is prominently posted and is adequately emphasized during advisement will encourage our students to adhere to taking courses in proper sequence.

In addition the department has responded to the following observations noted in the EAC final report:

> *The objectives of the program are published on the department's web page but do not seem to appear in recruitment materials.*

The department recognizes that wider dissemination of the program objectives is desirable and has included these in the recruitment materials that are mailed to prospective students and that are distributed to the local high schools.

> *Assessment materials presented to the visitors showed constituency concerns with respect to student writing. The department plans to require that students take a one-unit technical writing course given by the EE department. The EAC recommends careful evaluation of the implementation of this plan to ensure that program and ABET requirements are met.*

At the time of the last ABET visit, the electrical engineering department offered the only technical writing course in the College. The mechanical engineering department was considering making EE 330, Writing for Electrical Engineers, required for ME majors. However, subsequently, a one-unit course, ME 310, Mechanical Engineering Writing Laboratory, has been developed and made required. The new course focuses on technical and laboratory report writing (see section on laboratory experience and the course syllabus for ME310). The main objective of this course is to provide students with methods, strategies and contexts for developing clear and effective writing suitable for the mechanical engineering profession. Special attention is paid to issues of format, audience, purpose, organization, clarity, and style. To pass the course students must demonstrate, through reading, discussing, writing, and revising, that they can produce technical and business documents such as memos, letters of transmittal, technical presentations, procedures, proposals, abstracts and summaries, laboratory and research reports, and resumes. Workgroups and peer review comprise a significant part of the class.

In addition to this formal setting, the campus provides significant resources for students through the on line and in-person service of the University Writing Center. The Writing Center helps students with any part of the writing process, from understanding the assignment and generating ideas to revising and proofreading the final draft. The Writing Center also provides space and time for students to discuss ideas explore meaning, and engage in the trial and error that is part of learning to communicate effectively.

> *While the number of faculty members has declined since the last visit, enrollment has declined also, and student/faculty ratio seems appropriate. One faculty member believed that hiring two additional faculty members would be consistent with strengthening the department as it grows with the anticipated enrollment growth. Present department plans are to hire one additional person.*

Since the last ABET visit, one new faculty member in the area of Machine Design, Professor Adel Sharif, has been hired. In addition, Professor Samuel Landsberger, who held the college Manufacturing Endowed Chair position, has joined the department on a split appointment with the Kinesiology Department. There have been two retirements, Drs. Ram Manvi, and Stephen Felszeghy. Dr. Manvi retired at the end of AY 2004-2005. He is now on the Faculty early Retirement Plan (FERP). As a FERP, Dr. Manvi will continue to serve on the faculty on a half time assignment for five years starting in Fall 2004. Dr. Felszeghy announced his retirement in May 2005. He will also FERP and stay on the faculty on a half time basis for the next five years.

4. Contact Information

Dr. Maj Dean Mirmirani, Chair
Department of Mechanical Engineering
E&T A205
5151 State University Dr.
Los Angeles, CA 90032
Voice: (323)343-4492
Fax: (323)343-5004
E-mail: mmirmir@calstela.edu

B. Accreditation Summary

1. Students

The following sections describe how students are evaluated, advised, and monitored to ensure that they meet all Mechanical Engineering program objectives.

a. Evaluation of Students

Students are continuously evaluated from the time they apply for admission to the University until they graduate. These evaluations occur in every situation in which a student must attain a satisfactory ("passing") result to progress toward graduation. Each evaluation plays a role in ensuring that the educational objectives for the Mechanical Engineering program, presented in Section B.2, are achieved—i.e., that graduates of the Mechanical Engineering program have the knowledge, skills, and attitudes required for a successful career in Mechanical Engineering.

The first evaluation occurs when the University Admissions Office reviews a student's academic record, and, based on Systemwide standards, the student is either granted or denied admission to the University. For high school students, this evaluation is based on an Eligibility Index that combines high school GPA and SAT scores. For transfer students, the evaluation is based on grades achieved in work at prior institutions.

Once students are admitted, all non-exempt students are required to take the Entry-Level Mathematics Exam (ELM) and the English Placement Test (EPT). These diagnostic evaluations are used to place students in appropriate levels of mathematics and English coursework. Students may also be required to undergo further diagnostic evaluations in mathematics and chemistry before they can register for courses in these disciplines that are required for the major.

For transfer students, the University Admissions Office assumes the responsibility for determining transfer credit that meets University requirements in three areas: General Education, the ME major (if articulation agreements exist for transferable courses), and other courses acceptable as university-level courses. The Admissions Office posts the student's complete records, including the results from the transfer credit evaluation, electronically on the University's record keeping systems, OASIS (Online Student Information System) and GET (Golden Eagle Territory). OASIS is a large, computerized record-keeping system that contains student transcripts, class schedules, financial aid information, transfer credits, registration information, and a computerized telephone registration system. At the time of drafting this report, the online graduation tracking system is undergoing a change from OASIS to GET. The student's assigned ME advisor then accesses these records and evaluations on OASIS or GET and determines which additional courses, if any, from among those granted transfer credit, meet specific requirements of the ME program. Any transfer course that the ME Department approves as meeting degree requirements must accomplish the same program educational objectives and outcomes that the equivalent ME Department course accomplishes. If there are *any* deviations in the objectives or outcomes in the transfer course in question, approval is not given.

Except for transfer credits granted for equivalent coursework, no substitution for required courses is allowed without very serious and compelling reasons. Such substitutions are studied carefully and require the approval of the student's advisor and the Department chair.

Once students (transferring or continuing) have declared a Mechanical Engineering major and have met all prerequisites to enroll in Mechanical Engineering courses, the evaluation of students is assumed primarily by individual Mechanical Engineering faculty. These faculty generally rely on standard evaluation tools—exams, quizzes, homework assignments, design projects, computer assignments, oral presentations, written assignments, and a University-required final examination—to measure student performance in their courses.

As indicated above, the ongoing evaluation of students becomes integrated throughout the curriculum and decentralized by virtue of the fact that each professor chooses his or her own ways to evaluate students (except, of course, for the mandatory final exam). However, the ME Department ensures certain evaluation standards (e.g., all students must have the ability to apply mathematics) through the implementation of prerequisite, testing, and the required certain across-the-board evaluations. For example, writing is evaluated through the University Writing Proficiency Exam (WPE), which all students must pass before they complete 135 quarter units. Students' writing and oral communication skills are evaluated and strengthened in courses such as ME 310, Mechanical Engineering Writing Laboratory, Speech 150, and the Mechanical Engineering capstone design course. Students' ability to work in teams is developed and evaluated in laboratory and design courses.

Finally, all students are formally evaluated two quarters before their anticipated graduation. The pre-graduation evaluation process ensures that students have satisfied all curricular requirements and have achieved at least a 2.0 GPA in the following four areas: (1) all units attempted (including units accepted as transfer units); (2) all units attempted at CSULA; (3) all courses used to meet the General Education requirements; and (4) all courses required for the Mechanical Engineering major.

b. Advising Students

Prior to the start of their first quarter, all new students are encouraged to participate in the University Orientation Program. At this event, students are familiarized with the University—learning about important policies and procedures, student support services, and similar information to help ease their transition to university life and the CSULA campus. If they have already declared a Mechanical Engineering major, they are introduced to the College and the Mechanical Engineering program and are assigned a permanent faculty advisor. When they meet with their advisor during their first quarter (a mandatory meeting), the faculty advisor fills out a "Major Department Evaluation" (MDE) form (see Figure 1 at the end of this narrative), which lists all the major requirements, and a "General Education Advisement" (GEA) form (see Figure 2 at the end of this narrative), which lists all GE requirements. Upon completion, the faculty advisor and the Department chair, both sign off on the MDE and GEA forms, and copies are mailed to the student and filed in the ME Department office. Also at this meeting, students are given a copy of the *Mechanical Engineering Student Handbook* and are advised to obtain a University Catalog, each of which lays out the ME program requirements in detail. These documents will be sent to ABET team members prior to the visit and will be on display in the ABET Resource Room.

If a student has transferred to the University from another institution, a "Transfer Credit Evaluation" (TCE) form is sent to the student by the University, specifying which courses (if any) have been accepted towards the major. The information on the TCE form is available to the student's ME advisor on the OASIS and GET. A sample printout of this screen is shown as Figure 3 at the end of this narrative. (Once again, a detailed explanation of the evaluation process of transfer students is given in Section B.3 of this Self-Study and reiterated in Appendix II) . In some occasions during the initial advising the TCE may not yet have been completed by the University. In these cases, the advising will be based on a tentative evaluation by the advisor on the basis of an unofficial transcript, which will be formalized later once the University has completed its TCE.

After meeting with their faculty advisor during their first quarter of attendance, students are urged to see their advisor each quarter prior to registration. The purpose of these pre-registration meetings is to review the student's progress, to double check that the student is meeting the prerequisites, and to provide an opportunity for the student to discuss any questions he/she may have.

Students are required to see their advisor when they are ready to take upper-division technical electives. During this advisement session, the student discusses with the advisor the selection of a suitable set of six lecture courses and one laboratory course.

The last required advisement meeting is with the Department chair and takes place two quarters prior to graduation. The purpose of this meeting is to verify that the student has completed all graduation requirements and has satisfied all of the *ABET Engineering Criteria 2000*.

c. Monitoring Students

As students progress through the Mechanical Engineering program, they are monitored in a number of ways. First, the University Office of the Registrar flags any student who fails to maintain "good academic standing" (determined by the criterion that all students must maintain a minimum overall GPA of 2.0). Students whose GPA drops below 2.0 are automatically placed on academic probation. A letter is sent by the University to all students on probation requiring them to meet with their faculty advisor to discuss a remedial course of action. Students whose grade point deficiency becomes excessive are disqualified and can only be reinstated with the approval of the Department chair.

In addition to being monitored by their faculty advisors upon advisement, students are tracked by the information on their MDE's, which is updated manually each quarter. They also can be tracked through the University on-line administrative tools and record keeping systems.

The online graduation tracking system is undergoing a change from OASIS (Online Student Information System) to GET (Golden Eagle Territory). OASIS is a large, computerized record-keeping system that contains student transcripts, class schedules, financial aid information, transfer credits, registration information, and a computerized telephone registration system. OASIS is based on a command prompt system which does not provide for sufficient flexibility for faculty use. OASIS provides limited on-line access to students.

The GET system is a more user friendly system and represents one of the major initiatives by the campus. GET provides web based access to a more organized student record and information data. The Academic Advisement module within the GET is used to track the requirements and rules which a student must satisfy in order to graduate. The Academic Advisement Module offers great flexibility for the advisor to indicate "course substitutions" and "electives". At this time only the department chair, the associate chair, and the department primary advisor have access to GET on-line course substitution. Other faculty use the MDE for course substitution and transfer credit in the major, which will be reviewed and approved by the department chair or the associate chair. Academic Plan Templates are built based on approved curriculum. These templates form a basis for generating Student Advisement Reports which will provide real time information regarding the student's progress towards the degree. Advisors will be able to run a "Quick What-If" audit to generate Student Advisement Reports that clearly indicate all the missing requirements for the degree.

The department advisors have been trained by Mr. Chuck Mancillas, the Graduation Supervisor, to generate Student Advisement Reports. Mr. Mancillas has generated an Academic Advisement Users Guide which is of great help to the advisors.

New features are being added to the GET Advisement Module. A notable feature will be to give students a limited access to generate their own reports (similar to the advisor generated reports). This student view is expected to be completely implemented in 2006-2007.

With the Registrar's monitoring system OASIS and/or GET, and the MDE's, the Department has a comprehensive, effective process for monitoring students. There is no way a student can "slip through the cracks." Each student who is certified through the granting of a BSME degree has been thoroughly evaluated, advised, and monitored throughout his or her academic career. Through this process, the Mechanical Engineering faculty and Department chair are confident that all Mechanical Engineering graduates have met Mechanical Engineering program educational objectives and outcomes and possess every skill, knowledge, attitude, value, and interest specified in ABET's *Engineering Criteria 2000.*

d. Processes and Procedures Used to Enforce Policies for Acceptance of Transfer Students

The CSULA Office of Admissions and Outreach has the responsibility of enforcing the University's policies for the acceptance of transfer students. The Admissions Office ensures that transfer students will meet the California State University requirements for admission.

An undergraduate transfer applicant qualifies for admission as a transfer student if s/he has a C (2.0) grade point average or better in all transferable units attempted, is in good standing at the last college or university attended, and meets any of the following standards:

- Meets the freshman admission requirements in effect for the term to which s/he is applying (see section entitled "First-Time Freshman Applicants" in the *2005-2007 University Catalog*).
- Was eligible as a freshman at the time of high school graduation and has been in continuous attendance at an accredited college since high school graduation.
- Was eligible as a freshman at the time of high school graduation except for the subject requirements, has made up the missing subjects, and has been in continuous attendance in an accredited college since high school graduation.
- Has completed at least 84 transferable quarter (56 semester) units and has made up any missing subject requirements. Nonresidents must have a 2.4 grade point average or better.

e. Procedures Used to Validate Credit for Courses Taken Elsewhere

The criteria and procedures for granting credit to undergraduate transfer students are as follows. During the admissions phase, an evaluator examines all transcripts of courses taken at other institutions (both community colleges and four-year institutions) to determine transferable units. "Transferable units" are unit credit values for courses recommended by the faculty of a regionally accredited college or university and certified as appropriate for baccalaureate credit by the institution, and therefore acceptable at least as elective credit by the University.

Once an admitted student indicates his or her intention to enroll, the process of determining which graduation requirements are satisfied by the "transferable units" begins. First, credit for General Education courses is determined by an evaluator in the University Admissions Office. When approved articulation agreements are in place and have been entered in the on-line student records system, OASIS or GET, credit for General Education and for any articulated major requirements (see discussion of articulation below) is done automatically on line. Once this evaluation process is complete, the student is sent a Transfer Credit Evaluation form with instructions to meet with his or her academic advisor to determine credit for any additional major course requirements.

Granting of transfer credit for major requirements based on work done at California institutions is generally straightforward. We have developed course-by-course and 2+2 articulation agreements with all community colleges from which we draw an appreciable number of undergraduate transfer students. These articulations are developed jointly by our engineering department chairs and the community college engineering department chair. Once developed, they must be approved by our Dean of Undergraduate Studies and the community college Articulation Officer. Approved agreements are then entered into the on-line student record system (OASIS or GET) and serve as a contract with prospective students.

In addition, CSULA participates with all California community colleges, and most four-year institutions, in the California Articulation Number (CAN) System. Through CAN, a common number is assigned to transferable lower-division courses, and students who complete CAN courses at a participating campus are guaranteed credit at other participating campuses.

If articulation agreements do not exist, acceptance of transfer credit to meet major requirements is based on the recommendation of the student's advisor, and requires approval of the Department chair, the associate chair, or the department primary advisor. The determination of whether transfer courses are equivalent is made based on catalog descriptions, textbooks used, student notes, and consultations with engineering faculty at the other institution. Specific consideration is given to whether the course under consideration is equivalent in terms of ABET curricular criteria and program outcomes.

2. Program Educational Objectives

a. Consistency of Program Educational Objectives with University and College Mission Statements

The Mechanical Engineering educational objectives and corresponding program outcomes are consistent with both: (1) the mission statement of the University; and (2) the mission statement of the College of Engineering, Computer Science, and Technology.

The University Mission Statement

California State University, Los Angeles has one of the most diverse student populations of any college or university in the nation. Building on the strengths of this rich diversity, our University prepares students for success in advanced studies, in their careers, and throughout their lives. California State University, Los Angeles graduates constitute a major leadership force in Greater Los Angeles, a microcosm of the global society.

The University is committed to free scholarly inquiry, to high-quality teaching, and to academic excellence in undergraduate, graduate, and other post-baccalaureate and continuing education programs. This commitment underlies strong educational programs that are sensitive to the needs of the University's uniquely diverse student body. These programs include research, scholarship, creative activity, and community service. With the support of the administration, staff, alumni, and community, highly qualified faculty are the keystone of the University and the basis for the excellence of our programs.

As a comprehensive university, California State University, Los Angeles offers a broad range of liberal and professional programs designed to encourage student excellence, achievement and well being. Facilitated by close interaction between faculty and students, educational programs are designed to foster habits of disciplined inquiry and critical thinking while helping students master a body of knowledge. The University strives to promote understanding of and respect for diversity, and to serve the changing needs of a global society. Recognizing its commitment to teaching, research, scholarship, creative activities, and service, the University supports an effective library and the use of new technologies that enrich the instructional process and provide effective access to information in various forms.

The University is committed to providing students with a balanced and well-rounded educational experience including co-curricular activities that contribute to personal enrichment, leadership development, and institutional pride. Student organizations, campus residence life, artistic events, multicultural events, intercollegiate athletics, and intramurals are designed to be a significant part of this experience.

The close proximity of the University to civic, cultural, and economic centers enables it to foster strong cooperative relationships with alumni, community, business, scientific, educational, cultural, and government constituencies. Partnerships with these constituencies will continue to grow for the mutual enhancement of academic programs and the community.

California State University, Los Angeles is committed to fostering collegial relationships among faculty, administration, students, and staff. The principles of academic freedom and professional ethics are the responsibility of the entire academic community. We take pride in our continuing evolution as the University serving the Los Angeles Basin.

The College of Engineering and Technology Mission Statement

The mission of the College of Engineering and Technology is to graduate well-educated engineers and technologists who are prepared to meet the challenges of a rapidly changing, increasingly complex world. This will be accomplished through:

- A well-qualified faculty who care about students and their success
- A dynamic, up-to-date curriculum that has an optimal balance between theory and practice
- Laboratories, computer facilities, and instructional classrooms on par with any engineering and technology program in the nation
- Unique co-curricular opportunities for students such as participation in student design competitions, professional student organizations, and pre-professional employment
- Opportunities for undergraduate and graduate students to participate in research projects
- Mutually beneficial partnerships with area industry that take advantage of our location in one of the most concentrated high-tech centers in the nation
- Strong cooperative relationships with local high schools and community colleges

b. The Mechanical Engineering Program's Educational Objectives and Outcomes

Prior to the ABET review of 2000, the Mechanical Engineering Department utilized the program's primary constituents, ABET (a) – (k) outcomes, and the SME Manufacturing Education Plan: Phase 1 Report to develop educational objectives and learning outcomes. The SME Manufacturing Education Plan: Phase 1 Report is a 1997 study that obtained significant industry input to identify the competency gaps in newly hired engineering graduates. CSULA was a unique contributor to this study because its primary author was Dr. Michael Kelly, holder of CSULA's Northrop/Grumman Engineering Endowed Chair during 2000. Since the assessment plan for the program requires that the Objectives and Outcomes are readdressed every five years, this is occurring in 2005 and will be discussed later in this section.

The Mechanical Engineering program's educational objectives and outcomes are grouped into three categories—*knowledge, skills*, and *attitudes*—describing the attributes that the ME program strives to produce in its graduates:

- The ***knowledge*** they will have
- The ***skills*** they will possess

- The ***attitudes*** they will hold

To show the relation of the Mechanical Engineering program educational objectives to the University and College mission statements, the following three diagrams separate the declarations made in the mission statements into *knowledge*, *skills* and *attitudes*, and then connect them with the program's corresponding educational objectives and program outcomes. These diagrams show, that the educational objectives of the Mechanical Engineering program are consistent with the University and College mission statements. Specifically, the first diagram provides excerpts from the two mission statements to demonstrate that both the University and College are committed to enhancing students' knowledge in the field that they are studying by providing: (1) a stimulating learning environment; (2) modern teaching and research facilities; and (3) a well-qualified faculty. These three provisions support the program's objective of producing graduates who will have both the technical and non-technical knowledge necessary to approach Mechanical Engineering problems.

Likewise, the second diagram provides excerpts from the two mission statements to demonstrate that both the University and the College are committed to improving current skills and fostering new skills by: (1) making a broad range of liberal arts and professional courses available to each student; (2) offering a dynamic, up-to-date curriculum that encourages the utilization of modern tools and skills; and (3) providing classrooms and laboratories having state-of-the-art equipment. These three provisions are consistent with the program's objective of producing graduates who possess the skills necessary to perform the tasks given to Mechanical Engineers.

Finally, the third diagram provides excerpts from the two missions statements to demonstrate that both the University and the College are committed to encouraging attitudes that will benefit graduates in both their professional and personal lives. These attitudes are fostered by: (1) providing a well-rounded education in a culturally diverse setting; (2) embracing collegial relationships among faculty, administration, students, and staff; and (3) using co-curricular opportunities to develop constructive attitudes in students. Through these provisions, students will develop the attitudes of confidence and a firm belief in the value of lifelong learning—both of which are part of our ME program educational objectives.

Mission Statement Declarations Related to *Knowledge* and Their Connection with the Mechanical Engineering Program Educational Objective and Program Outcomes

Declarations in University's Mission Statement Related to <u>Knowledge</u>:	**Declarations in College's Mission Statement Related to <u>Knowledge</u>:**
• The University is committed to free scholarly inquiry, to high-quality teaching, and to academic excellence in undergraduate, graduate, and other post-baccalaureate and continuing education programs. • This commitment underlies strong educational programs …these programs include research, scholarship, creative activity, and community service. The University supports an effective library and the use of new technologies that enrich the instructional process.	• A well-qualified faculty who care about students and their success. • A dynamic, up-to-date curriculum that has an optimal balance between theory and practice. • Laboratories, computer facilities, and instructional classrooms on par with any engineering and technology program in the nation. • Opportunities for undergraduate and graduate students to participate in research projects. Mutually beneficial partnerships with industry that take advantage of our location in one of most concentrated high-tech centers in the nation.

Mechanical Engineering Program Educational Objective (Knowledge)

Graduates of the Mechanical Engineering program will have the **knowledge** in math, science, and engineering fundamentals, as well as societal issues, that allows them to approach real-world Mechanical Engineering problems, with an understanding of their impact on society.

Program Outcomes (Knowledge)

1. An ability to apply knowledge of mathematics, science, and engineering (abet a)

   In particular, an ability to apply knowledge of:
   - a) chemistry and calculus-based physics
   - b) advanced mathematics through multivariate calculus and differential equations
   - c) statistics and linear algebra
2. An understanding of professional and ethical responsibility (abet f)
3. The broad education necessary to understand the impact of engineering solutions in a global/societal context (abet h)
4. Knowledge of current events and societal contemporary issues -- non-engineering related (abet j)
5. A knowledge of computer-aided design and simulation software
6. A knowledge of measurement and manufacturing techniques

Mission Statement Declarations Related to *Skills* and Their Connection with the Mechanical Engineering Program Educational Objective and Program Outcomes

Declarations in University's Mission Statement Related to Skills:	**Declarations in College's Mission Statement Related to Skills:**
• California State University, Los Angeles offers a broad range of liberal and professional programs designed to encourage student excellence, achievement, and well being. • Educational programs are designed to foster habits of disciplined inquiry and critical thinking.	• A well-qualified faculty who care about students and their success. • A dynamic, up-to-date curriculum that has an optimal balance between theory and practice. • Laboratories, computer facilities, and instructional classrooms on par with any engineering and technology program in the nation.

Mechanical Engineering Program Educational Objective (Skills)

Graduates of the Mechanical Engineering program will posses the **skills** to work in group and individual settings, to define and solve problems related to thermal and mechanical systems and manufacturing processes, by applying engineering fundamentals and engineering tools with a logical approach, and be able to clearly communicate their findings.

Program Outcomes (Skills)

1. An ability to design and conduct experiments, as well as to analyze and interpret data (abet b)
2. An ability to design a system, component, or process to meet desired needs (abet c)
3. An ability to function on multidisciplinary teams (abet d)
4. An ability to communicate effectively (abet g)
5. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
6. An ability to select materials and manufacturing processes
7. An ability to visualize designs from engineering drawings
8. An ability to think in a logical, sequential process that lends itself to identifying, formulating, and solving engineering problems (abet e)

Mission Statement Declarations Related to *Attitudes* and Their Connection with Mechanical Engineering Program Educational Objective and Program Outcomes

Declarations in University's Mission Statement Related to <u>Attitudes</u>:	**Declarations in College's Mission Statement Related to <u>Attitudes</u>:**
• California State University, Los Angeles … prepares students for success in advanced studies, in their careers, and throughout their lives. • The University strives to promote understanding of and respect for diversity, and to serve the changing needs of a global society. • The University is committed to providing students with a balanced and well-rounded educational experience including co-curricular activities that contribute to personal enrichment, leadership development, and institutional pride. • California State University, Los Angeles is committed to fostering collegial relationships among faculty, administration, students, and staff. The principles of academic freedom and professional ethics are the responsibility of the entire academic community.	• Unique co-curricular opportunities for students such as participation in student design competitions, professional student organizations, and pre-professional employment. • Opportunities for undergraduate and graduate students to participate in research projects. • Mutually beneficial partnerships with area industry that take advantage of our location in one of the most concentrated high-tech centers in the nation. • Strong cooperative relationships with local high schools and community colleges.

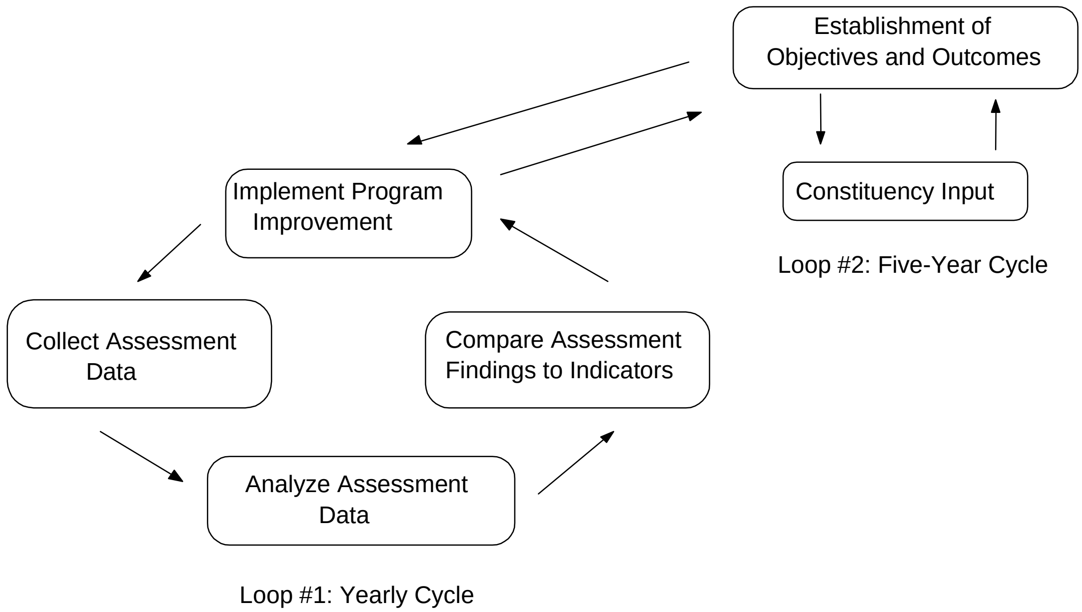
Mechanical Engineering Program Educational Objective (Attitudes)

Graduates of the Mechanical Engineering program will hold the **attitudes** of confidence in their abilities to be successful in industrial, academic, and governmental positions, and a positive, inquisitive outlook on life and learning, necessary to promote their continued professional and personal development throughout their careers.

Program Outcomes (Attitudes)

1. An understanding of and commitment to professional and ethical responsibility (abet f)
2. A recognition of the need for, and an ability to engage in lifelong learning (abet i)
3. An understanding of and willingness to accept responsibility and accountability
4. A desire to be a professional who exhibits values, dedication, and a need for continual improvement
5. A desire to be a flexible and adaptable team player (collaborative attitude)

The processes used to ensure achievement and continuous improvement of the educational objectives and outcomes are represented graphically in the two-loop diagram below.



Two-Loop Processes Followed to Ensure Achievement of Educational Objectives and Outcomes

The steps in Loop #1 are implemented on an annual cycle. This will ensure continual development and improvement in the Mechanical Engineering program. The steps in Loop #2 are implemented on a five-year cycle to ensure that the program stays in alignment with the changing needs and expectations of the program constituencies.

Since the original program objectives and outcomes were generated in the 1999-2000 year, the 2004-2005 year triggered the five year objective assessment and review cycle.

Since the program's original review under ABET 2000, ABET has clarified the meaning of Objective versus Outcome.

Objective: Describes a graduate of the program 3 to 5 years after completion

Outcomes: Describe an immediate graduate of the program

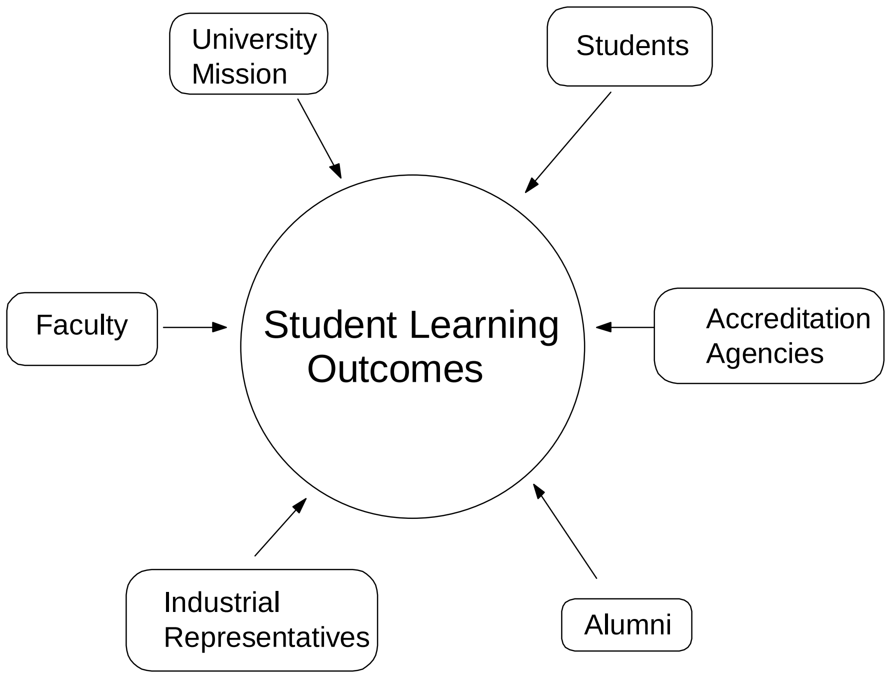
With these definitions, the program began to utilize the primary constituents to develop new objectives and outcomes.

c. Significant Constituencies of the Mechanical Engineering Program

The significant constituencies of the Mechanical Engineering program were identified as being the following:

1. Mechanical Engineering Students
2. Faculty and Staff of the Mechanical Engineering Department and the College
3. Industrial Representatives
    - (a) College Industry Advisory Board
    - (b) Supervisors of Recent Mechanical Engineering Graduates
4. Mechanical Engineering Alumni
5. Accrediting Agencies

These constituencies helped us formulate the Mechanical Engineering program educational objectives and the program outcomes as shown schematically in the following diagram.

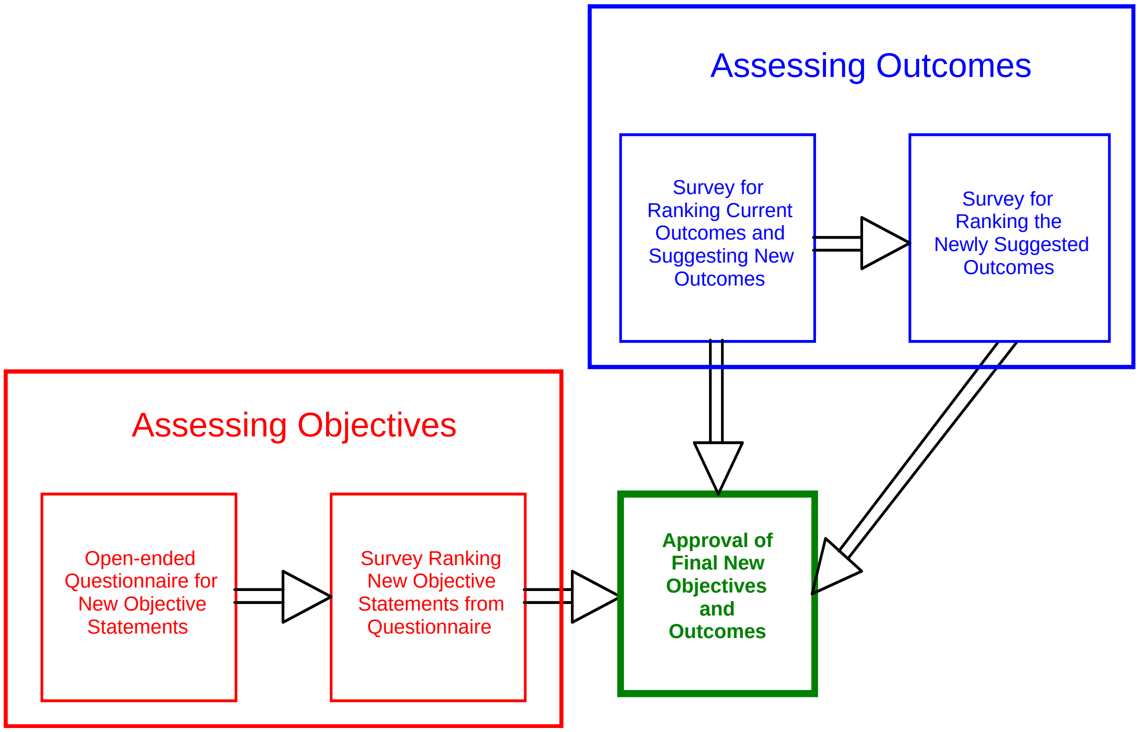


Constituencies Providing Input for Determining Program Objectives and Outcomes

d. Processes for Establishing and Reviewing Educational Objectives to Meet Needs of Constituencies

In 2005, the original objectives and outcome that were established in 2000 were updated. Specifically, new educational objectives were established simultaneously with new student learning outcomes. Extensive input was obtained from the various "constituencies" (ME faculty, ME students, employers, ME alumni), by asking them what knowledge, skills, and attitudes are important for our graduates to have.

The diagram below shows the two paths that were used to create the final educational objectives and student learning outcomes for the department of mechanical engineering.



Schematic Showing Paths used to Update the Program Objectives and Outcomes

Shown below are the specific steps taken to assess, update, and finalize the Mechanical Engineering program educational objectives and outcomes, ensuring that they addressed the needs and expectations of all constituencies.

Assessing / Developing Objectives

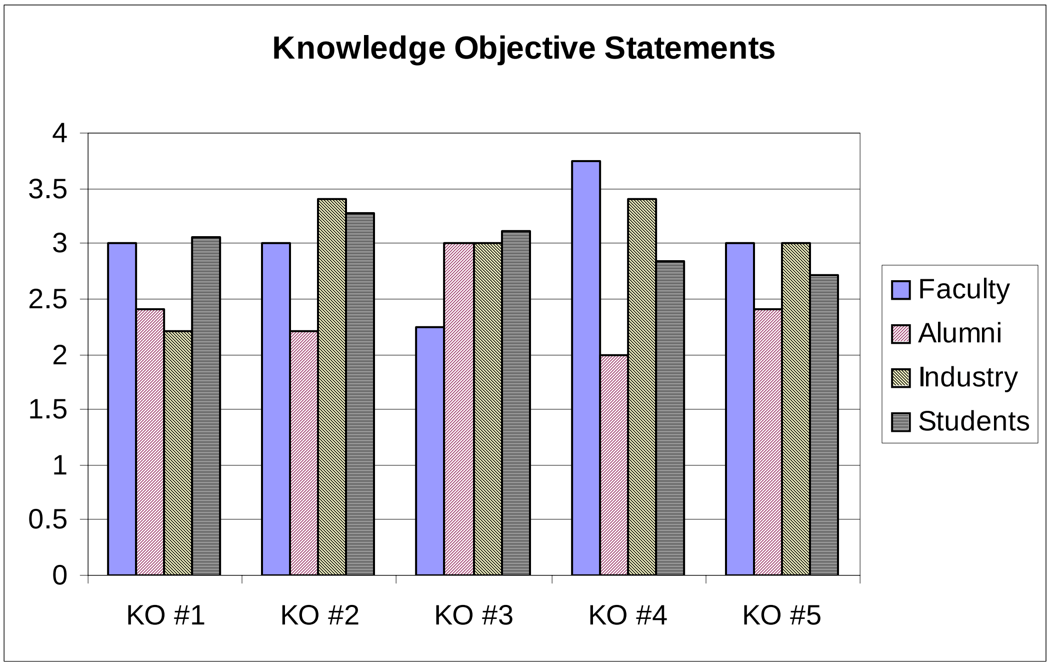
1. The Department Assessment Coordinator drafted an open-ended survey that stated the purpose of an objective, the old objectives and asked the constituents to draft new objective states for knowledge, skills, and attitudes. As a sample, the suggested attitude knowledge statements are shown below.

1.	Graduates of the Mechanical Engineering program will have the knowledge in math, science and engineering fundamentals, as well as societal issues, that allows them to approach real-world Mechanical Engineering problems with an understanding of their impact on society.
2.	Graduates of the Mechanical Engineering program will have the knowledge in math, science and mechanical engineering topics, as well as societal issues, that enables them to deal with real-world engineering problems with an understanding of their impact on society.
3.	Graduates of the Mechanical Engineering program will have the proper knowledge in math, science and engineering fundamentals to allow them to deal with real-world Mechanical Engineering problems with confidence. They are well aware of the impact their work might have on the broader issues relating to the environment and the society at large.
4.	Graduates of the Mechanical Engineering program will have the appropriate knowledge of basic and applied mathematics, engineering science and societal issues that will enable them to work on solution of mechanical engineering problems for the advance of the whole society.

5.	Graduates of the Mechanical Engineering program will have the knowledge in math, science, engineering fundamental, and current and emerging societal needs that allows them to competently solve the practical Mechanical Engineering problems considering all the aspects of the impact of the solution. The knowledge base shall be amply broad to enable our graduates to become professional engineers within three to five years of professional practice.

Sample Results: Suggested Drafts Regarding the Knowledge Objective Statement from the First Objective Survey

2. The Department Assessment Coordinator then drafted a second survey which listed all viable outcome statements and asked the constituencies to rank all statements. Sample data from this ranking can be seen in the table below:



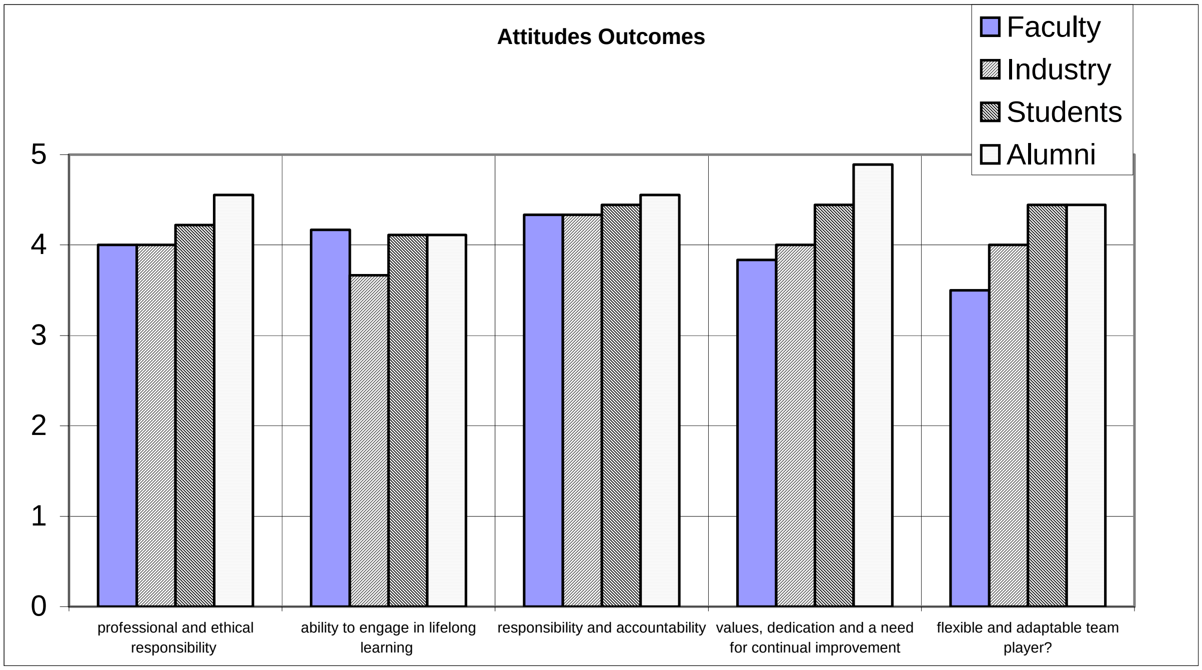
Sample Results Regarding the Knowledge Objective Statement from the Second Objective Survey

3. The department then used equal weighting factors for each constituent and summed the results for each objective statement. Each objective statement with the lowest total was then selected as the new statement

   Specifically, the constituents were asked to rank these statements from 1 to 5 with 1 being the best choice. These values where then summed. Thus, the knowledge outcome (KO) with the lowest total ranking (i.e. KO #1) was selected.

Assessing / Developing Outcomes

1. The department assessment coordinator drafted a survey that asked all constituents to rank the importance of all current outcome statement and asked for input for new outcome statements. Sample data from this survey can be seen in the figure below.



Sample Results Regarding Attitude Outcome Statements

In this survey, the constituents were asked to rate how much emphasis the Mechanical Engineering program should place on each of these attitude outcomes. The scale used was from 1 to 5 with 5 representing the maximum emphasis possible. As can be seen in the graph, the constituents believe that all of these outcomes should have relatively high emphasis (at least 3.5 and above).

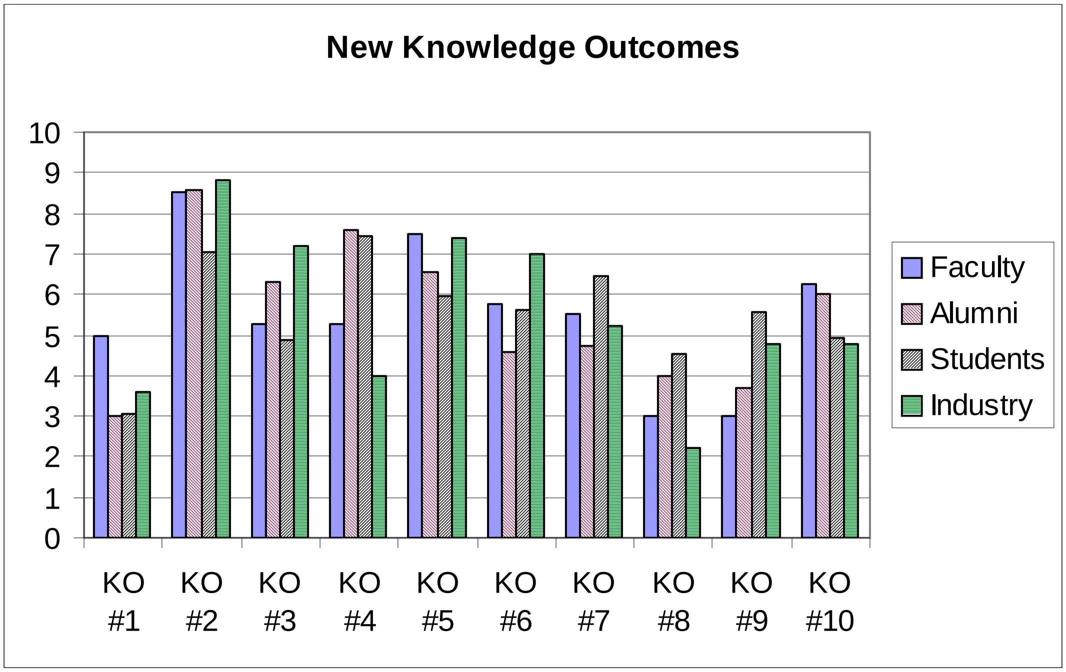
2. A second outcome survey was then generated that asked all constituents to rank the importance of all "write-in" outcomes from the previous survey and all outcomes that were not the ABET required a-k. As a sample of these results, the new suggested outcomes can be seen in the table below.

1. Ability to apply common sense
2. An understanding of newer disciplines such as biomedical and electro-mechanical
3. A knowledge of project team management
4. A knowledge of electro-mechanical fundamentals
5. A knowledge of the financial and managerial aspects of project engineering
6. A knowledge of quality standards
7. A knowledge of geometric dimensioning and tolerances
8. A knowledge of computer aided design and simulation software
9. A knowledge of measurement and manufacturing techniques
10. A knowledge of how mechanical engineering integrates into inter-disciplinary systems

Sample Results: Suggested New Knowledge Outcome

Statements from the First Outcome Survey

3. The constituencies were then resurveyed to obtain approval of the modified educational objective statements and to obtain feedback on the importance of the program outcomes. These results are shown below.



Sample Results Regarding New Knowledge Outcome Statements

4. The program outcomes were then finalized based on the feedback, including only those ranked as the two most important.

   Specifically, the constituents were asked to rank these outcome statements from 1 to 10 with 1 being the best choice. These values where then summed. Thus, the knowledge outcomes (KO) with the lowest total rankings (i.e. KO #1and KO #8) were ranked as the most important on the list.

The final draft of the Mechanical Engineering educational objectives and program outcomes was then sent to all constituencies for final comment and approval. The objectives were unanimously accepted.

The final new objectives and outcomes for the 2006-2011 assessment period are:

Knowledge

Graduates of the Mechanical Engineering program will have the knowledge in math, science and engineering fundamentals, as well as societal issues, that allows them to approach real-world Mechanical Engineering problems with an understanding of their impact on society.

This educational objective will be demonstrated by the following outcomes:

1. *an ability to apply knowledge of mathematics, science, and engineering (abet a)*

In particular, an ability to apply knowledge of:

a) chemistry and calculus-based physics.

b) advanced mathematics through multivariate calculus and differential equations.

c) statistics and linear algebra.

2. *an understanding of professional and ethical responsibility (abet f)*
3. *the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)*
4. *knowledge of current events and societal contemporary issues -- non-engineering related. (abet j)*
5. *a knowledge of computer aided design and simulation software*
6. *a knowledge of measurement and manufacturing techniques*
7. *an ability to apply common sense*

<u>Skills</u>

Graduates of the Mechanical Engineering program will be able to function competently as an individual or part of a team. They shall be able to analyze, define, and solve thermal, mechanical, manufacturing problems through application of engineering fundamentals and Mechanical Engineering tools logically and effectively as well as communicating the problems and their solutions clearly. They are expected to acquire professional competence in the aforementioned skills within five years..

This educational objective will be demonstrated by the following outcomes:

1. *an ability to design and conduct experiments as well as to analyze and interpret data (abet b)*
2. *ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)*
3. *an ability to function on multidisciplinary teams (abet d)*
4. *an ability to communicate effectively (abet g)*
5. *an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)*
6. *an ability to visualize designs from engineering drawings*
7. *an ability to identify, formulate, and solve engineering problems (abet e)*
8. *an ability to think in a logical, sequential, holistic process*

Attitudes

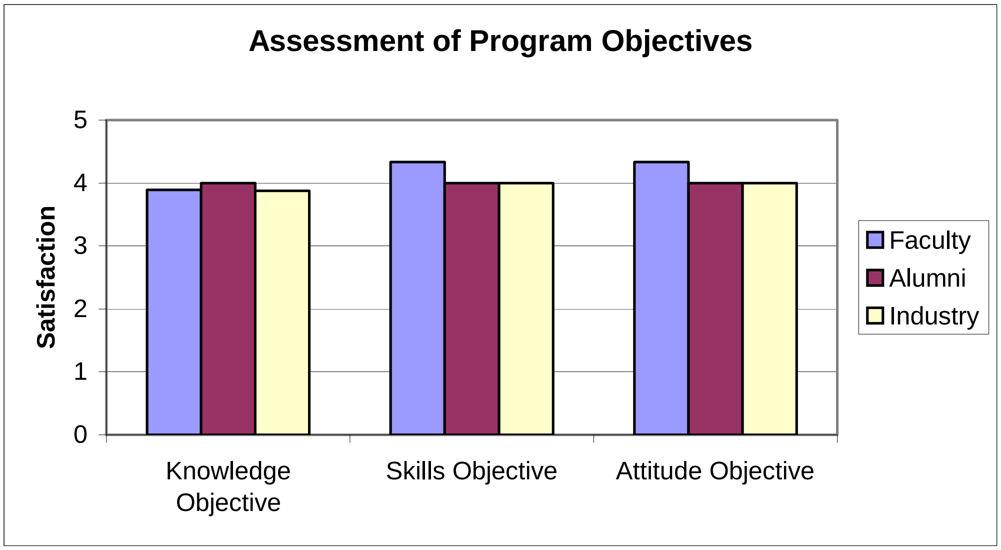
Graduates of the Mechanical Engineering program will have the confidence in their abilities to be successful in either industrial, governmental, or academic positions, and will have a positive and inquisitive outlook on life and continuous learning, necessary to promote their professional and personal development throughout their careers.

This educational objective will be demonstrated by the following outcomes:

1. *an understanding of professional and ethical responsibility (abet f)*
2. *a recognition of the need for an ability to engage in lifelong learning (abet i)*
3. *an understanding of responsibility and accountability*
4. *a desire to be a professional that exhibits values, dedication and a need for continual improvement*
5. *a desire to have critical thinking and organizational skills*

Assessment of the Program Objectives

Although these objective statements were created using input from all the constituents during the 2004-2005 assessment period, the department decided to perform a blind assessment of these same objective statements during the 2005-2006 assessment period. Specifically, the faculty, alumni, and industrial representatives were asked to rank the amount of emphasis that each objective statement should receive in our program on a scale of 1 to 5 with 5 being the greatest emphasis.

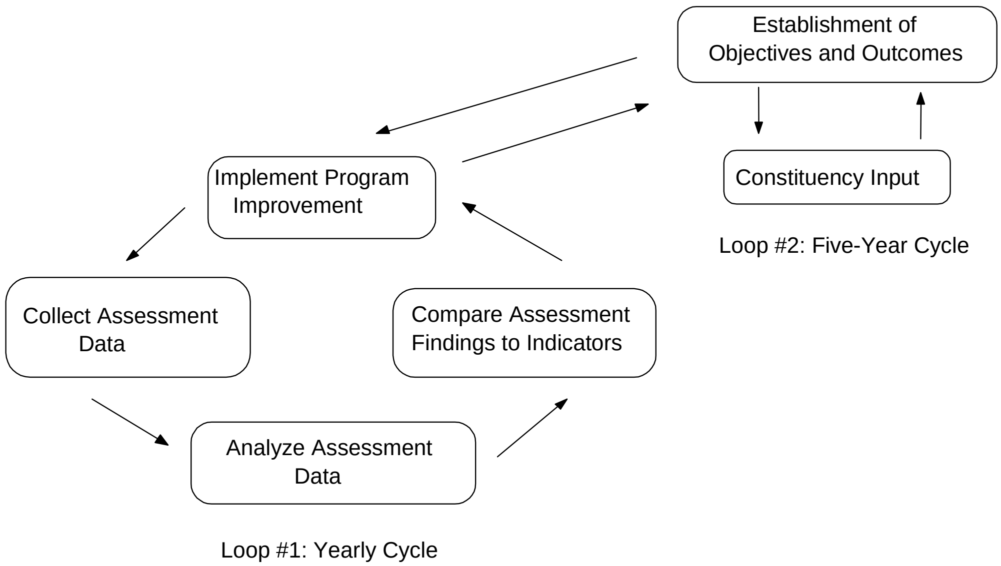


Sample Results Regarding Assessment of New Objective Statements

The results clearly show that all constituents approve of the new objective statements. Each group ranked all statements with nearly a 4 or above.

e. How Program Curriculum and Processes Ensure Achievement of Educational Objectives and Lead to Improvement of Program Effectiveness

As mentioned previously, the processes used to ensure achievement of the educational objectives and outcomes are represented graphically in the two-loop diagram below.



Two-Loop Processes Followed to Ensure Achievement of Educational Objectives and Outcomes

The steps in Loop #1 are implemented on an annual cycle. This will ensure continual development and improvement in the Mechanical Engineering program. The steps in Loop #2 are implemented on a five-year cycle to ensure that the program stays in alignment with the changing needs and expectations of the program constituencies.

Assessing the Strength of the Curriculum in Achieving 1999-2005 Program Outcomes

The process of documenting where in the curriculum and to what extent each program outcome is being achieved was conducted during summer 1999. The curriculum strength for the new outcomes, mentioned previously, is currently being assessed and the results will appear in the 2005-2006 assessment report.

For each required course in the Mechanical Engineering curriculum, the course coordinator was asked to specify the level (high, medium, low, or not at all) each program outcome is being addressed in his/her course. Nine points were awarded where the emphasis on the program outcome was "high", three points where the emphasis was "medium", one point where the emphasis was "low", and no points where there was no emphasis. Based on the data for each course, the total points were computed for the entire curriculum for each program outcome. The results, tabulated below, provide an initial indication of the relative strength of the curriculum in achieving each program outcome.

Strength of Mechanical Engineering Curriculum in Achieving Program Outcomes*

Knowledge	**Total Points**
Educational Objective: Graduates of the Mechanical Engineering program will have the *knowledge* in math, science, and engineering fundamentals, as well as societal issues, that allows them to approach real-world Mechanical Engineering problems with an understanding of their impact on society.	
This educational objective is demonstrated by the following outcomes:	

1. An ability to apply knowledge of mathematics, science, and engineering (abet a) In particular, an ability to apply knowledge of: a) chemistry and calculus-based physics b) advanced mathematics through multivariate calculus and differential equations c) statistics and linear algebra	120
2. An understanding of professional and ethical responsibility (abet f)	94
3. The broad education necessary to understand the impact of engineering solutions in a global/societal context (abet h)	56
4. Knowledge of current events and societal contemporary issues—non-engineering related (abet j)	33
5. A knowledge of computer-aided design and simulation software	115
6. A knowledge of measurement and manufacturing techniques	87
7. A knowledge of how Mechanical Engineering integrates into inter-disciplinary systems	75

Skills	**Total Points**
<u>Educational Objective</u>: Graduates of the Mechanical Engineering program will posses the *skills* to work in group and individual settings, to define and solve problems related to thermal and mechanical systems and manufacturing processes, by applying engineering fundamentals and tools with a logical approach, and be able to clearly communicate their findings.	
This educational objective is demonstrated by the following outcomes:	
1. an ability to design and conduct experiments, as well as to analyze and interpret data (abet b)	74
2. an ability to design a system, component, or process to meet desired needs (abet c)	118
3. An ability to function on multidisciplinary teams (abet e)	62
4. An ability to communicate effectively (abet g)	124
5. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)	133
6. An ability to select materials and manufacturing processes	74
7. An ability to visualize designs from engineering drawings	48
8. An ability to think in a logical, sequential process that lends itself to identifying, formulating, and solving engineering problems (abet e)	159

Attitudes	**Total Points**
<u>Educational Objective</u>: Graduates of the Mechanical Engineering program will hold the *attitudes* of confidence, in their abilities to be successful in industrial, academic, and governmental positions, and a positive and inquisitive outlook on life and learning, necessary to promote their continued professional and personal development throughout their careers.	
This educational objective is demonstrated by the following outcomes:	
1. An understanding of professional and ethical responsibility (abet f)	92

2.	A recognition of the need for, and an ability to engage in lifelong learning (abet I)	93
3.	An understanding of responsibility and accountability	128
4.	A desire to be a professional who exhibits values, dedication, and a need for continual improvement	124
5.	A desire to be a flexible and adaptable team player (collaborative attitude)	124

***Note:** This is not a measure of *absolute* performance. It is merely a measure of the *relative* achievement by the ME curriculum of each outcome.

3. Program Outcomes and Assessment

a. Established Program Outcomes Based on Program Educational Objectives

The Mechanical Engineering program's outcomes, based on its educational objectives and grouped according to ***knowledge***, ***skills***, and ***attitudes***, are delineated above in Sections B.2.b and B.2.e. Please refer to these sections, if needed, for the subsequent discussion.

b. Relation of Program Outcomes to Outcome Requirements of Criterion 3

The relation of the Mechanical Engineering program outcomes to the outcome requirements of Criterion 3—ABET (a) – (k)—is shown on the next page.

Correlation of ABET Criterion 3 with Mechanical Engineering Program Outcomes

Criterion 3	ME Outcome	Description
ABET (a)	Knowledge #1	An ability to apply knowledge of mathematics, science, and engineering
ABET (b)	Skill #1	An ability to design and conduct experiments, as well as to analyze and interpret data
ABET (i)	Skill #2	An ability to design a system, component, or process to meet desired needs
ABET (d)	Skill #3	An ability to function on multidisciplinary teams
ABET (e)	Skill #8	An ability to think in a logical, sequential process that lends itself to identifying, formulating, and solving engineering problems
ABET (f)	Knowledge #2, Attitude #1	An understanding of professional and ethical responsibility
ABET (g)	Skill #4	An ability to communicate effectively
ABET (h)	Knowledge #3	The broad education necessary to understand the impact of engineering solutions in a global/societal context
ABET (i)	Attitude #2	A recognition of the need for, and an ability to engage in lifelong learning
ABET (j)	Knowledge #4	Knowledge of current events and societal contemporary issues–non-engineering related
ABET (k)	Skill #5	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

c. Relation of Program Outcomes to Program Educational Objectives

The ME program educational objectives are defined as broad statements of attributes of the graduates of the program after working as an engineer for three to five years. Three statements have been developed as follows:

1. One statement describing the *knowledge* that graduates will have
2. One statement describing the *skills* that graduates will possess
3. One statement describing the *attitudes* graduates will hold

The process used to develop these statements was iterative. First, the various constituencies were surveyed to determine the desired attributes of CSULA Mechanical Engineering graduates. A set of program outcomes in each of three categories—knowledge, skills, and attitudes— was then developed and sent to the constituencies for feedback. Once the three lists of program outcomes were finalized, a broad, overarching statement (educational objective) was written for each. Therefore, there is a direct relationship between the program outcomes and the program educational objectives.

Processes Assuring Graduates Have Achieved Program Outcomes

Two departmental subcommittees—the Mechanical Engineering Program Assessment Committee and the Mechanical Engineering Program Improvement Task Team—are charged with ensuring that graduates of the Mechanical Engineering program achieve the Program Outcomes. The Program Assessment Committee and the Program Improvement Task Team have a three-year, rotating membership that ensures over time that every department faculty member plays a significant role in the assessment process. The two groups meet on a bi-monthly basis. The role of each is discussed below.

<u>Program Assessment Committee</u>

Members: Maj Mirmirani
Darrell Guillaume (Chair)
Adel Sharif
Samuel Landsberger

The primary functions of this committee are:

1. Identify assessment tools
2. Implement assessment tools and collect data

The assessment tools that have been already implemented by the committee, are:

1. Capstone design course
    a. Oral presentations
    b. Written presentations
2. Webfolios
3. Surveys of ME seniors
4. Surveys of recent ME graduates
5. Fundamentals of Engineering (FE/EIT) Exam

A matrix showing the assessment tools used to assess each program outcome is presented below.

Correlation of Program Outcomes with Primary Assessment Tools

Student Outcome versus Assessment Tool

	Capstone Course	Webfolios	Surveys of Employers	Surveys of Students	Pretests/ FE Exam
Knowledge					
Math/Science/ Engineering	No	No	**Yes**	**Yes**	**Yes**
Contemporary Issues	No	No	**Yes**	**Yes**	No
Broad Education	No	No	**Yes**	**Yes**	No
Ethics	**Yes (Test)**	No	**Yes**	**Yes**	No
Skills					
Experimental Work	Maybe	**Yes**	**Yes**	**Yes**	No
Problem Solving	**Yes**	No	**Yes**	**Yes**	No
Design	**Yes**	**Yes**	**Yes**	**Yes**	No

	Capstone Course	Webfolios	Surveys of Employers	Surveys of Students	Pretests/ FE Exam
Communication skills	**Yes**	**Yes (written)**	**Yes**	**Yes**	**Yes (WPE)**
Work in Teams	**Yes**	No	**Yes**	**Yes**	No
Use Tools	**Yes**	No	**Yes**	**Yes**	No
Information Competency	Maybe	No	**Yes**	**Yes**	No
Attitudes					
Lifelong Learning	No	No	**Yes**	**Yes**	No
Professionalism	**Yes**	**Yes**	**Yes**	**Yes**	No
All Other Attitudes	No	No	**Yes**	**Yes**	No

<u>Program Improvement Task Team</u>

Members: Maj Mirmirani (Chair)
Darrell Guillaume
Lih-Min Hsia
Chivey Wu
Neda Fabris

This task team consists of four or five members: the Department chair, the Department Assessment Coordinator, and two or three elected members of the Department faculty (three-year term). The Department chair serves as chair of the Program Improvement Task Team. The primary functions are:

1. Analyze the data collected by the Program Assessment Committee
2. Draw conclusions from the data
3. Develop program strengths and program areas for improvement
4. Develop action plans designed to bring about improvements in the program

It is the responsibility of the Department chair, working with the Department faculty, to implement the action plans developed by the Program Improvement Task Team.

d. Qualitative and Quantitative Data that Demonstrate Graduates' Satisfaction of Program Outcomes

The assessment tools described previously are used to collect both qualitative and quantitative data related to graduates' achievement of each program outcome. The six primary tools used are described below. These tools are implemented each assessment period to provide data for the Program Assessment Committee. The data is then presented to the Program Improvement Task Team and they recommend changes to the curriculum to address any areas of improvement found. The individual assessment reports complement this self-study by providing the findings and program modifications for each assessment period.

Tool #1: Capstone Design Course

In the capstone design course, the students' final oral presentations and their final written reports were used to measure students' achievement of a number of program outcomes.

Outcomes addressed by Tool #1:

Design a system or component
Clearly defined objective
Devise a plan of action
Produce a sufficient amount of work
Exhibit progress on the project
Organize the flow of communication
Use visual aids
Use presentation time effectively
Answer questions posed
Use modern engineering tools/techniques
Function as a cohesive team
Display professionalism
Knowledge of contemporary issues

Each student team, comprised of three students or fewer, makes a formal 15-minute formal oral presentation that is followed by a five-minute period for questions from the audience. The audience (assessors) consisted of fellow ME students, College faculty members, and industry representatives.

From the data collection and analysis of these findings, several areas of improvement have been identified and addressed. For example, the constituents found that students were having a difficult time addressing questions posed by the audience. To address this, mock presentations were performed and their classmates, developed lists of questions to help them prepare for the final presentation. This addressed this weakness and it no longer appears on the areas for improvement lists.

Tool #2: Written Reports

For the assessment process, the final written reports for the senior design capstone course were used to assess the following outcomes:

Knowledge of mathematics

Knowledge of science
Knowledge of engineering
Ability to design a system or component
Ability to think in a logical, sequential process
Ability to use modern engineering tools/techniques
Ability to communicate
Ability to organize in a logical, sequential process
Use of appropriate diagrams and figures
Use of appropriate references
Knowledge of contemporary issues
Display of professionalism

Each group's final written report is reviewed and evaluated by constituents. Specifically, these reports are evaluated by engineers currently working in the field, faculty that do not teach the course, and by alumni. The findings clearly showed that the students in the program needed improvement in their writing. To address the results of this assessment, the department has developed, and now requires a technical writing course.

Tool #3: Surveys of ME Seniors

The opinions of junior and senior ME students were obtained using a survey instrument that asked students to rate the degree to which each Mechanical Engineering outcome was addressed in the courses they had completed. Example results from this assessment showed that students wanted more practical and focused elective courses. To address this request, the department has been developing more aerospace courses in the curriculum.

Tool #4: Webfolios

Webfolios are web-based portfolios that are used to collect key elements that correspond to the program's student learning outcomes. These elements are collected throughout the students' academic career at Cal. State LA with the final design element collected in the students' senior level capstone course. The complete portfolios are assessed by selected members of the program's constituents with a rubric based on the program's outcomes.
The elements included in the portfolio are:

- A lifelong learning plan
- An essay regarding contemporary issues in society
- A resume'
- A laboratory report
- An executive summary of the student's capstone design project

The Internet location of the webfolio along with an assessment rubric were emailed to Industrial Representatives, Faculty, and Alumni to obtain their assessment of this sample work (password protected). The goal of these webfolios is to evaluate the following outcomes:

- abet (b) An ability to design and conduct experiments as well as to analyze and interpret data
- abet (c) An ability to design a system, component, or process to meet desired needs
- abet (e) An ability to think in a logical sequential process that lends itself to identifying, formulating and solving engineering problems
- abet (f) An understanding of professional and ethical responsibility
- abet (g) An ability to communicate effectively
- abet (i) A recognition of the need for an ability to engage in lifelong learning
- abet (j) Knowledge of current events and societal contemporary issues -- non-engineering related.

An example program improvement that was indirectly identified by this assessment tool was students' lack of knowledge regarding the University resources available to them. Many were having difficulty writing resumes. Once students were notified that the Career Center offered help, the quality of the resumes drastically improved.

Tool #5: Surveys of Recent ME Graduates

Recent graduates of the ME program were assessed using a standardized survey instrument developed by Educational Benchmarking, Inc. (EBI). A majority of the Mechanical Engineering program outcomes are included in the EBI survey questions.

The results from the EBI survey directly address the ABET a-k criteria. In most cases, these findings show that recent graduates are pleased with the amount of focus that the Mechanical Engineering programs places on each of these criteria.

Tool #6 : Surveys of Employers

The Mechanical Engineering program's industrial constituencies were surveyed to determine their opinion of the importance of each of the program's outcomes as well as their opinion of how graduates of the Mechanical Engineering program perform on each of the outcomes. To ensure that those surveyed were familiar with the ME program, surveys were sent to:

- Members of the Department's Industry Advisory Board
- Mechanical Engineering members of the College Industry Advisory Board
- Practicing engineers that teach part-time in the ME program
- Practicing engineers who traditionally employ our ME graduates

Employer input has been valuable in both setting the program objectives and outcomes and in determining areas for improvement within the program.

e. Changes, and Supporting Qualitative and Quantitative Data, to Further Develop and Improve Program

Data Collected and Changes Made from the 1999-2005 Assessment Activities

Based on data collected in the 1999-2005 Mechanical Engineering program assessment, the ME program's strengths and the ME program's areas for improvement were identified. The data used came from three primary sources: (1) industry input, (2) ME student input, and (3) ME alumni input. The data are presented below, along with the corresponding changes that have been identified to improve the ME program from 1999 to 2005. The "outcome" statement numbers that appear below are those used on the survey forms sent to the various program constituencies.

Presentation of detailed data can be found in the reports listed at the end of this section. Presented here are sample graphs and data from a variety of the assessment tools used that show representative participation by faculty, students, alumni, and industrial representatives.

Example #1

This is an example of actual results found with the Capstone Design Course. Specifically, after completing a sequence of three consecutive quarters of Senior Design, the student are expected to make a formal presentation of their findings to an audience consisting of Industrial Representatives, Faculty, Senior Students and Alumni. All audience members are given an assessment rubric and asked to assess the students' performance.

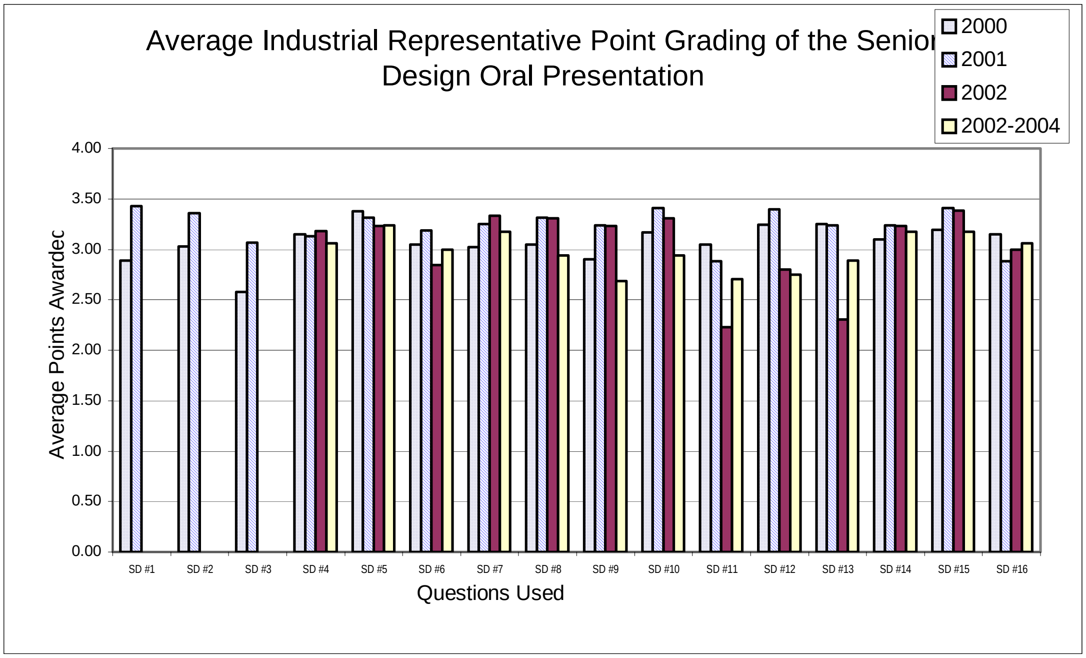
Tool: Capstone Oral Presentation
Constituents: Industrial Representatives, Faculty, Senior Students, Alumni
Outcomes Assessed:

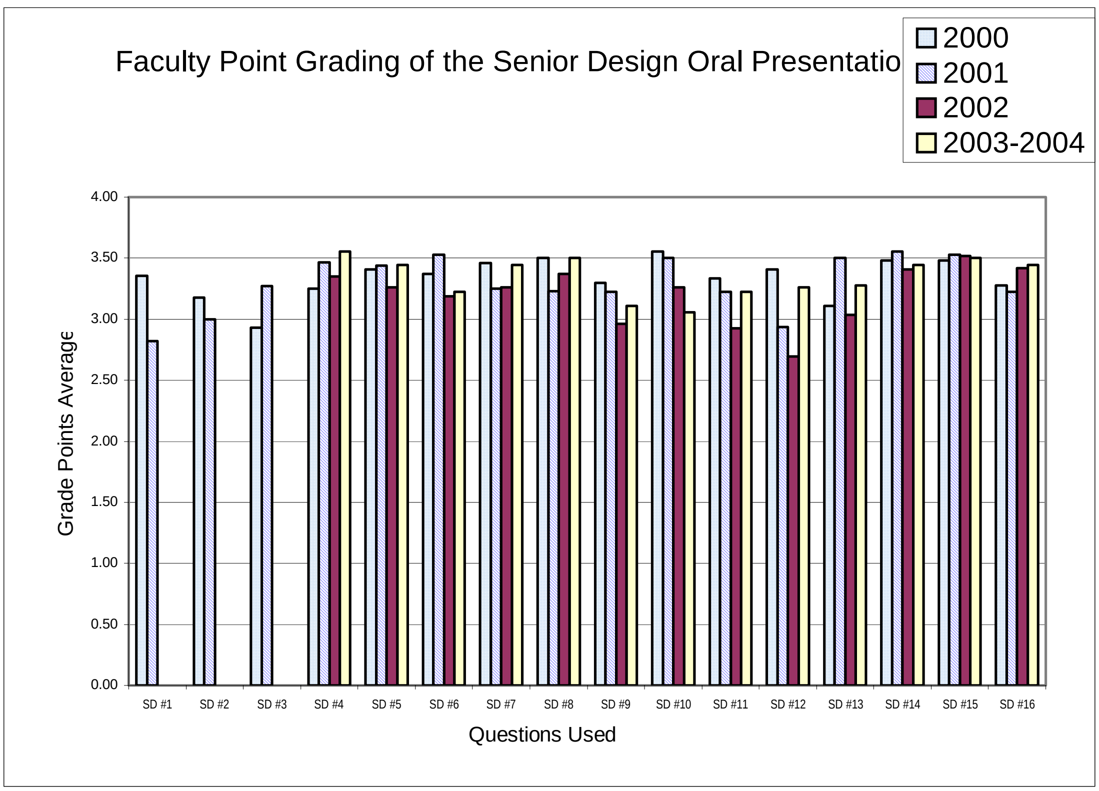
Label	Outcome
S.D. #1	Design an experiment?*
S.D. #2	Conduct an experiment?*
S.D. #3	Analyze data?*
S.D. #4	Design a system or component?
S.D. #5	Clearly defined objective?
S.D. #6	Devise a plan of action?
S.D. #7	Produce a sufficient amount of work?
S.D. #8	Exhibit progress on the project?
S.D. #9	Organize the flow of communication?
S.D. #10	Use visual aids?
S.D. #11	Use presentation time effectively?
S.D. #12	Answer questions posed?
S.D. #13	Use modern engineering tools/techniques?
S.D. #14	Function as a cohesive team?
S.D. #15	Display professionalism?
S.D. #16	Knowledge of contemporary issues?
S.D. #17	Design an experiment?

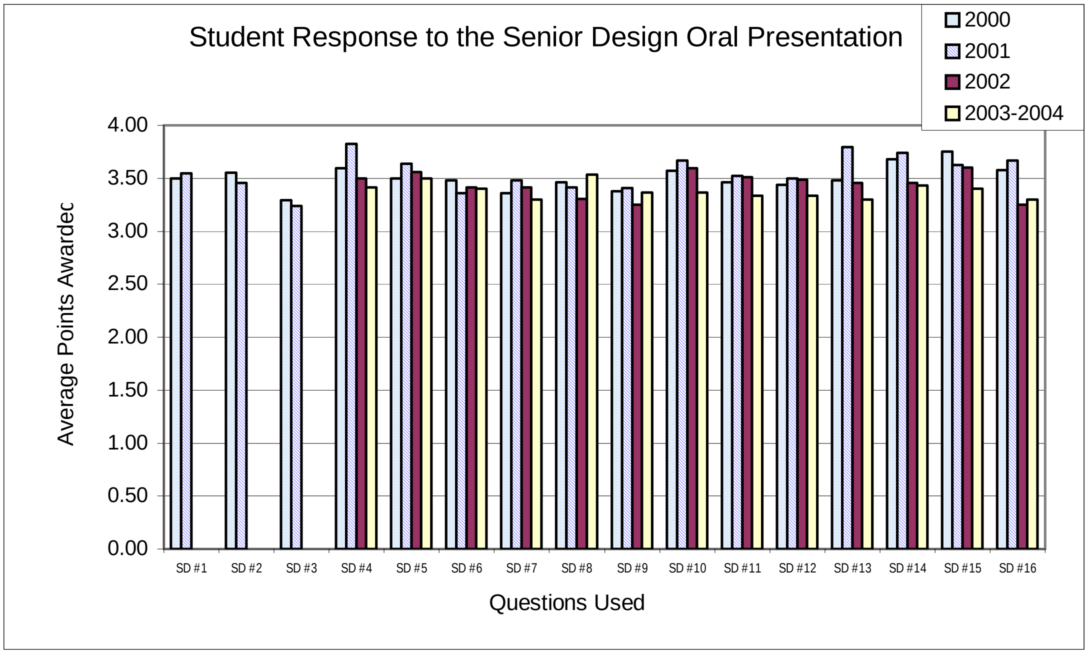
Key to Senior Design Capstone Presentations Graphs

* Note: These three outcomes were removed from this tool after the 2001 assessment period when the majority of the constituents responded to these outcomes as "not applicable" on the presentation survey.

The following graphs show sample findings from this assessment tool for assessment periods of 2000, 2001, 2002, 2002-2004. Notice that the first three outcomes were discontinued from assessment with this tool after the 2001 assessment period. This is because the majority of the constituents responded to these outcomes as "not applicable" on the presentation survey.


Average Industrial Representative Point Grading of the Senior Design Oral Presentation
2000
2001
2002
2002-2004
Average Points Awarded
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
SD #1
SD #2
SD #3
SD #4
SD #5
SD #6
SD #7
SD #8
SD #9
SD #10
SD #11
SD #12
SD #13
SD #14
SD #15
SD #16
Questions Used


Faculty Point Grading of the Senior Design Oral Presentation
2000
2001
2002
2003-2004
Grade Points Average
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
SD #1
SD #2
SD #3
SD #4
SD #5
SD #6
SD #7
SD #8
SD #9
SD #10
SD #11
SD #12
SD #13
SD #14
SD #15
SD #16
Questions Used



Graphical Results from Capstone Oral Presentations

For this data, the scale on the rubric was from 0 to 4 with 4 being the best possible performance. Comparison of the assessment graphs generated from Students, Faculty, and Industrial Representatives show that opinions differ on which outcome is a strength and which is an area of improvement. However, trends can be seen as more years of data are collected.

In the supplemental yearly assessment reports, this data are analyzed for trends and both strengths and areas for improvement are identified. For example:

Assessment Period	**Constituent**	**Strengths**	**Area for Improvement**
2003-2004	Indust. Rep	Define Objective	Flow of Communication
2003-2004	Indust. Rep	Cohesive Team	Presentation Time
2003-2004	Indust. Rep	Professionalism	Answer Questions
2002	Faculty	Design Component	Devise a Plan of Action
2002	Faculty	Exhibit Progress	Flow of Communication
2002	Faculty	Professionalism	Use of Visual Aids
2000	Student	Design Component	Devise a Plan of Action
2000	Student	Cohesive Team	Sufficient Work
2000	Student	Professionalism	Flow of Communication

Sample Observations from the Assessment of the Capstone Oral Presentation

Once these trends are analyzed, the Program Improvement Task Team suggests curriculum changes to the department to address the areas for improvement.

<u>Example #2</u>

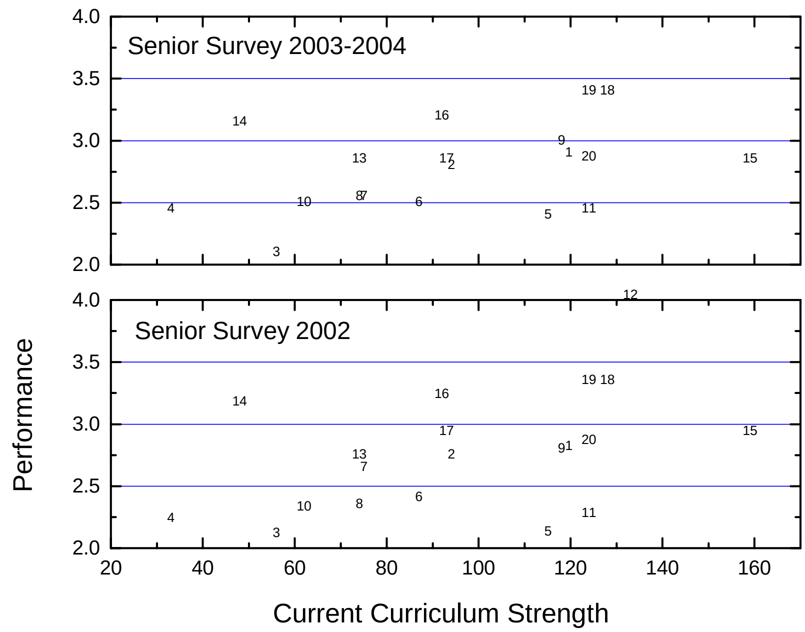
This is an example of actual results found with the Senior Survey. Specifically, seniors about to graduate are surveyed regarding the Mechanical Engineering Outcomes to determine how well, in their opinion, they are being addressed.

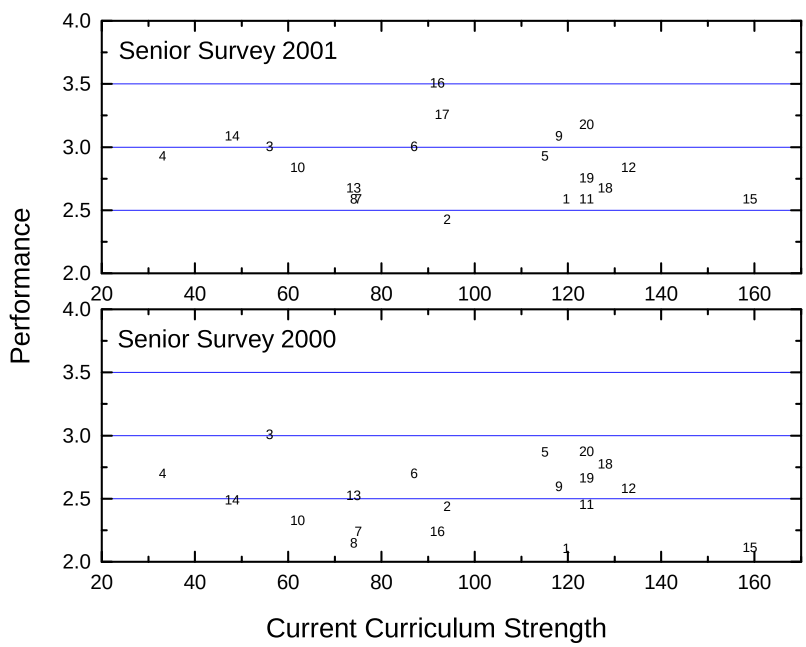
Tool: Senior Survey
Constituents: Senior Students
Outcomes Addesssed (Key for Curriculum Assessment):

1 An ability to apply knowledge of math, science, and engineering (abet a)
In particular, an ability to apply knowledge to:
   a chemistry and calculus-based physics
   b advanced math through multivariate calculus and differential equations
   c statistics and linear algebra
2 An understanding of professional and ethical responsibility (abet f)
3 A broad education necessary to understand the impact of engineering solutions in a global/societal context (abet h)
4 A knowledge of current events and societal contemporary issues – non-engineering related (abet j)
5 A knowledge of computer aided design and simulation software
6 A knowledge of measurement and manufacturing techniques
7 A knowledge of how mechanical engineering integrates into inter-disciplinary systems
8 An ability to design and conduct experiments as well as to analyze and interpret data (abet b)
9 An ability to design a system, component, or process to meet desired needs (abet c)
10 An ability to function on multidisciplinary teams (abet e)
11 An ability to communicate effectively (abet g)
12 An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
13 An ability to select materials and manufacturing processes
14 An ability to visualize design from engineering drawings
15 An ability to think in a logical sequential process
16 An understanding of professional and ethical responsibility (abet f)
17 An recognition of the need for an ability to engage in lifelong learning (abet i)
18 An understanding of responsibility and accountability
19 A desire to be a professional that exhibits values, dedication and a need for continual improvement
20 A desire to be a flexible and adaptable team player (collaborative attitude)

The following graphs plot performance (i.e., how well the ME outcomes are being addressed in the program) versus curriculum strength (i.e., how much emphasis is placed on each outcome in the program). These graphs are useful in determining if more curriculum focus is needed or if too much is being allotted for the amount of benefit provided. For example, an outcome that shows:

- a high strength and high performance makes sense. More effort should equal more results. For example, see year 2002-2004: outcome number 19
- a low strength and a low performance also make sense. Low effort should yield low results. For example, see year 2002: outcome number 4
- a high strength and low performance shows that there is waste occurring. Not enough benefit for the effort. For example, see year 2000: outcome number 15
- a low strength and high performance just means that we are lucky. For example, see year 2001: outcome number 44





Graphs Showing Student Opinion of Outcome Performance
Versus the Current Curriculum Strength

The following table shows the strengths and areas for improvement identified by the Senior Survey. Once these trends are analyzed, the Program Improvement Task Team suggests curriculum changes to the department to address the areas for improvement.

Assessment Period	**Strengths**	**Area for Improvement**
2003-2004	Professional/Ethical Responsibility	Global Societal Context
2003-2004	Accountability	Knowledge Contemp Issues
2003-2004	Continuous Improvement	Knowledge of CAD
2002	Professional/Ethical Responsibility	Global Societal Context
2002	Accountability	Knowledge Contemp Issues
2002	Continuous Improvement	Knowledge of CAD
2001	Professional Ethical Responsibility	Professional Ethic Responsibility
2001	Engage Life Long Learning	Conduct Design Experiments
2001	Flexible Team Player	Think Sequential Process
2000	Global Societal Context	Knowledge of Math/Science
2000	Knowledge of CAD	Conduct Design Experiments
2000	Flexible Team Player	Think Sequential Process

Sample Observations from the Assessment of the Capstone Oral Presentation

Example #3

This is an example of actual results found with the Webfolio Assessment. Specifically, students throughout their program are expected to add items to this web-based portfolio as they progress through the program. The completed Webfolios are sent to constituents (via password protected website) with a rubric for assessing the performance on specific outcomes.

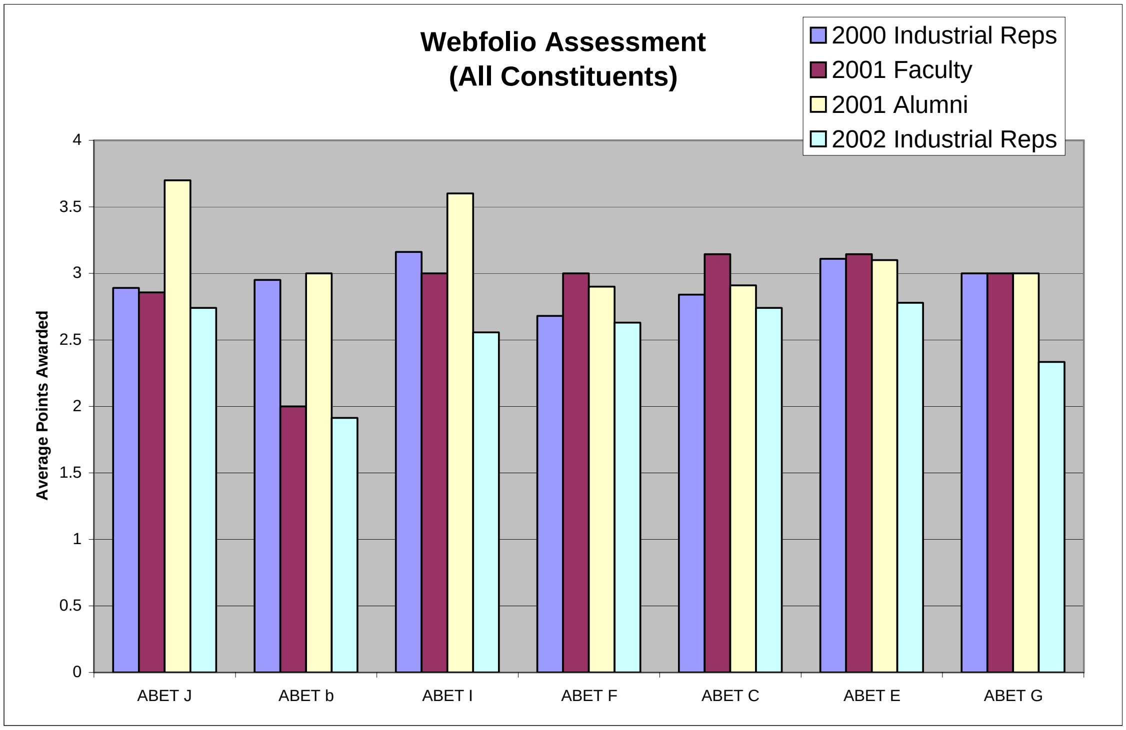
Tool: Webfolio Assessment

Constituents: Industrial Representative, Faculty, Alumni

Outcomes Addressed:

- abet (b) An ability to design and conduct experiments as well as to analyze and interpret data
- abet (c) An ability to design a system, component, or process to meet desired needs
- abet (e) An ability to think in a logical sequential process that lends itself to identifying, formulating and solving engineering problems
- abet (f) An understanding of professional and ethical responsibility
- abet (g) An ability to communicate effectively
- abet (i) A recognition of the need for an ability to engage in lifelong learning
- abet (j) Knowledge of current events and societal contemporary issues -- non-engineering related.

The following graph shows the results of the Webfolio assessment from 2000 to 2002. As can be seen, opinions vary but general trends can be observed. Specifically, industrial representatives seem to be the toughest assessors while the alumni seem to be the most forgiving. The area of improvement that is most obvious is “b” which states that students should have “an ability to design and conduct experiments as well as to analyze and interpret data." We have recently addressed this concern by making the final experiment in several of our lab "open-ended." Students are given phenomena to be studied and they are expected to design the experiment and select the equipment.



Graphs Comparing Webfolio Results Obtained from Industrial Representatives in 2000 with Faculty and Alumni Results

Assessment Period	Constituent	Strengths	Area for Improvement
2002	Indust. Reps	Solve Eng Problems	Professional
2001	Faculty	Design	Experiment
2001	Alumni	Current Events	Professional
2000	Indust. Reps	Life Long Learning	Professional

Sample Observations from the Assessment of the Webfolios

Once these trends are analyzed, the Program Improvement Task Team suggests curriculum changes to the department to address the areas for improvement.

Summary of Strengths/Areas for Improvement Determined for the 2000-2004 Assessment Period

Strengths:

The following section summarizes the strengths determined over the past five-year assessment period. The table summarizes these findings based on:

- The assessment period that the strength was identified
- Description of the program's strength

Period	Strength
2000	Ability to apply knowledge of engineering for solving problems Ability to conduct an experiment Ability to analyze and interpret data obtained from an experiment A knowledge of current events and societal contemporary issues – non engineering related An ability to design and conduct experiments as well as to analyze and interpret data A desire to be a professional that exhibits values, dedication and a need for continual improvement An ability to design a system, component, or process to meet desired needs A recognition of the need for an ability to engage in lifelong learning
2001	Ability to apply knowledge of engineering for solving problems Ability to conduct an experiment Ability to analyze and interpret data obtained from an experiment A knowledge of current events and societal contemporary issues – non engineering related An ability to design and conduct experiments as well as to analyze and interpret data A desire to be a professional that exhibits values, dedication and a need for continual improvement An ability to design a system, component, or process to meet desired needs An recognition of the need for an ability to engage in lifelong learning
2002	Knowledge of contemporary Issues An understanding of responsibility and accountability A desire to be a professional that exhibits values, dedication and a need for continual improvement An recognition of the need for an ability to engage in lifelong learning An ability to think in a logical sequential process A desire to be a flexible and adaptable team player (collaborative attitude) An understanding of professional and ethical responsibility
2002-2004	Ability to analyze and interpret data obtained from an experiment A recognition of the need for an ability to engage in lifelong learning. A desire to be a professional that exhibits values, dedication and a need for continual improvement An ability to design a system, component, or process to meet desired needs

	An ability to think in a logical sequential process A recognition of the need for an ability to engage in lifelong learning An understanding of professional and ethical responsibility

The following section summarizes the areas for improvement determined over the past five-year assessment period. The tables summarizes these findings based on:

- The assessment year that area for improvement was identified
- Description of the area for improvement

Period	Area for Improvement
2000	Ability to select material and manufacturing processes A broad education necessary to understand the impact of engineering solutions in a global/societal context Ability to write technical documents Ability to apply knowledge of math, science and engineering An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
2001	An understanding of professional and ethical responsibility Ability to write technical documents An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice An ability to design and conduct experiments as well as to analyze and interpret data
2002	Knowledge of contemporary issues Ability to answer questions posed during an oral presentation Too many courses are cancelled during each quarter Several courses seem to cover redundant material Many of the prerequisites for courses are not necessary and prevent student from making timely progress on the degree
2002-2004	Ability to apply knowledge of math, science and engineering (Specifically Dynamics) An ability to design and conduct experiments as well as to analyze and interpret data Ability to answer questions posed during an oral presentation An ability to visualize design from engineering drawings An ability to function on multidisciplinary teams Ability to formulate and solve engineering problems (specifically, problem similar to those found on the EIT

Curriculum Changes

- The following section summarizes the curriculum change made to the Mechanical Engineering program in order to address the areas for improvement identified by the assessment tools. These areas for improvement are sub classified as 1) Specific Curriculum Content Changes (changes to existing courses), and 2) General Curriculum Changes (adding/deleting courses and changing required/elective courses.

Specific Curriculum Content Changes

Curriculum Change
The design projects in the upper division elective courses (400 level courses) have been improved so that more specific detail is required of the student. The projects now require: • Group participation (attitude outcome #3) • Material selection (skills outcome #6) • Multi-disciplinary approach (business, economics, design) (Skills outcome #3) • Relevance to contemporary issues. (Knowledge outcome #4) • Utilization of modern engineering tools is required of most design projects (FEM, CAD/CAM, MathCAD, MATLAB, MasterCAD, etc.) (skills outcome #5) • Formal written reports that are critiqued and returned (skill outcome #4)
Courses across the curriculum now required current-event write-ups turned in with the homework (for example: 407). This addresses: • Contemporary issues. (knowledge outcome #4) • And provide the broad education necessary to understand the impact of engineering solutions in a global/societal context. (knowledge outcome #3)
The senior design course now requires student to explain the ethical relevance, from a professional standpoint, of their capstone project. This addresses: • Ethics (knowledge outcome #2) • Professionalism (attitude outcome #1)
The prerequisite and co-requisite course requirements to the courses under the jurisdiction of the ME department have been reviewed. Some adjustments to these requirements have been made to simplify them, wherever possible, and to ensure that the students have the needed preparation for the connecting courses.
All required laboratory courses now require a final experiment in which the students must design their own procedure to investigate a give phenomena. This addresses: • Design of experiment (skills outcome #1) • Analysis of data (skills outcome #1)
To further assess writing, all student enrolled in the first course of the capstone program must

complete an individual report. This report is then assessment by all major constituents. (skills outcome #4)
Mathematics/Science workshops are being offered by graduate students on Fridays to assist undergraduates struggling with basic concepts. (knowledge outcome #1)
The gatekeeper prerequisite to the capstone course, machine design, now includes an emphasis on material selection. (skills outcome #6)
To address contemporary and global / societal issues, guest speakers are being invited to Engr 100, 300, and ME 327, 416, 420, 497a, and the National Engineers week – an event held on campus (knowledge outcome #3)

General Curriculum Changes

Curriculum Change
A required technical writing course has now been added to the curriculum. This complements the English department in that it continues the students' education from basic writing to technical writing. (skills outcome 4)
A second mechanics course is now required of all students. This address the weakness found in our students' knowledge in mathematics and science. (knowledge outcome #1)
A thermo-systems lab is now required. It focuses more on fundamentals science concepts and strengthens the students' background. (knowledge outcome #1)

f. Materials Available for Review to Verify Achievement of Program Outcomes and Assessment

A comprehensive display of materials related to the Mechanical Engineering program outcomes and assessment effort will be set up in the ABET Resource Room. The following will be included:

- Final Report on Mechanical Engineering Program Assessment
  - 1999 - 2000 Assessment Report
  - 2000 - 2001 Assessment Report
  - 2001 - 2002 Assessment Report
  - 2002 - 2004 Assessment Report
  - 2004 - 2005 Assessment Report (New Objectives and Outcomes)
  - 2004 - 2006 Assessment Report
  - 2006 Assessment Report
- Results of Educational Benchmarking Inc (EBI) survey of recent Mechanical Engineering graduates
  - 2000 Survey
  - 2001 Survey
  - 2002 Survey

- ➢ 2003 Survey
- ➢ 2004 Survey
- ➢ 2005 Survey

❖ Computer access to Mechanical Engineering student Webfolios

4. Professional Component

The following discussion addresses ABET's Self-Study Guidelines regarding Criterion 4 - Professional Component, *and* the curricular requirements of Criterion 8 - Program Criteria. By integrating our responses to these two criteria, we hope to condense and simplify this Self-Study, while covering all of the mandates specified in each criterion.

a. Curriculum Content

The basic-level curriculum requires the completion of 194 units spread over four categories: 53 units in Math and Basic Sciences (including a Biology course as part of the General Education upper division theme), 85 units in Engineering Topics, 44 units in General Education and 12 units in Other Topics. The courses comprising the curriculum are listed and are distributed under the previous four categories in Table 1 - *Basic-Level Curriculum* in Appendix IA. Note that the elective courses are not identified by any specific course title or number; only the general subject of an elective course is shown. The course syllabi for all the courses used to satisfy the Math and Basic Sciences, and Engineering Topics, required by Criterion 4, and for some required courses belonging to Other Topics, can all be found in Appendix IB.

It can be verified from Table 1, in conjunction with the course syllabi in Appendix IB, that the curriculum meets requirements (a) and (b) of Criterion 4. It can also be verified from Table 1, in conjunction with the course syllabi in Appendix IB, that, as required by Criterion 8, the curriculum meets the “Curriculum” provisions of the Program Criteria because the curriculum includes five units of Chemistry, 16 units of Calculus-based Physics, four units of Multivariate Calculus, four units of Differential Equations, four units of Statistics and Matrix Algebra, 8 units of other basic sciences.

The curriculum incorporates a coherent set of required and technical elective courses which, upon completion, allows our graduates to work professionally in both the thermal and mechanical systems areas including the design and realization of such systems. Under the guidance of a faculty advisor, each student is allowed to choose 25 units of upper-division technical elective courses consisting of six four-unit lecture courses and a single one-unit laboratory course. Added to this, each student is required to complete a one-year sequence of three, four-unit, Mechanical Engineering Senior Project courses, namely ME 497 A,B,C.

The technical elective lecture courses in the thermal systems area that are available to our students are the following: ME 403, Aerodynamics; ME 406, Heat Transfer II; ME 407, Design of Thermal Systems; ME 408, Fluid Mechanics II; ME 415, Air Conditioning; ME 416, Energy Systems. The technical elective lecture courses in the mechanical systems area that are available to our students are the following: ME 321, Kinematics of Mechanisms; ME 402, Advanced Mechanics of Materials; ME 411, Vibrational Analysis I; ME 414, Machine Design II; ME 421, Dynamics of Mechanisms; ME 428, Automation and Computer-Aided Manufacturing; ME 430, Properties Selection of Engineering Materials; and EE/ME 481, Introduction to Robotics. Five elective courses available to our students, which are more interdisciplinary in nature or have variable content, are: ME 409, Mechanical Engineering Analysis; ME 410, Control of Mechanical Systems; ME 422, Optimization of Mechanical

Engineering Systems; ME 423, Introduction to Finite Element Method; and ME 454, Special Topics in Mechanical Engineering. In addition, two aerospace related courses, ME 404, Aircraft Design, and ME 418,Flight Mechanics I, are being developed and will soon be available to our students.

Curricular Changes since Last ABET Visit

In this section we present curricular changes which were made in the Mechanical Engineering undergraduate degree program since the last ABET visit. All the faculty members are involved in the evaluation and development of the ME curriculum. Curricular matters are discussed regularly at the weekly Department meetings. New course proposals and program change proposals are regularly forwarded from the Department to the next level of approval in the College, once these proposals have been reviewed and voted on in the Department. The ME faculty's involvement in curricular issues has been heightened even further since the Department undertook the implementation of an assessment process to achieve stated outcomes through continuous improvement. The Department has implemented some curricular changes since the last ABET visit. These changes were brought about by the department assessment processes as well as other considerations.

With all changes described below, the total number of units to complete the program, 194, has remained the same. There are no changes in the Lower Division Major Requirements. The Physics and Mathematics departments have proposed changes which are not yet implemented, so they are not included in this document. The Upper Division requirements have changed. First, as mentioned above, ME310, formerly a measurements lab has been converted to Mechanical Engineering Writing Lab. This change, as described above, has been made in response to the recommendation of the last ABET review which is consistent with the findings of the assessment process. Experiments and topics related to measurements have been integrated in other required labs. As such, two formerly elective labs, ME313, Fluid Mechanics Lab and ME315, Thermal Systems Lab, are now required. As a result, the program contains only one upper division lab. This change has brought more consistent pedagogy, and has enabled the department to focus its resources to enhance these laboratories and to offer them more frequently than before. With ME312, Strength of Materials Lab, the department ensures that each student is exposed to lab experiments in all major stems of Mechanical Engineering: Mechanics, Fluids, and Thermal.

In addition, we have added 4 units to the Upper Division Major Requirements; the requirement is now 53 units. Students have a choice to select ME321, Kinematics, or ME421, Dynamics of Machinery as the added course. Both of these courses were formerly listed under the Upper Division Technical Electives. If a student chooses to take both ME321 and ME421, one will automatically be counted as an elective. This change was made as a direct result of analysis of FE exam data and observation by the faculty. Both strongly suggested that having only one required course, ME320, Dynamics I, is inadequate. The contents of ME321 and ME421 have been modified and tailored to fill the gap of knowledge in dynamics. During advising, students who show special interest in Machine Design/Applied Mechanics area are advised to take both courses.

ME319, Computer-Aided Problem Solving in Mechanical Engineering, which was a required course, has been enhance, re-designated as ME419, Computer-Aided Mechanical Engineering, and is now an elective. The rational for this change is that students at the junior level already possess a good degree of computer skills, through ME 103, Introduction to Mechanical Design, self learning, and through other courses which increasingly require the use of various engineering software packages. The four units saved with removing ME319, was used to add a second course in dynamics, ME321 or ME421 as described above. More advanced computer skills which require rigorous learning are offered in ME419.

Upper division technical electives now include six lectures and one laboratory as described above. Two new courses have been developed with two others under development, which provide a broad choice and access by students to traditional as well as emerging topics in Mechanical Engineering. The new courses include: ME423, Introduction to Finite Element Method, ME430, Properties and Selection of Materials. In addition, two new courses are under development. These are ME424, Mechanics of Flight, and ME 427, Flight Dynamics and Control.

Finally, ME 454, Special Topics in Mechanical Engineering, is added to the list of upper-division technical electives as a way to bring timely and new subjects to our students. Some of the topics that have been covered in recent offerings of ME 454 are: Engineering for Manufacturing, Rapid Prototyping, Advanced CAD and Solid Modeling, Engineering Materials and Material Selection, Multidisciplinary Finite Element Analysis, and Advanced Solid Modeling.

b. Course and Section Size Summary

The course and section size summary for the Summer 2004 through Spring 2005 quarters can be found in Table 2, entitled *Course and Section Size Summary*, in Appendix IA.

c. Major Design Experience

The curriculum provides for an integrated major design experience at the senior level through a required three-quarter-long capstone course, ME 497A,B,C. How the curriculum prepares the students for this experience is described below.

The Mechanical Engineering program is based on an integration of engineering design throughout the curriculum, beginning at the elementary level and culminating in a major capstone design experience in the senior year. The design experience is assimilated by repetition and reinforcement in a progressive manner.

The curriculum introduces the students to engineering design in two elementary-level courses. These are ENGR 100, Introduction to Engineering, where ethics, professionalism, safety and environmental concerns are introduced, and ME 103, Introduction to Mechanical Design, where design tools such as three-dimensional geometric modeling, elementary computer-aided design techniques, and graphical presentation of data are presented.

In addition, many elements and concepts relating to engineering design are introduced in 100- and 200-level courses through lectures and homework problems.

In the junior 300-level lecture courses, elements and processes of engineering design are introduced in problems that have a scope beyond fundamental concepts. At this point in the curriculum, most students have taken ENGR 300, Engineering Economics, and ENGR 301, Ethics and Professionalism. This allows economic factors, safety and reliability issues, and social impact issues to be reinforced. Analytical tools, with limited application and appropriate to specific areas, are covered in courses categorized as engineering science. Safety, teamwork, and technical report writing are emphasized in laboratory courses offered at the 300-level. Some of the required courses at this level with heavy emphasis on the elements of design include: ENGR 301, Ethics and Professionalism; ME 306, Heat Transfer I; ME 321, Kinematics of Mechanism; ME 323, Machine Design I; ME 326B, Thermodynamics II; and ME 327, Manufacturing Processes.

In the senior 400-level required and elective lecture courses, advanced cross-disciplinary and application-oriented analytical tools for engineering design are introduced. Most of the courses at this level have a split content between engineering design and engineering science. In most courses, where appropriate, subject-centered projects involving most elements of engineering design are assigned. These assignments embody many aspects of the design process, from the conceptual and preliminary design, to detailed description of the design and report writing. They often require the development of specifications, alternative solutions, feasibility considerations, analysis, synthesis, and use of computer-aided design and analysis software. With the exception of ME 409, Mechanical Engineering Analysis, all Mechanical Engineering courses at this level have a content which includes most elements of engineering design. Elective courses, such as: ME 414, Machine Design II; ME 421, Dynamics of Machines; and ME 407, Design of Thermal Systems, have a significant design focus and prepare students for ME 497 A,B,C, Mechanical Engineering Senior Project.

A major design experience is offered during the senior year through a required three-quarter-long sequence, ME 497A,B,C, Mechanical Engineering Senior Project, in which the focus is entirely on design, and one or more significant program-centered projects must be undertaken.

The first quarter in the sequence is an instructor-guided design experience. The primary objective is to teach students how to conduct a design project of significant scope and complexity from its inception to its final completion. Each student is required to complete an assigned project, interdisciplinary in nature, so that all steps in the design process are covered. In addition, guest lecturers are invited from industry to provide the class with case studies selected specifically to emphasize ethical, societal, environmental, and political aspects encountered in engineering practice.

Prior to completion of the first quarter, students are required to select a project for the next two quarters, and prepare a proposal in consultation with a faculty advisor, or an industrial sponsor, who will supervise the student's progress and provide technical assistance. Students form teams to work on their projects. Although regular class meetings are required in ME 497B and C, independent work is strongly fostered in these phases of the senior design course sequence.

The design projects, which come mostly from industry, address "real-world" engineering problems. They are representative of what a Mechanical Engineer will encounter in the practice of his/her professional career. Students not only need to apply what they have learned from their coursework, but they must also be creative in problem solving.

The past examples of the industry-sponsored projects range from the design of a delicate surgical tool for hip replacement to a gigantic two-and a half ton handling fixture for a satellite covering a wide range of applications. For these projects, students are required to develop design specifications, generate workable concepts, perform analysis, finish detail design, prepare engineering drawings, and often build a working prototype. In addition to attending to the technical details, students must also consider other factors affecting design decisions including safety, reliability, economics, aesthetics, ethical and social impacts. At the end of each quarter senior design students must make a formal presentation. In ME 497A each student presents his/her individual design for the same project. Since 2005-2006 AY, every fall the department invites a member of the Industry Advisory Board to present a case study in ME 497A. The case study is carefully selected to incorporate and highlight the realistic constraints identified in ABET Criterion 4 and the presentation is in an interactive format to inspire discussion with audiance participation. The synopsis of these case studies explicitly outlines under separate headings requirements, technical, cost scheduling, environmental, safety, regulatory, and ethical issues of the case. In addition, to ensure that the students have methodically considered realistic constraints with a heightened awareness, it is required that the senior design project final report submitted by each student team include a checklist that indicates how design constraints are addressed in the project .

In ME 497 B in addition to an interim report, each team makes a presentation to an audience of faculty, industry sponsors, and their peers. Finally in ME 497 C each team submits a complete report, and makes a comprehensive oral presentation in a formal setting before an audience of faculty, members of the department Industry Advisory Board, the Industry sponsors (the customer) their peers and the college administrators. This year-long major design experience prepares students for entering the profession and to be successful.

d. General Education

The California State University System (CSU) requires that each baccalaureate graduate complete a program of General Education requirements in addition to a major program of study. The General Education program is designed to ensure that graduates "have made noteworthy progress toward becoming truly educated persons." Although the general areas of study and minimum unit requirements within them are prescribed by the CSU Board of Trustees, the individual campuses are given the discretion to set course requirements within those areas, to add other requirements, and to enact other regulations. California State University, Los Angeles has designed its general education program within these guidelines.

The General Education (GE) program for ME students consists of 12 four-unit courses, for a total of 48 units. These courses are spread over the following categories:

Basic Subjects: ENGL 101, Composition I; COMM 150, Oral Communication.

University Requirement: ENGL 102, Composition II.

American Institutions: HIST 202A or B, United States Civilization; POLS 150, Government and American Society.

Natural Sciences: One upper-division biology course taken as part of an Upper-Division Theme.

Humanities: Three lower-division courses selected from three different areas out of five areas: (1) Literature and Drama; (2) Arts; (3) Philosophy and Religious Studies; (4) Languages other than English; (5) Integrated Humanities. One upper-division course taken as part of an Upper-Division Theme.

Social Sciences: One upper-division course taken as part of an Upper-Division Theme.

Lifelong Understanding and Self-Development: One lower-division course.

When the required courses shown under the category of American Institutions are added to the Social Sciences category, then the students complete, in total, 12 units in the Social Sciences area, and 16 units in the Humanities area. These courses are designed to integrate a broad general education experience in the social sciences and humanities. They are intended to make graduates fully aware of their social responsibilities and to enable them to consider these and other factors in decision-making processes. To ensure that students acquire both depth and breadth in the Humanities and Social Sciences. Studentsare required to complete a 12-unit Upper-Division Theme after they have achieved upper-division standing (i.e., after they have completed 90 units). The theme consists of integrated courses designed to educate students about an achievement or concern of enduring significance in the human experience.

Certain General Education courses are identified as being "diversity" courses. All CSULA students are required to select and complete at least two of these courses at either the lower- or upper-division level of their General Education programs.

e. Written and Oral Communication Skills

Discussed below is how the University in general, and the Mechanical Engineering program in particular, address students' written and oral communication skills—important parts of an engineering student's education and ABET's Professional Component.

Written Communications

In recognition of the diverse writing strengths and weaknesses that new students bring with them to CSULA, the University has adopted a "Writing across the Curriculum" policy (WAC), which involves *every* department in developing students' English writing skills. The English department continues to retain primary responsibility for developing, evaluating, and monitoring students' writing skills, but, under WAC, all departments offering General Education courses are required to include some writing instruction and practice in those courses. At the upper-division level, the oversight of the students' English skills is passed to the students' major departments, and Mechanical Engineering is no different. The ME program includes a required upper-division course, ME 310, Mechanical Engineering Writing Laboratory, that focuses on technical and laboratory report writing. In addition, the ME program offers many "writing-intensive" courses that give students guided practice in the kinds of writing tasks they will encounter in the "real world" of engineering. The most noteworthy among them are ME497 A,B,C, the capstone design course where students are required to prepare a professional level written report and make a final formal oral presentation before their piers, faculty, members of Industry Advisory Board, and industry representative sponsoring the projects.

As noted above, because new students enter the University with diverse competencies in writing, they must take an English Placement Test (EPT). Based on their performance on the EPT, they are then placed in either ENGL 095, 096, or 101. ENGL 095 and 096 are remedial courses designed to bring students' writing skills up to the university level. ENGL 101 is the first of two required courses that prepare students for the advanced writing demands that their General Education and major courses will require. ENGL 101, Composition I, teaches descriptive and expository writing; shows students how writing is a logical, recursive process of drafting, writing, and revising; and has students write essays in which the writing *process* is stressed. Once students pass ENGL 101, they enroll in ENGL 102, Composition II, which expands on the strategies and concepts presented in ENGL 101; introduces the importance that *audience* plays in all forms of writing; and requires more demanding assignments entailing analytical, persuasive, and argumentative strategies—as well as library, Internet, and field research.

Students who are placed in ENGL 095 and/or 096 are graded on a "pass/no pass" basis. Students who take ENGL 101 and 102 must earn a grade of C or better to satisfy the University's Lower-Division Writing Requirement.

For students who transfer to CSULA, the Admissions Office determines whether a student has met the Lower-Division Writing Requirement. If not, the Office administers diagnostic tests and places students in appropriate writing courses.

To assure that students, regardless of major, have attained the required writing competency for graduation, all must pass a Writing Proficiency Examination (WPE) prior to completing 135 units. Transfer students who have completed 135 units upon entering the University must pass the WPE during their first quarter of attendance at CSULA. Students who do not pass the WPE in a timely fashion are subject to academic probation or disqualification. The WPE is a prerequisite to ME 310, Mechanical Engineering Writing Laboratory.

Oral Communications

Every student must take COMM 150, Oral Communication. This course introduces the student to the methods for effective oral communication through study and experience in the analysis, synthesis, and presentation of subject matter in oral discourse. At the upper-division level, all ME students take ME 310, Mechanical Engineering Writing Laboratory, which also includes oral communication, and information technology as well.

As was discussed above, the importance of written and oral communication skills is stressed throughout the curriculum. The Department of Mechanical Engineering seeks to develop the communications skills of its students in a variety of ways. The importance of communication skills is stressed early to freshmen students in ENGR 100, Introduction to Engineering, and reinforced throughout the curriculum through oral and written reports required in laboratories, the senior project sequence, and technical elective courses which have design projects associated with them.

The particular oral communication skills important to the Mechanical Engineering profession are presented in ME 310, Mechanical Engineering Writing Laboratory, and are put into practice when the students make oral presentations of their progress reports and final results in the required senior project sequence of courses. Many technical elective courses with design projects, as well as many laboratory courses, also require oral presentations. In the case of the senior project sequence, oral and written communication skills are significant factors in the grading of the students' work.

Faculty who identify students with deficient communications skills can refer such students to the University Writing Center for individual tutoring and assistance.

f. Computer Experience

Discussed below is how the curriculum develops the students' competence in the engineering application of computers. Described are the required and optional introductory courses, with the level of competence in computer programming attained. Also described is the extent to which computer applications and problem solutions are required in the lower-division and upper-division courses, including software usage in engineering courses.

All students are required to take the following courses that contain significant computer applications:

ENGR 100, Introduction to Engineering: Microcomputer-based word processors and spreadsheets are taught, and computer-aided design and drafting software are introduced in this course. Class assignments often require searching for information on the Internet and using E-mail as a communication tool.

ME 103, Introduction to Mechanical Design: Learning to use the SolidWorks software as a Computer-aided design (CAD) tool is one of the major objectives of this course. Students are trained to become proficient in using the software, and are required to create 3-D CAD models and production drawings of design projects. The class is conducted in well-equipped computer classrooms in the College. The course also serves as a prerequisite for more advanced CAD/CAM/CAE-related courses in the curriculum.

CS 290, Introduction to FORTRAN Programming: Computer programming using the FORTRAN language is taught in this class. Computer programming classes using other languages, such as C++, are permitted as substitutes.

ME 327, Manufacturing Processes: Students are introduced to numerically controlled manufacturing using computer-aided manufacturing (CAM) software, such as MasterCAM.

Two elective courses at the 400-level have been developed to specifically enhance the computational skills of our students:

ME 423, Finite-Element Method: This course introduces the finite-element method for solving problems in statics, dynamics and heat transfer. While students are required to write computer programs to solve basic problems, commercial software packages, such as MSC/NASTRAN and I-DEAS, are also introduced to model more complex problems.

ME 419, Computer-Aided Mechanical Engineering: This course is focused on the applications of engineering software packages in modeling statics, dynamics, control, heat transfer, fluid dynamics and multidisciplinary problems. Currently, MATLAB/Simulink and SolidWorks/COSMOS are the software packages being utilized.

In addition to the above courses, many other required ME courses and virtually all ME technical elective courses require some programming and/or use of computers. For example, in the following mechanical systems related courses, MathCAD, MATLAB/Simulink, COSMOS, NASTRAN are used to perform analysis and calculations: ME 321, 323, 402, 410, 411, 414, and 421.

Specialized applications software packages that are included with the text book, available on-line, or developed by the faculty, are used in the following courses: ME 303, 306, 326A, 326B, 402, 403, 404, 406, 410, 411, 420 and 426.

Some laboratory classes, such as ME412, ME413, ME417 and ME427 include experiments with data-acquisition systems, which consist of both computer hardware and software. These lab classes also require the students to use word-processors, spreadsheets and CAD software to generate lab reports.

The capstone Senior Design course sequence (ME497A/B/C) requires the use of computers and appropriate software as indispensable tools for design, analysis, documentation and presentation. The class is conducted in a computer lab. The students' designs and technical drawings must be CAD-generated, the reports must be computer-generated and the presentations are all computer-based.

The Computer Productivity Center in the College has well-equipped computer classrooms. The latest versions of a host of professional-grade math and engineering software are always made available to support our computer-related courses. These include MathCAD, MATLAB, SolidWorks, COSMOS, MasterCAM, Pro/E, MSC/NASTRAN, I-DEAS and Fluent.

g. Laboratory Experience

Described below is the laboratory experience that is part of the curriculum. Discussed are how laboratory safety procedures are taught, implemented, monitored, and evaluated.

The Chemistry and Physics course sequences include a total of five laboratories that emphasize the scientific experimental methods. Additionally, every student must take six engineering laboratory courses. Five of these laboratory courses are specified:

EE 210, Electrical Measurements Laboratory
ME 310, Technical Writing Laboratory
CE/ME 312, Strength of Materials Laboratory I
CE/ME 313, Fluid Mechanics Laboratory I
ME 315, Thermal Systems Laboratory I

The Fluid Mechanics and Thermal System Labs were added to the required list more recently to ensure balanced lab experience in all major area of specialization in mechanical engineering, i.e., solid mechanics, fluid mechanics and thermal science.

In addition to these required laboratory courses, students must complete one of the following elective laboratory courses:

ME 412, Strength of Materials Laboratory II
ME 413, Fluid Mechanics Laboratory II
ME 417, Machine Analysis Laboratory
ME 427, Thermal Systems Laboratory II
ME 431, Materials Laboratory
EE 438, Control Systems Laboratory
ME 499, Undergraduate Directed Study

The laboratory courses are designed to demonstrate and to integrate the material learned in the lecture courses on the subjects. Students are required not only to perform experiments in small groups, but to reconcile their findings with the theories presented in the lecture courses.

All the engineering laboratory courses contain both demonstration of principles and hands-on experiments. Some of the elective laboratory courses require experimental projects as a part of the course. Modern data acquisition equipment is available and is used in some of the required laboratory courses and all of the elective courses.

Awareness and exercise of safety is an integral part of the Mechanical Engineering program, and safety is emphasized in all the laboratory courses. In addition to verbal instructions during the first meeting of a laboratory course, students are given a handout on laboratory safety procedures. The instructions are aimed at developing an attitude for safety and a knowledgeable awareness of potential hazards in a laboratory and include general safety practices and emergency procedures. Strict observance of safe laboratory procedures constitutes a significant part of a student's performance evaluation and of his/her final grade in the course. College regulations require that the instructor, or a technician, be present at all times to monitor the students' work in the laboratories and to ensure safety.

The laboratory courses are conducted with a class limit of between 12 and 16 students, depending upon the available equipment. These limits are strictly adhered to with rare exceptions. Students normally work in small groups of less than four in order to assure that they receive a meaningful “hands-on" laboratory experience. Every laboratory course includes assignments that exercise the students' communications skills, including writing lab reports and taking turns to serve as group leader. Some labs also conduct final exams in the form of oral presentation.

h. Student Development in Engineering Professional Practice

The Department of Mechanical Engineering develops students' understanding of ethical, social, safety, and economic issues in engineering practice by classroom instruction, discussion, and their application in appropriate design projects.

ENGR 100, Introduction to Engineering, is a required one-unit course for all students. It is designed to make students aware of the importance of ethical, social, safety, and economic considerations in the profession of engineering from the very outset of their engineering education.

ENGR 300, Engineering Economics, is a required four-unit course for all students. This course teaches the fundamental relationship between economics and engineering problems and solutions. The course deals with the role of interest and capital in cost minimization, analysis of financial statements, original and alternative investments, and capital depreciation and replacement.

ENGR 301, Ethics and Professionalism, is a required one-unit course for all students at the junior level. This course seeks to develop in students a concern for the ethical, social and safety considerations involved in engineering as well as the role that professionalism plays in assuring that these concerns are properly taken into account.

In addition, many technical elective courses with design content use one or more of the above considerations as a constraint on the design. Health and safety considerations are integral parts of the Mechanical Engineering program. These concerns are stressed in all laboratories through specific instructions and strict observance of safety rules and procedures. A handout, which includes an introduction to safety rules and procedures, emergency procedures and general laboratory safety practices, is given to students in each laboratory course. Each year the Department invites experts from industry to ME497A as guest speakers to discuss issues related to the practice of the engineering profession in the context of case studies. These are selected to highlight the societal impact of the engineering decision making process and heighten students' understanding and awareness of the economic, ethical, aesthetic, social, safety, and political impact of their work.

As part of the General Education program, students are required to select an Upper-Division Theme consisting of three integrated four-unit courses. Each theme has a Natural Science, Social Science and Humanities course as one of its components. All of these themes seek to explore, in one way or another, the aesthetic, ethical, social, and safety considerations of scientific developments and their technological use by engineers. The themes serve to increase the students' understanding of these considerations in the practice of engineering.

Described next are the opportunities on campus that are available to students for participation and membership in those technical, professional, and/or honorary societies that are most closely associated with this program. Discussed are the support for these activities supplied by the College, Department and the faculty.

The College has active student chapters of the ASME, SAE, SAMPE, SME, the Society of Hispanic Engineering and Science Students (SHESS), the National Society of Black Engineers (NSBE), the Society of Women Engineers (SWE), Tau Beta Pi, and Pi Tau Sigma honorary societies. The Engineering, Computer Science, and Technology Student Council serves as an active coordinating body for all of the societies.

Department faculty are active members of national engineering societies and local chapters, including ASME, ASEE, SME, SAMPE, and AIAA, and are fully committed to their organizations and take part in many activities. ME faculty encourage student participation in organization activities through classroom discussions and occasionally schedule class meetings in conjunction with professional society meetings so that the entire class can benefit.

Service as an officer in a national engineering society, or as a faculty advisor to a student chapter, is recognized by the retention, tenure, and promotion (RTP) committees, and the

College and Department administration as an important criterion to evaluate faculty performance. Such activities may be recognized either as professional achievements, or as service to the University, depending on the nature of the activities.

Listed below are the student organizations, open to all Mechanical Engineering students, and their faculty advisors and officers:

ORGANIZATION	**PRESIDENT**	**FACULTY ADVISOR**
ASME	Robert Schissler	Adel Sharif
SAMPE	Diran Arshak Yanikian	Narendra Taly
SAE	Sam Szeto	Adel Sharif
SME	Vacant	N. S. Fabris
Pi Tau Sigma	Alberto Luna	M. Mirmirani
Tau Beta Pi	Selene Sanchez	D. W. Guillaume
SWE	Patty Ortiz	N. S. Fabris

Described below is the way in which interaction is enhanced between the students and practitioners in industry, government, and private practice.

Our ASME student chapter meets regularly during the academic year and one or two times during the summer. Most of the meetings consist of presentations by engineers from industry, government and private practice on subjects and issues involved in engineering practice. In addition, each quarter selected members of the Department Industry Advisory Board and other industry professionals are invited to attend student presentations of the senior design projects. Since most senior design projects have an industry sponsor, students involved in these projects are routinely in contact with industry monitors.

The Society of Manufacturing Engineers Student Unit (U113) was promoted to the level of Student Chapter S318 in Fall 1999. The Student Chapter has very active officers who have attended both meetings and training organized by professional SME chapters as well as development activities organized by the CSULA Associated Students, Inc. The number of students in S318 has doubled in six months. The SME student unit (and later chapter) has organized several technical presentations, tours of companies, and trips to manufacturing conferences and exhibits

Students also have opportunities to interact with practitioners from industry during programs sponsored by the University Career Center.

Each year, during the National Engineers' Week, the College sponsors a major industry career day. During this event, representatives from industry, government and private practice are invited to set up information tables, and to meet with students throughout the day. Typically representatives from 20 - 30 companies are present at these events.

The Department is keenly aware of the importance of professional registration. The importance of professional registration is discussed in two required courses: ENGR 100, Introduction to Engineering; and ENGR 301, Ethics and Professionalism in Engineering. In addition, each graduating ME senior is counseled by the Department Chair on the importance of professional registration.

The Engineering-In-Training (EIT) Review course is offered annually by College faculty through the Office of Continuing Education. This course is open to the professional community and our engineering students and alumni.

Although passing the Fundamentals of Engineering (FE/EIT) Examination is not a requirement for graduation, the ME students are required to take this exam before they graduate. As an incentive, students who pass the exam are reimbursed for the cost. The required courses in the Mechanical Engineering program contain all the essential topics covered in this examination. The FE/EIT Examination application forms and a schedule of examination dates are available to the students in the Department Office.

5. Faculty

a. Qualifications and Broadness of Specialization

There are nine faculty members in the Department, as can be seen from the table below. Seven of these faculty members are full professors, one is an associate professor and one is an assistant professor. Two of the full professors, identified as FERPs, are in the Faculty Early Retirement Program, and they teach half or less of a full load. All of the faculty members hold Ph.D. degrees, all from recognized institutions in the U.S. Many of the faculty have taken additional professional courses or workshops beyond their terminal degrees. Three of the faculty are Registered Professional Engineers in the State of California. All the faculty in the Department are competent in the English language and communicate well. From Table 4 - *Faculty Analysis* in Appendix IA, it can be seen that all senior faculty have many years of teaching experience, and most have significant industrial experience as well.

ME Faculty - Degrees and Areas of Specialization

Name	Rank	Degree/Professional Registration	Areas of Specialization
Neda S. Fabris	Professor	Ph.D., Illinois Institute of Technology.	Manufacturing; material science; mechanics; design.
Stephen F. Felszeghy (FERP)	Professor	Ph.D., University of California, Berkeley.	Solid mechanics; finite-element methods; mechanical vibrations; dynamics.
Darrell W. Guillaume	Associate Professor	Ph.D., University of California, Irvine. *Registered Professional Mechanical Engineer.*	Fluid mechanics; turbulence; thermodynamics; heat transfer.
Lih-Min Hsia	Professor	Ph.D., University of California, Davis. *Registered Professional Mechanical Engineer*.	Kinematics of mechanisms; computer-aided design; robotics.
Samuel Landsberger	Professor	Ph.D., Massachusetts Institute of Technology	Design, kinematics, rehabilitation Engineering
Adel Sharif	Assistant Professor	Ph.D., University of California, Irvine	Machine design, Structural Materials
Ram Manvi (FERP)	Professor	Ph.D., Washington State University. *Registered Professional Mechanical Engineer*.	Energy conversion; thermal and environmental engineering.
Maj Dean	Professor	Ph.D., University of	Dynamic systems and control; applied

Mirmirani		California, Berkeley	mechanics
Chivey C. Wu	Professor	Ph.D., University of Illinois	Computer-aided design; computational fluid dynamics; multidisciplinary analysis

The area of interest and expertise of Professors Guillaume, Manvi, and Wu is thermal systems. The area of interest and expertise of Professors Fabris, Felszeghy, Landsberger, Hsia, and Mirmirani, is mechanical systems and materials. As a group, these nine faculty members have the competencies to cover all of the curricular areas of the program.

b. Student-Faculty Interactions

The undergraduate student/faculty ratio in the Department is about 12 and the graduate student-faculty ratio is about six. With such low student/faculty ratios existing in the Department, the ME faculty maintain high levels of student/faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners and employers of ME graduates. This is borne out by the range of activities in these areas that are listed by the faculty in their curricula vitae in Appendix IC, and by the faculty activity data listed in Table 3 - *Faculty Workload Summary* in Appendix IA. All of the faculty are members of one or more professional societies, such as, ASME, ASEE, SAE, SME, AIAA, and SAMPE. Many have presented technical papers at conferences or published technical papers in refereed journals.

Our students have ample opportunities to interact with the full-time ME faculty in the classroom or laboratory because very few classes are taught by part-time instructors and most classes are small. ME students also have ample opportunities to interact with the ME faculty outside the classroom. For example, Professors Hsia, Guillaume, Mirmirani, and Wu have sizeable grants, and they employ both undergraduate and graduate students in their research projects. Other faculty with smaller grants also employ students. Specifically these research projects include:

NASA University Research Center

In 2003, NASA awarded the university a five-year $6M University Research Center (URC) grant. Cal State LA was one of the three Minority Institutions (MI) nationwide to receive this award. Cal State LA is the only CSU campus with a NASA URC. The URC award, $1.2 M per year is equally divided between the departments of Mechanical and Electrical Engineering. It comprises two major laboratories, the Multidisciplinary Flight Dynamics and Control Laboratory (MFDCLab), directed by ME Professor and department chair Maj Mirmirani, and Structures, Pointing, and Control Engineering, directed by EE Professor Helen Boussalis. The PI of the URC is the Dean of Engineering, Computer Science and Technology, Dr. Kuei-Wu Tsai, who provides overall oversight of the project. In addition to Professor Mirmirani, Professors Chivey Wu and Darrell Guillaume are among MFDCLab investigators. The URC is monitored through NASA Dryden Flight Research Center. The URC has university and industry partners including the University of Southern California (USC), Cal State Long Beach, University of Kansas, Oklahoma State University, Boeing, and Northrop Grumman.

MFDCLab was established in 2001 on an Air Force Office of Scientific Research (AFOSR) a three-year $800,000 grant, and four other NASA Dryden Flight Research Center grants awarded to Professors Mirmirani and Wu. MFDCLab is focused on developing:

- State-of-the-art computing tools and techniques and networking technologies to enable “virtual aircraft design,” the ability to simulate an entire aircraft via computational capabilities,
- Crucial technology bases for modeling, control and simulation of high-performance and unusual aircraft of the future such as the airbreathing hypersonic flight vehicle, morphing and variable geometry aircraft, reusable launch vehicles, and unmanned aerial vehicles,
- Intelligent autonomous, self-commanding, self-diagnosing and self-repairing flight control systems,
- High-efficiency, low-environmental-impact propulsion systems

Over 15 Mechanical Engineering students currently work on various research projects at MFDCLab. Of the 15 seven are undergraduates. Over 30 have received a unique learning experience through participation in this multidisciplinary lab since its inception. Another 40 students are expected to participate, and likewise benefit, during the next three years of NASA and AFOSR funding.

In addition to being an undergraduate rigorous research opportunity for ME students, the URC has generated interest in and has provided impetus for curriculum in aerospace engineering. Several aerospace related courses are currently under development. The graduate program in Mechanical Engineering has thrived as the result of the URC. Undergraduate ME students who are hired at MFDCLab give make a pledge to continue for their Masters degree. An overwhelming majority have fulfilled their commitment, some have continued to a Ph.D. program at one of the collaborating universities. A chapter of AIAA is being established on campus, students participate in writing and presentation of technical papers in professional forums. MFDCLab graduates upon graduation have multiple offers, some have ended up working NASA and major aerospace firms.

Thanks to the URC grant, the aerodynamics lab has been renovated. Last year the College invested $50,000 to refurbish the supersonic wind tunnel. This year, there is another $50, 000 in Year 3 budget for design and fabrication of a fully automated model support with state-of-the-art Lab View data acquisition system for the subsonic wind tunnel. These instruments will be used for instruction as well as research.

Air Force Office of Scientific Research Awards

Mechanical Engineering Professors Maj Mirmirani and Chivey Wu, have been the PI and the Co-PI, respectively of a three-year $800,000 project funded by the Air Force Office of Scientific Research, titled “ Multidisciplinary Control of High-Performance Air Vehicles.” Using this grant, Professors Mirmirani and Wu established the MFDCLab, which now is one of URC’s two major laboratories. Professors Mirmirani and Wu have been awarded a new three –year $350K AFOSR grant, starting on August 1, 2005 titled “ Modeling, Control, and Simulation of Airbreathing Hypersonic Vehicles.”

Inflatable Structures Research Awards

Mechanical Engineering Professor Lih-Min Hsia has been working, in collaboration with engineers at the Jet Propulsion Laboratory, on the development of inflatable structures technology since 1999. Since June 2000 he has received several grants from JPL totaling

$360,000. The main thrust of this work is to develop light weight inflatable/self-rigidizable aluminum laminate booms as the main load-carrying members of large space structures. In the last five years, he and a group of CSULA students have used this technology to design and build several square membrane-type antennas ranging in size from one and half meters to seven meters. These projects entitled“ The 3 Meter Ka-band Inflatable Microstrip Reflectarray Engineering Model Development,” “Development of a Membrane Based Reflector for a Dual Frequency, Ka/Ku Band Radar,” “The Development of Seven-Meter Reflectarray Antenna,” “NEXRAD in Space,” have employed a large number of Mechanical Engineering Students working with Professor Hsia and his co-investigators at JPL, mainly on site at JPL. In addition, Professor Hsia was awarded a $6,000 NSF grant for “Planning for International Education Exchange Program: In Collaboration with Tongji University, China.”

Environmental Electron Microscopy, NSF Instrumentation Award

Mechanical Engineering Professor Adel Sharif (PI) and Civil Engineering professor Christ Khachikian (Co-PI) were awarded a $247,000 NSF RUI grant in 2002 to purchase an Environmental Scanning Electron Microscope (ESEM). The instrument is used for a multitude of research and training activities with applications to fields ranging from the environmental sciences to materials science and machine design to forensics science. The ESEM will help the College and the Department maintaining state-of-the-art research in engineering and the sciences. In addition, Dr. Sharif has received a CSULA $4200 Mini Grant entitled “Design of Structural Materials for the Next Generation of Gas Engines.” The aim of this research proposal is to investigate the source of anomalous solid solution hardening/softening and yield stress anomalies observed in $MoSi_2$.

Other NSF Awards

Mechanical Engineering Professor Neda Fabris (PI), and College of Education professor Fawn Upkolo received a $94,000 NSF grant in 2002. The grant entitled “Engineering for Teachers Program” was dedicated to Partnership Program (MSP) between the CSULA College of Engineering, Computer Science and Technology, College of Education and local k-12 schools. The project was completed in August 2004. Professor Fabris was subsequently awarded a $20,000 National Science Foundation Summer Research for Teachers Supplementary grant. Two teachers participated in the summer research: one middle and one high school teacher. Although awarded before the period of interest of this report it is notable that Professor Fabris is the receipiant of one of the most unique NSF grants, $97,988, 1999-2000, entitled “Mother – Daughter Academy.” The award was one of the 11% granted proposals in Human Resource Division.

Mechanical Engineering Professor Maj Mirmirani is the Co-PI on a 4-year $600,000 NSF grant. This grant is focused on development of multimedia and animation software in three areas: Space telescopes, semiconductor processing, and flight dynamics.

Student-Faculty Interactions on Student Competitions

Students also interact extensively with faculty when they work on extracurricular projects such as the Mini Baja and Super Mileage Cars, and the Aero Design project. The department continues to play a leadership role in the Mini Baja tradition at Cal State LA. The Cal State LA Mini Baja team has consistently won top places in the past twenty years. Every year a large percentage of the College Instructionally Related Activity Award (IRA) is allocated to this activity. In the past three years project teams, composed almost entirely of ME students, under the guidance of Professor Sharif have had notable success in the Mini Baja West competition, sponsored by the Society of Automotive Engineers.

6. Facilities

a. Engineering and Technology Building Facilities

Having undergone a recent major building remodel and laboratory upgrade ($36M, including $5M for equipment) which was completed in 2001, the College of Engineering, Computer Science, and Technology facilities and laboratories are modern and up-to-date. In addition, every year the College receives a varying amount of equipment budget which is allocated among the departments according to the priorities set by the dean and the associate dean, in consultation with the departments. Due to a precipitous budget crisis at the State level in the past five years, the annual College equipment budget has been low or non-existent. However, since approximately $5 M was used to purchase laboratory equipment during the building remodel in 2001, the recent budget shortfall has had no significant impact on the quality of our laboratories. All Mechanical Engineering laboratories have been upgraded and, in most cases, still represent state-of-the-art.

b. Computer Support Services

University Centralized Computer Support

The university centralized computer support is provided by The Division of Information Technology Services (ITS). It provides administrative direction for information technology to fully support the University's strategic plan and technology needs. Vital support services are provided through the following four units within the division:

Collaborative Management Systems (CMS) and Enterprise Systems: CMS and Enterprise Systems continue to support the migration to the California State University's CMS, and is an active partner in developing and implementing the web-based Golden Eagle Territory (GET) Student Administration system. The initial rollout is in four phases, with subsequent upgrades and functionality being rolled out in increments of six months or less. This ITS unit contributes to the installation, upgrades, application development, and technical support for Financials Systems (general ledger, asset management, grants, etc.), HR Systems (employee records), Contributor Relations, Student Financials, Financial Aid, and Student Administration (including Admissions, Student Records, Campus Community, and Academic Advisement).

IT Infrastructure - provides services ranging from technical architecture and design, to configuration and support in the areas of network (LAN/WAN), servers, computer operations, database administration, telecommunications, and desktop services. These services are delivered to a diverse constituency of students, faculty and staff. This ITS unit is heavily involved in the architecture, configuration, and deployment of the technical infrastructure components to support the web-based GET Student Administration system and the campus-wide Technology Infrastructure Initiative (TII) Terminal Resources Project.

IT Security Management and Compliance - ensures that the use of information technology at Cal State L.A. adheres to Federal and State statutory regulations and requirements, as well as University policies and procedures. This unit is responsible for writing ITS guidelines and policies, auditing ITS procedures for security compliance, managing the ITS document control process, and maintaining the campus directory. In addition, this unit sponsors campus security awareness events and the RUSecure? website, where users get the latest security best practices and related links.

Support Services - provides support designed to increase the personal productivity of both the campus users and the ITS division. It is responsible for maintaining the ITS software archive; distributing site license software; distributing access accounts for e-mail, OASIS, and GET. This unit offers a variety of staff and student workshops, as well as documentation for basic applications and Internet navigation. Support Services also installs and maintains the equipment available in the dozens of Electronic Classrooms, Technologically Enhanced Classrooms (TEC), and Media Enhanced Classrooms (MEC) located throughout the university; and provides the ITS Help Desk, a one-stop source for information on computing resources. The Support Services unit works closely with Educational Support Services delivering the technology used in instruction and research, and ensuring that the appropriate computing and information services are available for the academic community. A wide variety of services designed to increase the personal productivity of our users are offered, such as: Administrative Support Services; Baseline Project Management; Digital Documentation Services; ITS Help Desk & Services Accounts; Media Technical Support Services; Multimedia Services; Training Services; and Web Services.

Educational Support Services (ESS) provides leadership and support for promoting and maintaining CSULA's academic goals, instructional computing services (technology-mediated classroom instruction and distance learning), and commitment to effective teaching and learning. In collaboration with other units and constituencies within the University, this includes planning for academic technology, coordinating the relationship between instructional and administrative technology plans, and managing CSU academic technology projects.

To accomplish this mission, ESS offers the following specific services:

The Center for Innovation and Excellence in Teaching and Learning (CIETL) helps fulfill CSULA's commitment to assist and promote teaching excellence, which leads to successful and meaningful learning.

The Faculty Instructional Technology Support Center (FITSC) trains and supports faculty in the application of appropriate pedagogy and computer-based technology as tools of instruction both in the classroom and at a distance.

Information Technology Consultants (ITCs) are professionals playing critical roles in the use of information technology to support teaching and learning. ITCs are resources and liaisons between ESS, the six CSULA colleges and the Library and Extended Education, and Information Technology Services (ITS).

Open Access Labs (OALs) provide CSULA students with the computing tools and staff support to accomplish their academic goals.

ESS coordinates the installation of Instructional Software on workstations in Open Access Labs, Computer Classrooms, and Technology-Enhanced Classrooms, providing faculty and students the software tools necessary to enhance learning outcomes.

Faculty and students can access computing facilities both on- and off-campus. Off-campus access is provided through the campus modem pool or an Internet service provider. To further support the computer needs of faculty, staff, and students, ITS assigns Instructional Technology Consultants (ITCs) to each academic unit. Telephone and e-mail help desks are also available to the campus community. The College of Engineering, Computer Science, and Technology currently has three ITCs assigned to us: Yin Tam, Fernando Loza and Jeffrey Cheam (who also supervises all of the ITCs on campus).

The College Computer Facilities and Support

The Engineering, Computer Science and Technology Computer Productivity Center (CPC) supports the computing needs of engineering, computer science and technology students, faculty, and staff in the College. It provides facilities, hardware, software, and training to encourage the many uses and applications of computers as part of the educational experience (e.g., engineering computation, modeling and simulation, computer-assisted design, computer programming, graphics and laboratory applications).

The CPC is housed in a multi-room suite located in the Engineering and Technology Building (C-wing, second floor) that includes six primary-use rooms and three support rooms. In the center of the suite is a support area that consists of a student "help desk," file server room, plotter room, and director's office. The help desk is surrounded by five computer classrooms: three for general college computer-related instruction and two for specialized use. The sixth primary use room is an open access facility.

The CPC's flexible, functional design allows for support staff to monitor and assist in all areas of the CPC, while allowing for classroom privacy, as needed. Scheduling is done so that classrooms can provide additional open access stations during high demand time. When the entire facility is operating in "open access" mode, students have access to more than 150 workstations.

The CPC provides users an array of hardware, software, documentation, handouts, file servers, and output devices. A number of Dell PowerEdge servers are used as file servers and license servers. A Sun Fire 880 server w/ 900 MHz CPU, referred to as "Mars," supports software applications under the UNIX environment. All of the College users' physical home drives reside on this server. Output devices available in the CPC include HP laser printers, Epson printers, and high-end HP Designjet color plotter. All workstations in the CPC are connected to the campus-wide network. In addition to access to local applications (Windows, Mac and UNIX), students and faculty have access to other academic time-share computing systems both on- and off-campus, such as library resources, electronic bulletin boards, electronic mail, and the Internet.

The open access facility, known as the "ECST Computer Link," is open six days and 68 hours per week during the quarter. The computer facility provides individual access to 42 workstations including PC, Sun, and Macintosh platforms. Among the 42 workstations, are 32 Dell Pentium 4 340 workstations. Twenty seven of the Dell workstations are configured with 512MB SDRAM, 40 Gig hard drive, 32MB nVidia graphic card, CD-ROM, 250 MB Zip drives, and 19" Ultrascan monitors The remaining five are equipped with 1 Gig SDRAM, 20" flat panel monitors and 64MB nVidia graphics card. All of these workstations operate under Windows XP OS. General and college specific applications available to users include Microsoft Office Suite, Microsoft Visual Studio, Microsoft Visual Studio .NET, Visio, Microsoft Project, Adobe Photoshop, Macromedia Flash, Macromedia Dreamweaver, Borland JBuilder, SICStus Prolog, Allegro CL, Oracle, Pro/ENGINEER Wildfire, Pro/MECHANICA Wildfire, Ideas, SolidWorks, Cosmos, CATIA V5, Delmia, Autodesk Suite, MicroStation, SolidEdge, MasterCAM, MathCAD, SAP 2000, ETAB, MSC Nastran, and Matlab.

Users also have access to eight Sun Ultra 10 workstations to run UNIX applications. The Sun Ultra 10 model is configured with 360MHz UltraSPARC-Iii, 512MB RAM, CD-ROM drive, floppy drive, Elite3D graphics accelerator card, and a 21" monitor. Available UNIX applications include FORTRAN and C++ compilers, VI and EMACS editorsPro/ENGINEER Wildfire, Pro/MECHANICA Wildfire, IDEAS, CATIA V5, Mathematica, MATLAB, MSC NASTRAN, PATRAN, Cadence software suite, TeX and Star Office.

Two high-end Apple Power Macintosh G4 with 17" flat panel monitors are also available to support needs of specific graphics users.

In addition to the E&T Computer Link, the CPC has three PC-based general application computer classrooms (C255D, C255E, and C255G) each equipped with 25 Pentium-based workstations. One of the classrooms is equipped with Dell GX270, each having a Pentium 4, 2.60GHz, 512 MB DDR, 80GB EIDE hard drive, 250 MB ZIP drive, CD-ROM drive, and a 19" multiscan monitor. The other two classrooms are equipped with Pentium III workstations with 21" monitors. All three classrooms are multimedia-ready with state-of-the-art instructional aids such as an XGA resolution projection system, a retractable projection screen, and the LINK Video Networking System.

The two other computer classrooms are designed to meet specialized curricular needs. One classroom (C254) is a computer aided design laboratory equipped with twenty workstations. Each workstation is a Dell Precision Workstation 370, Pentium 4 2.80GHz, 1GB RAM, 160 GB SATA hard drive, 128MB nVidia Quadro FX 1300 video card, CD-RW/DVD combo drive and a 21" multiscan monitor. The fifth classroom (C256) is group work laboratory. There are 19 Hewlett Packard Kayak Pentium III 600MHz, 512MB RAM, 40 GB hard drive, CD-ROM drive, and a 21" monitor.

There are four other computer classrooms outside the CPC area that are used for specialized curricular needs. The Mac lab in B9 is used mainly to teach graphics and desktop publishing courses. There are 25 Apple Power Mac G4 with 512MB SDRAM, DVD-R/CD-RW, 60 GB hard drive, Zip 250, nVidia GeForce2MX graphics card and 17” flat panel display. The remaining three computer classrooms, C159, A210 & A220, are mainly used by Computer Science department. There are 30 Dell GX260 Pentium 4 2.26 GHz with 512MB RAM, 80GB hard drive, ZIP 250, CD-ROM drive and a 17” monitor in A210. There are 30 Dell GX240 Pentium 4 1.7GHz with 256MB RAM, 40GB hard drive, ZIP 250, CD-ROM drive and a 17” monitor in A220. C159 computer classroom has 30 Dell GX110 P3 933MHz, 256MB RAM, 40 GB hard drive and Zip 250 drive. All the computers in the classrooms are connected to the campus-wide network, access to local applications, access to other academic time-share computing systems both on- and off-campus, such as library resources, electronic bulletin boards, electronic mail, and the Internet. These computer classrooms are multimedia-ready with instructional aids such as an XGA resolution projection system and a retractable projection screen.

Mr. Jeff Cheam is the lead Information Technology Consultant (ITC) for the College. Under him are two other full time ITCs, Mr. Yin Tam and Mr. Fernando Loza. They all work closely with department chairs, faculty, staff and college administration to ensure that the computing needs of the college programs are met. ITC’s job responsibilities include training of students, staff, and faculty; updating and maintaining hardware, software and documentation; ensuring the college’s hardware configuration meets current and evolving needs; and participating in College and University system development projects.

All Mechanical Engineering faculty have Pentium IV-based workstations on their desks. All of our faculty's workstations are connected to the network. This enables faculty to access the same network resources that can be accessed from our Computer Productivity Center.

c. Classroom Facilities

Most of the ME undergraduate student teaching takes place in the Engineering and Technology Building, which houses all of the College's faculty and staff, laboratories, and computing facilities, and many of its classrooms. All classrooms are assigned at the university level. This means that large classes are sometimes assigned classrooms that are not in the E&T Building. However, most of the Mechanical Engineering classes are held in the E&T Building. The E&T classrooms are well suited for lectures and are well maintained. All are equipped with dry-erase boards, an overhead projector, and a screen. In many cases they are multimedia ready. Additional audio-visual equipment, such as slide projectors, computer projectors, and video playback equipment, can be obtained upon request.

d. Laboratory Facilities

The entire Engineering and Technology Building has undergone a recent renovation. As a result, all laboratory facilities have been modernized. New cabinetry and shelving, benches, sinks, acid-resistant countertops, a versa-duct power distribution system with voice and data ports, new HVAC, new laboratory air, gas and vacuum, and cabinets for flammable and acid containers have been installed throughout the laboratory facilities.

Some laboratory facilities are shared with the Departments of Civil Engineering, Electrical Engineering and the Department of Technology. For each shared laboratory, each department has a laboratory coordinator. The laboratory coordinators are responsible for coordinating laboratory equipment needs among the departments and for the general maintenance of the laboratories.

Advanced Strength of Materials Laboratory (E&T C-22)

This laboratory provides the testing equipment that is needed for performing experiments in advanced strength of materials for ME 412, Strength of Materials Laboratory II. The equipment in this laboratory is older and sparse, but it is unique in terms of design, capability and range. This laboratory is shared with the Department of Civil Engineering. The laboratory is also utilized to support structural research projects in both departments including Professor Hsia's Inflatable Structures research project. In addition independent study projects are conducted in this lab from time to time.

Photoelasticity Laboratory (E&T C-164A)

This laboratory houses the NSF Scanning Electron Microscope and a circular polariscope that is used in teaching ME 412, Strength of Materials Laboratory II.

Aerodynamics Laboratory (E&T C-19)

This laboratory is equipped for fundamental and intermediate level studies and experimentation in aerodynamics. Before the NASA University Research Center, this laboratory was used only for teaching ME 413, Fluid Mechanics Laboratory II, and independent study projects. Since the awarding of the URC the lab has received special attention and funding to accommodate the needs of the URC research as well as the instructional needs of the Department. Last year, the college allocated $50K – its entire budget for equipment for retrofitting the supersonic wind tunnel to make it operational. Additional $50K in the URC budget will be used this year to design and build a fully motorized automated 3 DOF model support with computer-based data acquisition system and LABVIEW, load cells and pressure readouts.

The current equipment includes: a 28" x 22" subsonic wind tunnel, a 12" x 12" subsonic wind tunnel, and a 6" x 6" supersonic wind tunnel. The larger subsonic wind tunnel is equipped with a 3-component balance system and a data acquisition system. The smaller subsonic wind tunnel, equipped with a smoke-generating device, is used mainly for flow visualization. The supersonic wind tunnel, which can operate at Mach numbers from 1 to 4.5, is also equipped with a Schlieren system for visualization of shock waves. Except for the supersonic wind tunnel, all the wind tunnels are in good condition and support the instructional needs of the program. This facility will be used mainly for research projects related the URC for validation of CFD simulation design and for testing and aerodynamic data base for the UAV project.

Automated Manufacturing and Robotics Laboratory (E&T B-109) and CAD/CAM Laboratory (E&T B-110)

These facilities house several industrial robots, numerically controlled machines, a complete Computer Integrated Manufacturing (CIM) cell, and computer hardware and software supporting CAD/CAM. The facilities are jointly used and operated by the Mechanical Engineering and the Technology Departments. The ME Department uses these laboratories for instructional support and research in the areas of robotics, manufacturing and automation, and in the following courses: ME 428, Automation and Computer-Aided Manufacturing; EE/ME 491, Robotics Laboratory; and ME 454, Special Topics in Mechanical Engineering (Rapid Prototyping).

Control Systems Laboratory (E&T C- 154)

This laboratory is shared by the Electrical and Computer Engineering and Mechanical Engineering departments. It supports the control systems area in both departments. Although the Mechanical Engineering department does not have a laboratory course in controls, EE 468, Cotrol Systems Laboratory, is allowed as the upper division elective laboratory for ME students. The facility contains one control moment gyroscope, two torsional plants, two inverted pendulums, one magnetic levitation apparatus, two rectilinear plants, and eight Dell optiplex systems. The laboratory allows students to perform experiments on both analog and digital systems.

EE Measurements and Circuits Laboratory (E&T C-249)

This laboratory supports instruction in basics circuit measurements and has a full complement of basic electrical measurement instrumentation (e.g., oscilloscopes and meters) and signal sources. The laboratory is used for teaching EE 210, Electrical Measurements Laboratory.

CE/ME Senior Design Workroom (E&T A-309) and CE/ME Senior Design Computer Laboratory (E&T A-310)

This workroom and laboratory provide support for the Mechanical Engineering Senior Project sequence of courses, ME 497ABC. The laboratory has 16 CAE/CAD workstations. The workroom and laboratory are shared with the Civil Engineering Department.

Fluid Mechanics Laboratory (E&T C-259)

The equipment in this laboratory is adequate for the instructional needs in the fluid mechanics area. This laboratory is shared with the Civil Engineering Department, and it is used for teaching CE/ME 313, Fluid Mechanics Laboratory I, and CE/ME 413, Fluid Mechanics Laboratory II.

Machine Analysis Laboratory (E&T C-153)

This laboratory is located in a new room dedicated to teaching ME 417 Machine Analysis Laboratory, which provides instructional support and demonstration of theory of mechanisms and machines, and how measurements are made in mechanical systems.

Metallurgy Laboratory (E&T C-164)

Since the last ABET visit this laboratory has received two major pieces of equipment: A new optical microscope (TYPE AND MODEL), and a Scanning Electron Microscope (SCM). The additional microscope, polishing and etching equipment used in this laboratory are adequate for the limited instructional activities it is used for in teaching ME 329, Metallography Laboratory.

Strength of Materials Laboratory (E&T C-163)

The Strength of Materials Laboratory 1, is an exceptionally modern and sophisticated destructive testing facility. This facility completely supports the laboratory experiments and curriculum of the Mechanical Engineering Department Department including support for CE/ME-205, CE/ME-312, ME-412 and ENGR 207 courses. In addition the lab provides support for the Senior Design courses, Graduate Research, and special projects.

The Strength of Materials Laboratory has the capacity to accurately perform and record all of the standard accepted tests such as tension, compression, torsion, single/double shear, hardness, ductility and impact. The equipment in this laboratory include:

Tinius-Olsen, 60 KLb. Super “L” Universal Testing Machine. This machine is equipped with tension, compression, single/double shear, V- grips, flat grips, extensometer and deflectometer accessories.

Tinius-Olsen, 200 KLb. Super “L” Universal Testing Machine. This machine is equipped with tension, compression, single/double shear, V-grips, flat grips, extensometer and deflectometer accessories.

Tinius-Olsen, 200 KLb. Super “L” pit mount Universal Testing Machine. This machine is equipped with tension, compression, single/double shear, V-grips, flat grips extensometer and deflectometer accessories. This machine has been recently retrofitted with the new Tinius-Olsen 398 digital display, Test Navigator software with dedicated computer system.

Tinius-Olsen, 400 KLb. Super “L” Universal Testing Machine. This machine is equipped with tension, compression, single/double shear, V-grips, flat grips, extensometer and deflectometer accessories. This machine has been recently retrofitted with the new Tinius-Olsen 398 digital display, 496 servo control, Test Navigator software with dedicated computer system. This laboratory is versatile in capability and is well maintained.

Thermal Systems Laboratory (E&T C-153)

This is a large, spacious and well-equipped laboratory. Three adjoining chambers in this laboratory have been converted to research offices for the Multidisciplinary Flight Dynamics and Control Laboratory of the URC, one for development and construction of UAV. The instructional segment of this laboratory is used for teaching ME 315, Thermal Systems Laboratory I, and ME 427, Thermal Systems Laboratory II, and ME 417, Machine Analysis

Laboratory. Recent purchases have centered on modern, bench-top equipment with computer-based data acquisition system.

e. Laboratory Development Plan

The Department of Mechanical Engineering uses twelve laboratories and one workroom in its program. Two of these facilities, the Senior Design Workroom and Senior Design Computer Laboratory are shared with the Civil Engineering Department. The Computer Productivity Center is shared with the four other departments in the college. These shared laboratories are jointly administered through the Associate Dean's office in consultation with the departments. In addition, one Electrical Engineering laboratory and the Control Systems Laboratory are administered by the Electrical and Computer Engineering Department. Three laboratories in the areas of strength of materials and fluid mechanics are jointly administered with the Civil Engineering Department. The Automated Manufacturing and Robotics Laboratory, CAD/CAM Laboratory is administered by the Technology Department, leaving the Aerodynamics, Machine Analysis, Metallurgy, and Thermal Systems laboratories under the sole administration of the Department of Mechanical Engineering.

Each laboratory facility administered solely by the Department of Mechanical Engineering has an ME faculty director. The Laboratory Director is responsible for the equipment and general condition of the laboratory. The Directors of the Mechanical Engineering Laboratories are as follows:

Aerodynamics Laboratory	C. Wu
Metallurgy Laboratory	A. Sharif
Photoelasticity Laboratory	S. Felszeghy
Thermal Systems Laboratory	D. Guillaume
Machine Analysis Laboratory	S. Landsberger

Three laboratories have been designated, by the College, for joint use by the Department of Mechanical Engineering and the Department of Technology. They are:

Manufacturing Processes Laboratory (E&T B-111)
Material Processes Laboratory (E&T B-115)
Pneumatics and Hydraulics laboratory (E&T B-109A)

One laboratory that has been designated by the College for joint use by the Department of Mechanical Engineering and the Department of Electrical and Computer Engineering is:

EE/ME Controls Laboratory (E&T C-156)

The ME Department maintains a five-year equipment plan for the ongoing development of its laboratory and other instructional facilities. This plan will be shared with the ABET visiting team members.

f. Laboratory Maintenance.

The Department has the services of two technicians, one full-time, Mr. Dan Roberto, and the other half-time, Mr. Chris Reid, both supervised by a Head Technician, Mr. Bruce Fischer, who devotes approximately 25 percent of his time to Department activities. In addition, the Department has the support of an Information Technology Consultant, Mr. Jeff Cheam, who is available to help faculty in integrating the use of computers in the curriculum. These highly qualified individuals maintain the equipment and provide support to faculty in laboratory courses. Parts are purchased through the Supplies/Services budget allocation to the Department. The top priority for the use of all resources is the maintenance and support of the existing laboratory facilities.

7. Institutional Support and Financial Resources

The following sections describe the level and adequacy of institutional support, financial resources, and constructive leadership that ensure the continuity of the Mechanical Engineering program and the achievement of program objectives.

a. Budget Process

The College of Engineering, Computer Science, and Technology receives an annual General Fund allocation from the University. The allocation is divided into three areas: (1) faculty salaries; (2) staff salaries; and (3) operations and expenses (O&E). The Mechanical Engineering program is allocated resources to cover the salaries of all full-time faculty and staff and an additional allocation for part-time faculty salaries based on enrollment projections and programmatic needs. Resources for faculty salaries support the Department in offering all courses for which there is student demand.

In addition, the Mechanical Engineering program is allocated a portion of the College O&E budget to cover departmental supplies and services needs, including laboratory supplies. The level of this allocation is based on student head count and expenditure history. Resources for communications (including telephone and postage), duplicating costs, and most office supplies are managed centrally by the College and fully cover all Mechanical Engineering program needs. In recent years, the University has allocated a fixed dollar amount per faculty member for faculty travel. This amount was $1000 for the Academic Year 2005-2006. Supplemental travel funds are obtained through the Continuing Education Recovery Fund (CERF), which is the revenue the Department recovers from tuition paid by non-matriculated students enrolled in ME courses.

b. Adequacy of Institutional Support, Financial Resources, and Constructive Leadership

This section discusses the adequacy of institutional support, financial resources, and constructive leadership provided to the Mechanical Engineering program.

Institutional Support

The engineering programs at CSULA, including the Mechanical Engineering program, have received a high level of support from the institution. The University President, Dr. James Rosser, and the Provost and Vice President for Academic Affairs, Dr. Herman Lujan, recognize the importance of engineering to the society at large and to the University. The success of the faculty in obtaining large multi year research grants including the URC has strengthened the support for the College.

The University has long recognized engineering as a "high cost" program, and has provided the resources necessary to maintain program quality. Two tangible indications of this are: (1) the engineering programs have been allowed to operate at a student faculty ratio (SFR) of approximately 14/1, while the average SFR for the rest of the University is approximately 21/1; and (2) the engineering programs are budgeted at approximately $9,200 per year for each full-time equivalent student, while the average for the University is much lower.

Another indication of the commitment of the University and its leadership to the engineering programs is the $31 million renovation of the Engineering and Technology Building which was completed in 2001. This represented an expenditure of approximately $30,000 per enrolled student for facility upgrades.

Other examples of institutional support are designation of the URC as one of the “Programs of Distinction” by Vice President of Academic Affairs and Provost Dr. Lujan and a commitment of $70,000 of capital outlay in 2002 for the purchase of software licenses for the URC research laboratories for two years.

Financial Support

The Mechanical Engineering program receives resources to cover the salaries of all full-time faculty and staff and an allocation based on projected enrollment to cover the salaries of part-time faculty. Resources have been provided to offer all courses for which there is a student demand.

Expenditures by the Mechanical Engineering program in support areas of operations, travel, equipment, and student assistants are shown in Appendix IA, Table 5. Expenditure levels are adequate to meet the needs of the program. The program's faculty travel expenditures are substantially more than shown since most faculty travel is supported by non-state funds. Equipment expenditures reflect the large infusion of equipment support included in the Engineering and Technology Building renovation project. Operations include telephone, duplicating, laboratory supplies, software, office supplies, and other items.

Other sources of funding available to the Mechanical Engineering program include Lottery Funds, Instructionally Related Activity (IRA) funds, Open University revenue, Grant Seed Funds, and Instructional Improvement Funds. Lottery funds are awarded by the College's Resource Allocation Advisory Committee (RAAC) on a competitive basis. Instructionally Related Activity funds for continuing projects are ongoing. New IRA projects are funded through a competitive University-wide process. Open University revenue is generated from fees paid by students who enroll in Mechanical Engineering courses through Continuing Education. Grant Seed funds support faculty in developing proposals for external funding, and Instructional Improvement Funds support faculty in innovative instructional projects including program assessment. Grant Seed funds are awarded based on the recommendation of the dean, and Instructional Improvement Funds are awarded through a University-wide competition. Mechanical Engineering faculty have utilized each of these sources to accomplish the objectives of the program.

Constructive Leadership

The primary leadership of the Mechanical Engineering program is the responsibility of the Chair of the Department of Mechanical Engineering, Dr. Maj Dean Mirmirani. Currently in his third year in the position of chair, Dr. Mirmirani is providing outstanding leadership to the department. Dr. Mirmirani is very "student oriented," and he has played a major role in improving many of the processes related to evaluating, monitoring, and advising students. Three years prior to assuming the position of chair, Dr. Mirmirani had served as the chair for two consecutive three year terms from 1994 – 2000 leading the department through an ABET review in 1994. Under his leadership the Department was able to hire an outstanding new junior faculty member, Dr. Adel Sharif and receive authorization to open a new search for a faculty member in the area of Thermal Sciences. Dr. Mirmirani has set an example for his faculty through his strong record of grant activity, scholarly work and publications. He has involved the two most junior faculty members Drs. Guillaume and Sharif in the running of the Department, thereby bringing much energy, vitality to the leadership of the Department. Dr. Guillaume as the Department Associate Chair has helped Dr. Mirmirani to implement a number of initiatives including streamlining the prerequisites, a program modification involving a number of new courses and course modifications. Dr. Sharif, while actively participating in management of the Department is the graduate Principal Advisor and in charge of the Masters program comprehensive exam. Dr. Sharif receives two units of release time for his leadership role and advising. Dr. Mirmirani also invited Dr. Guillaume to participate in the URC and provided mentorship for him to assume a critical role at MFDCLab. In the past three years the enrollment in Mechanical Engineering has almost doubled from an average of 45-50 FTES to 85 -90. Under his leadership, the morale of department faculty, staff, and students is extremely high. The department sponsors several student organizations and the SAE and ASME organizations are very active. The department has excelled in the area of engineering student competitions with a remarkable record of successes in the Mini Baja, and SAE-sponsored Aero Design competitions. Dr. Mirmirani has provided leadership in the establishment and maintenance of an active Mechanical Engineering Industry Advisory Board.

Dr. Mirmirani serves as a member of the College Executive Council (EC). The Executive Council comprised of the dean, associate dean, four department chairs, the College Director of Development, MEP Director, MESA Engineering Director, and College Outreach coordinator weekly to address various issues that impact each program, including the Mechanical Engineering program. With input from each department, EC establishes College priorities and directions annually.

c. Faculty Development

The University and the College provide numerous opportunities for faculty development. Among those provided by the University are a fee waiver program, sabbatical leaves, and difference-in-pay leaves. The Center for Innovation and Excellence in Teaching and Learning (CIETL) supports faculty in improving their teaching effectiveness through resources and reference materials, workshops and seminars, assistance with course development, and feedback on instructional technique. The Faculty Instructional Technology Support Center (FITSC) assists faculty in the use of advanced instructional technologies through workshops and seminars and opportunities to preview new software.

New faculty are assigned a faculty mentor, and both the new faculty member and his/her mentor receive release time from teaching to participate in a quarter-long faculty development workshop conducted by the University. New faculty are also encouraged to participate in the National Effective Teaching Institute (NETI), conducted in conjunction with the ASEE Annual Conference, as well as other short courses and workshops related to teaching effectiveness.

Faculty are encouraged to attend professional conferences, both in their technical area of specialty and in engineering education. Mechanical Engineering faculty have taken advantage of these opportunities as their curriculum vitae show.

d. Resources to Acquire, Maintain, and Operate Facilities and Equipment

We believe that members of our Fall, 2006 ABET visiting team will find our Mechanical Engineering facilities impressive. Since our last EAC/ABET visit, we have completed a $31 million project, in 2001, to renovate the Engineering and Technology Building, including all instructional classrooms, laboratories, and computer facilities. This project provided approximately $2 million in new Group I (built in) equipment and $4 million in new Group II (moveable) equipment. This major influx of new equipment provides the Mechanical Engineering program with instructional facilities that are among the finest of any Mechanical Engineering program in the nation.

We are currently updating our five-year equipment plan to reflect the renovated facilities and to map out plans for continued improvement of those facilities over the next five-year period. This plan will be transmitted to the ABET team members prior to the campus visit.

We believe our facilities are one of the most significant strengths of our mechanical engineering program and that the resources available to acquire, maintain, and operate these facilities are more than adequate.

e. Adequacy of Support Personnel

The Mechanical Engineering program has 5.6 full-time equivalent staff support positions. This includes a full-time department secretary and a full-time laboratory technician. The other 3.6 positions are made up of proportional shares of the following College staff: Director of Development; Resource Coordinator; Instructional Computing Consultants (2); Technical Supervisor; MESA Engineering Program Director; MESA Engineering Program Associate Director; Outreach Coordinator. Detailed descriptions of the support provided by these staff can be found in Appendix II, Section K, Non-Academic Support Units. In addition, student assistants support the Mechanical Engineering program in the department office, the dean's office, and the Outreach Coordinator Office. These support personnel are adequate to meet the needs of the Mechanical Engineering program.

Many other university services, too numerous to list, support the Mechanical Engineering program. Primary among these are the Career Center, the Student Health Center, the Financial Aid Office, the Learning Resource Center, the Writing Center, the University Library, the University Information Resources Management (IRM) Division, and many, many more.

8. Program Criteria

The following sections discuss how the Mechanical Engineering program satisfies the applicable program criteria in the areas of curriculum and faculty.

a. Curriculum

Chemistry and Calculus-Based Physics

As indicated in Section 4 - Professional Component, all Mechanical Engineering graduates are required to complete CHEM 101 (5) and four calculus-based physics courses totaling sixteen units—PHYS 201, 202, 203, and 204. The CSULA Chemistry Department is one of the finest in the California State University System. Because of the high standards of that department, a passing grade in CHEM 101 reflects adequate knowledge of chemistry as required by the Mechanical Engineering program. The knowledge gained in the required physics courses is reinforced and applied throughout the required Mechanical Engineering curriculum.

Mathematics through Multivariate Calculus and Differential Equations

As indicated in Section 4, all Mechanical Engineering graduates are required to complete five calculus courses totaling 20 units—MATH 206, 207, 208, 209, and 215. MATH 209 - Calculus IV: Several Variables covers multivariate calculus. MATH 215 - Differential Equations covers differential equations and has an applied focus as indicated by the catalog description ("Ordinary differential equations with concentration on methods of finding solutions; applications in science and engineering."). Knowledge and application of calculus is reinforced throughout the Mechanical Engineering curriculum. This outcome is verified through the Mechanical Engineering program assessment, including the implementation of a mathematics prerequisite test.

Statistics and Linear Algebra

All Mechanical Engineering graduates must complete CE/ME 210 - Matrix Algebra for Engineers, and CE/ME 211 - Statistics and Probability for Engineers. These two courses, along with the use and application of both statistics and linear algebra in required Mechanical Engineering courses ensure that students have a strong background in these subjects.

Ability to Work Professionally in Both Thermal and Mechanical Systems Including the Design and Realization of Such Systems

Required Thermal Systems		**Required Mechanical Systems**	
Course Number	**Units**	**Course Number**	**Units**
ME 303: Fluid Mechanics I	4	ME 201: Statics	4
ME 306: Heat Transfer I	4	ME 205, Strength of Materials	4
ME 326A: Thermodynamics II	4	ENGR 207, Materials Science	4
ME 326B: Thermodynamics II	4	ME 320, Dynamics I	4
ME 313: Fluid Mechanics Lab I	1	ME 323, Machine Design I;	4
ME 315: Thermal Systems Lab	1	ME 321, Kinematics or ME 421, Dynamics of Mechanisms	4
		ME 312: Strength of Materials Lab	1
Total Units	**18**		**25**

The curriculum incorporates a coherent set of required and technical elective courses which, upon completion, allows our graduates to work professionally in both the thermal and mechanical systems areas, including the design and realization of such systems.

The Mechanical Engineering curriculum contains a comprehensive core of required courses in both the thermal systems and mechanical systems areas.

All Mechanical Engineering majors are required to take the following lecture courses in thermal systems: ME 303, Fluid Mechanics I; ME 306, Heat Transfer I; ME 326A, Thermodynamics I; and ME 326B, Thermodynamics II. Additional content in fluid mechanics and thermal systems are contained in the required laboratory courses, ME 313, Fluid Mechanics Laboratory I, and ME 315, Thermal Systems Laboratory I.

All Mechanical Engineering majors are required to take the following lecture courses in mechanical systems: ME 201, Statics; ME 205, Strength of Materials I; ENGR 207, Materials Science and Engineering; CE/ME 320, Dynamics I; ME 323, Machine Design I; and at least one of the two courses ME 321, Kinematics, and ME 421, Dynamics of Mechanism, and the laboratory course, CE/ME 312, Strength of Materials Laboratory. Additional content in mechanical systems is contained in ME 327, Manufacturing Processes.

Under the guidance of a faculty advisor, each student selects 25 units of upper-division technical elective courses consisting of six four-unit lecture courses and one one-unit laboratory course. Students are encouraged to maintain breadth in their major by selecting a combination of courses from both areas.

The technical elective lecture courses in the thermal systems area that are available to our students are the following: ME 403, Aerodynamics; ME 406, Heat Transfer II; ME 407, Design of Thermal Systems; ME 408, Fluid Mechanics II; ME 415, Air Conditioning; ME 416, Energy Systems; ME 420, and Power Plants. The technical elective lecture courses in the mechanical systems area that are available to our students are the following: ME 321, Kinematics of Mechanisms; ME 402, Advanced Mechanics of Materials; ME 410, Control of Mechanical Systems; ME 411, Vibrational Analysis I; ME 414, Machine Design II; ME 421, Dynamics of Mechanisms; ME 428, Automation and Computer-Aided Manufacturing; and EE/ME 481, Introduction to Robotics. Three elective courses, available to our students, which are more interdisciplinary in nature or have variable content, are: ME 409, Mechanical Engineering Analysis; ME 422, Optimization of Mechanical Engineering Systems; ME 423, Introduction to Finite Element Method, and ME 454, Special Topics in Mechanical Engineering.

In addition, all Mechanical Engineering majors are required to complete a one-year sequence of three, four-unit Mechanical Engineering Senior Project courses, namely ME 497 ABC. This major design experience draws on student knowledge in both the thermal and mechanical systems areas. This major design experience is discussed in detail in Section B.4.c.

b. Faculty

Every faculty member's responsibility in the Department includes the oversight of the upper-division ME program. There are various ways the faculty maintain their currency in their specialty areas. Some of these ways are evident from the faculty's curricula vitae in Appendix IC. For example, some faculty are involved in research, others consult in industry, and many belong to professional societies, read the societies' journals and magazines, and attend regularly professional conferences. Some faculty serve as reviewers of articles for peer reviewed professional journals, and also review occasionally manuscripts for textbooks.

Another way faculty keep current is by attending workshops to learn new engineering software, or to improve their skills in using engineering software they are already familiar with. The faculty regularly receive fliers from book publishers, and visits from book publishers' representatives, advertising new textbooks, or new editions of textbooks. The faculty order desk copies of those new textbooks that interest them for potential adoption. The faculty also receive brochures, catalogs and advertisements from laboratory equipment manufacturers. The Department has an Industry Advisory Board that provides input to the Department on the needs and trends in industry.

9. General Advanced-Level Program

Accreditation of an advanced-level program is not being sought.

Figure 1: Major Department Evaluation (MDE)

CALIFORNIA STATE UNIVERSITY, LOS ANGELES

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERIN

Major Department Evaluation (MDE)

Mail to Student Date ____________
____

Name ______________________________ Phone Home ____________ CIN ____________
Last *First* *Middle*
Work ____________
Email ____________

Address ____
Street *City* *Zip Code*

Quater admitted ____________ Readmitted ____________
Qtr/Yr *Qtr/Yr*

Date MDE Submitted to Graduation Section ____________ Expected Graduation Date ____________

Advisor ____________ Transfer Institution ____________

COURSE		TRANSFERRED FROM		QTR UNITS	GRADE	
		INSTITUTION	DEPT & COURSE			
LOWER DIVISION REQUIRED COURSES (68 units)						
ENGR 100	Introduction to Engineering (1)					
ME 103	Introduction to Mechanical Design (3)					
CE/ME 201	Statics (4)					
ME 204	Mechanical Engr Measurements and Instrumentation (4)					
CE/ME 205	Strength of Materials I (4)					
ENGR 207	Materials Science and Engineering (4)					
CE/ME 210	Matrix Algebra for Engineers (2)					
EE 210	Electrical Measurements Laboratory (1)					
CE/ME 211	Statistics and Probability for Engineers (2)					
CHEM 101	General Chemistry I (5)					
CS 290*	Introduction to FORTRAN Programming (2)					
MATH 206	Calculus I: Differentiation (4)					
MATH 207	Calculus II: Integration (4)					
MATH 208	Calculus III: Sequences, Series, & Coordinate Systems (4)					
MATH 209	Calculus IV: Several Variables (4)					
MATH 215	Differential Equations (4)					
PHYS 201	General Physics (4)					
PHYS 202	General Physics (4)					
PHYS 203	General Physics (4)					
PHYS 204	General Physics (4)					

* May substitute a course in any high-level programming language with department approval.

WPE PASSED ____________ (must be taken prior to the completion of 135 units)

GRADUATION CHECKLIST OF DEGREE REQUIREMENTS

Refer to ______________ (Fall 1998 or later) catalog for GE requirements; refer to ______________ (Summer 1999 or later) catalog for major requirements.

Bachelor of Science major ……………… 194 units.
Lower General Education ………………. 32 units, must select two *diversity* courses from among all GE courses taken
University Requirement …………………. 4 units
Upper General Education ……………….. 12 units, a biology course must be included as part of Upper GE Theme
Grade Point Average …………………….. minimum C average (2.0) is required in:

- all college work
- all courses attempted at CSULA
- all GE courses
- all courses required in major
- all Upper Division courses in major

Major ………………………………………. 146 units
Residence ………………………………… 45 units in residence at CSULA, including 36 Upper Division units; 18 units in major; and 12 units in Upper GE
Upper Division Units …………………….. 60 units minimum
Writing Skills Requirement ……………… minimum C grade in ENGL 101, ENGL 102 and passing score on Writing Proficiency Examination (WPE)

CAUTION: These requirements remain in effect only if you remain in continuous attendance. If for any reason you find it necessary to drop out of school for more than two consecutive quarters, you must apply for and be granted an official leave of absence, or you will be held for requirements in effect at the time you return. Consult your advisor for additional details.

COURSE		TRANSFERRED FROM		QTR UNITS	GRADE	
		INSTITUTION	DEPT & COURSE			
UPPER DIVISION REQUIRED COURSES (53 units)						
ENGR 300	Economics for Engineers (4)					
ENGR 301	Ethics and Professionalism in Engineering (1)					
CE/ME 303	Fluid Mechanics I (4)					
ME 306	Heat Transfer I (4)					
ME 310	Mechanical Engr. Writing Laboratory (1)					
CE/ME 312	Strength of Materials Laboratory I (1)					
CE/ME 313	Fluid Mechanics Laboratory I (1)					
ME 315	Thermal Systems Laboratory I (1)					
CE/ME 320	Dynamics I (4)					
ME 321*	Kinematics of Mechanisms (4)					
ME 323	Machine Design I (4)					
ME 326A	Thermodynamics I (4)					
ME 326B	Thermodynamics II (4)					
ME 327	Manufacturing Processes (4)					
ME 421*	Dynamics of Mechanisms (4)					
ME 497A	Mechanical Engineering Senior Project (4)					
ME 497B	Mechanical Engineering Senior Project (4)					
ME 497C	Mechanical Engineering Senior Project (4)					
**Students must select either ME321 or ME421 as a required Course. The other may be used as an upper division technical elective*						
UPPER DIVISION TECHNICAL ELECTIVES (25 units)						
Select 6 lecture courses from the following:						
ME 321	Kinematics of Mechanisms (4)					
ME 402	Advanced Mechanics of Materials (4)					
ME 403	Aerodynamics (4)					
ME 406	Heat Transfer II (4)					
ME 407	Design of Thermal Systems (4)					
ME 408	Fluid Mechanics II (4)					
ME 409	Mechanical Engineering Analysis (4)					
ME 410	Control of Mechanical Systems (4)					
ME 411	Vibrational Analysis I (4)					
ME 414	Machine Design II (4)					
ME 415	Air Conditioning (4)					
ME 416	Energy Systems (4)					
ME 419	Computer Aided Mechanical Engineering (4)					
ME 421	Dynamics of Mechanisms (4)					
ME 422	Optimization of Mechanical Engineering Systems (4)					
ME 423	Introduction to finite Element Method (4)					
ME 428	Automation and Computer-Aided Manufacturing (4)					
ME 430	Properties and Selection of Engineering Materials (4)					
ME 454	Special Topics in Mechanical Engineering (1-4)					
EE/ME 481	Introduction to Robotics (4)					
Select 1 laboratory course from the following:						
ME 412	Strength of Materials Laboratory II (1)					
CE/ME 413	Fluid Mechanics Laboratory II (1)					
ME 417	Machine Analysis Laboratory (1)					
ME 427	Thermal Systems Laboratory II (1)					
ME 431	Materials Laboratory (1)					
ME 499	Undergraduate Directed Study (1)					

NOTE: No subject credit is allowed for transferred Upper Division courses with “D” grades.

EVALUATION APPROVAL			
Advisor:	____________________	Date:	__________
Department Chair:	____________________	Date:	__________

Figure 2: General Education Advisement Form

COURSE	TRANSFERRED FROM		QTR UNITS	GRADE	
	INSTITUTION	DEPT & COURSE			
I. LOWER DIVISION GENERAL EDUCATION (32 units) (Please skip to Part II if the Lower Division GE is entirely completed and certified at a community college.)					
BLOCK A: BASIC SUBJECTS (8 units)					
A1: ENGL 101					
A2: SPCH 150					
AMERICAN INSTITUTIONS (8 units)					
HIST 202A *or* 202B					
POLS 150					
BLOCK C: HUMANITIES (12 units) *Select three courses from three different areas*					
C1: LITERATURE AND DRAMA ANTH/ENGL 245 ENGL 250, 258, 260, 270, 280 SPAN 242 TA 152					
C2: ARTS ART 101ABC, 150, 152, 155, 156, 157, 159, 209 BCST/DANC/TA 210 BCST/ENGL 225 CHS 112 (approved diversity course) CHS/PAS 260 *(approved diversity course)* DANC 157 LBS 234 *(approved diversity course)* MUS 150, 151, 152, 156, 160					
C3: PHILOSOPHY AND RELIGIOUS STUDIES PHIL 151, 152 PHIL/RELS 200 *(approved diversity course)* PHIL 220 *(approved diversity course)*					
C4: LANGUAGES OTHER THAN ENGLISH COMD 150 CHIN 100ABC, 101ABC, 200ABC, 201ABC FREN 100ABC, 130, 200AB GERM 100ABC, 200ABC ITAL 100ABC, 200ABC JAPN 100ABC, 130, 200ABC, 230 KOR 100ABC LATN 100ABC, 222 PAS 120 PORT 100ABC RUSS 101AB SPAN 100ABC, 105, 130, 200ABC, 205ABC, 230					
C5: INTEGRATED HUMANITIES BCST/ENGL/TA 240 ENGL/PHIL 210					
BLOCK E: LIFELONG UNDERSTANDING AND SELF-DEVELOPMENT (4 units)					
ANTH 265 ART 240 *(approved diversity course)* BUS 200 CHDV/SOC 120 *(approved diversity course)* HS 150 PE 150 PHIL 230 POLS 120 PSY 160 SPCH 230 SOC 202 TECH 250					
II. LOWER DIVISION GENERAL EDUCATION CERTIFICATION					
ρ GE Certification					
III. UNIVERSITY REQUIREMENT (4 units)					
ENGL 102					
WPE	* must be taken at CSU				

COURSE	TRANSFERRED FROM		QTR UNITS	GRADE	
	INSTITUTION	DEPT & COURSE			
IV. GENERAL EDUCATION UPPER DIVISION THEME (12 units)		Theme Designation			
	* must be taken at CSU				
	* must be taken at CSU				
	* must be taken at CSU				

GENERAL EDUCATION NOTES

* A minimum *C grade average* in GE is required of all students following the 1987-1989 or any later catalog.
* Students, who fall under the Fall 1998 or any later GE catalog, must complete ***two diversity courses*** which may be selected from BLOCK C, BLOCK E or from the GE Upper Division Themes.
* ENGL 102 is required for all students who entered Cal State L.A. Summer 1993 or later, and who are subject to the requirements of the 1993-95 or later GE catalog. A minimum C grade is required. *A 'C-' grade is not acceptable*.
* Engineering majors, who fall under the Fall 1998 or any later GE catalog, must complete a BIOLOGY course as part of their Upper Division Them

Advisor: ______________________________ Date: ____________________

Department Chair: ______________________________ Date: ____________________

Figure 3: GET Advisement Report

```
Advisement Transcript
        Name      :  Pena,Daniel
        Student ID:  201310648
        Address   :  1509 Adkisson Ave
                     Los Angeles, CA 90063
                     United States
        California State University, Los Angeles
        5151 State University Drive
        Los Angeles, CA 90032
        United States
        Requested By :  Guillaume,Darrell W
        Print Date   :  2005-12-13
```

- - - - A C A D E M I C   A D V I S E M E N T   R E P O R T - - - -

B. S.

Career

Totals

CUM GPA : 2.131 CUM TOTALS : 260.00 236.00 492.200

- - - - A C A D E M I C   A D V I S E M E N T   R E P O R T - - - -

Career Simulation - Simulating Baccalaureate Career
Engineering & Technology Program
Mechanical Engineering Plan

Report on Baccalaureate Career

Requirements Not Satisfied

Engineering & Technology Program

Requirements Not Satisfied

UNIVERSITY REQUIREMENTS [RG 2]

Overall Requirement Not Satisfied -

60 UPPER DIVISION UNITS REQUIRED FOR DEGREE [RQ 14]
Units/Courses/GPA (actual): 81.00/25.00/2.068

45 UNITS REQUIRED IN RESIDENCE [RQ 17]
Units/Courses/GPA (actual): 257.00/82.00/2.289

36 UPPER DIVISION UNITS REQUIRED IN RESIDENCE [RQ 18]
Units/Courses/GPA (actual): 81.00/25.00/2.068

UNIVERSITY WRITING REQUIREMENT: ENGL 102 [RQ 21]
Units/Courses/GPA (actual): 4.00/1.00/3.000

Term	Course		Description	Units	Grade	Code
Winter 99	ENGL	102	COMPOSITION II	4.00	B	EN

UNIVERSITY WRITING REQUIREMENT: WRITING PROFICIENCY [RQ 22]
Units/Courses/GPA (actual): 0.00/1.00/0.000

Term	Course		Description	Units	Grade	Code
Winter 00	UNIV	400	WPE/GWAR	0.00	CR	EN

INTRODUCTION/TRANSITION TO HIGHER EDUCATION [RQ 966]
Required if subject to the 1997 - 1999 or later catalog.
Requirement Not Satisfied -
Courses (required/actual/needed): 1.00/0.00/1.00

2.00 GPA REQUIRED FOR ALL COURSEWORK [RQ 19]
Units/Courses/GPA (actual): 310.00/95.00/2.131

2.00 GPA REQUIRED FOR CSULA COURSEWORK [RQ 20]
Units/Courses/GPA (actual): 300.00/93.00/2.131

LOWER DIVISION GENERAL EDUCATION REQUIREMENTS FOR ENGINEERING MAJORS [RG31] (new ge)

ENGINEERING GE BLOCK A - BASIC SUBJECTS. A MINIMUM GRADE OF "C" OR BETTER IS REQUIRED IN ALL BASIC SUBJECTS [RQ 96].
Units (required/actual): 12.00/12.00

GE BLOCK A1 - WRITTEN COMMUNICATION

Units/Courses/GPA (actual): 4.00/1.00/3.000

Term	Course		Description	Units	Grade	Code
Fall 98	ENGL	101	COMPOSITION I	4.00	B	EN

GE BLOCK A2 - ORAL COMMUNICATION
Units/Courses/GPA (actual): 4.00/1.00/3.000

Term	Course		Description	Units	Grade	Code
Winter 99	SPCH	150	ORAL COMMUNICATION	4.00	B	EN

GE MATHEMATICS
Units/Courses/GPA (actual): 4.00/1.00/2.300

Term	Course		Description	Units	Grade	Code
Spring 99	MATH	206	CALCULUS I	4.00	C+	EN

GE BLOCK AM AMERICAN INSTITUTIONS [RQ 34]
Complete U.S. History and U.S. Constitution (Integrated or Non-Integrated)
Units (required/actual): 8.00/8.00

U.S. HISTORY
Units/Courses/GPA (actual): 4.00/1.00/3.000

Term	Course		Description	Units	Grade	Code
Spring 99	HIST	202A	U S CIVILIZATION	4.00	B	EN

U.S. CONSTITUTION: Integrated course covering U.S. Constitution and California State/Local Government
Units/Courses/GPA (actual): 4.00/1.00/2.000

Term	Course		Description	Units	Grade	Code
Summer 99	POLS	150	GOVT+AMER SOCIETY	4.00	C	EN

ENGINEERING GE BLOCK B - NATURAL SCIENCES [RQ 103]
Units (required/actual): 4.00/4.00

GE B2B - PHYSICAL SCIENCE WITH INTEGRATED LAB
Units/Courses/GPA (actual): 4.00/1.00/3.000

Term	Course		Description	Units	Grade	Code
Fall 99	PHYS	201	GENERAL PHYSICS	4.00	B	EN

GE BLOCK C HUMANITIES - NON HUMANITIES BASED MAJORS [RQ 60]
Units (required/actual): 12.00/12.00

GE C2 - ARTS
Units/Courses/GPA (actual): 4.00/1.00/2.000

Term	Course		Description	Units	Grade	Code
Spring 00	MUS	150	MUSIC IN WORLD CULTU	4.00	C	EN

GE C3 - PHILOSOPHY AND RELIGIOUS STUDIES
Units/Courses/GPA (actual): 4.00/1.00/3.000

Term	Course		Description	Units	Grade	Code
Summer 99	PHIL	200	INTRO TO COMPARATIVE	4.00	B	EN

GE C4 - LANGUAGES OTHER THAN ENGLISH
Units/Courses/GPA (actual): 4.00/1.00/0.000

Term	Course		Description	Units	Grade	Code
Fall 98	SPAN	20BP	AP:INTERMED SPANISH	4.00	CR	EN

GE BLOCK D - ECONOMICS FOR ENGINEERS [RQ 106]

ENGINEERING GE BLOCK D
Units/Courses/GPA (actual): 4.00/1.00/2.000

Term	Course		Description	Units	Grade	Code
Fall 00	ENGR	300	ECON FOR ENGRS	4.00	C	EN

BLOCK E - LIFELONG UNDERSTANDING [RQ 131]
Units (required/actual): 4.00/4.00

ENGINEERING GE BLOCK E
Units/Courses/GPA (actual): 4.00/1.00/3.300

Term	Course		Description	Units	Grade	Code
Winter 01	CHDV	120	INTIM RELATIONSHP IN	4.00	B+	EN

G.E. DIVERSITY REQUIREMENT [RQ 64]

G.E. DIVERSITY

Units/Courses/GPA (actual): 20.00/5.00/2.720

Term	Course		Description	Units	Grade	Code
Summer 99	PHIL	200	INTRO TO COMPARATIVE	4.00	B	EN
Winter 01	CHDV	120	INTIM RELATIONSHP IN	4.00	B+	EN
Spring 02	SOC	300	CULTURAL EMOTIONS	4.00	C	EN
Fall 02	SOC	341	SOCIOLOGY OF GENDER	4.00	B	EN
Spring 03	COMM	385	SEX & GENDER LANGUAG	4.00	C+	EN

GE ENGINEERING UD THEME [RG32]

Requirement Not Satisfied -

Units (required/actual/needed): 12.00/8.00/4.00

GE UPPER DIVISION THEME C: GENDER IN THE DIVERSITY OF HUMAN EXPERIENCE [RQ 51]

Requirement Not Satisfied -

Units (required/actual/needed): 12.00/8.00/4.00

Natural Sciences

Requirement Not Satisfied -

Units (required/actual/needed): 4.00/0.00/4.00

Social Sciences

Units/Courses/GPA (actual): 4.00/1.00/3.000

Term	Course		Description	Units	Grade	Code
Fall 02	SOC	341	SOCIOLOGY OF GENDER	4.00	B	EN

Humanities

Units/Courses/GPA (actual): 4.00/1.00/2.300

Term	Course		Description	Units	Grade	Code
Spring 03	COMM	385	SEX & GENDER LANGUAG	4.00	C+	EN

++++++++++COLLEGE OF ENGINEERING, COMPUTER SCIENCE, AND

TECHNOLOGY++++++++++

Mechanical Engineering Plan

Requirements Not Satisfied

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING [RG 92]

Requirement Not Satisfied -

Units (required/actual/needed): 146.00/136.00/10.00

LOWER DIVISION REQUIRED COURSES [RQ 2353] (IP)

Requirement Not Satisfied -

Units (required/actual/needed): 68.00/67.00/1.00

LOWER DIVISION REQUIRED MECHANICAL ENGINEERING COURSES

Units/Courses/GPA (actual): 19.00/6.00/1.989

Term	Course		Description	Units	Grade	Code
Spring 02	ME	204	MECH MEASUREMENTS &	4.00	D+	EN
Summer 02	ME	201	STATICS	4.00	C+	EN
Fall 02	CE	210	MATRIX ALGEBRA FOR E	2.00	C	EN
Use in place of ME 210 MATRIX ALGEBRA FOR ENGINEE						
Fall 02	ME	103	INTRO TO MECHANICAL	3.00	A	EN
Winter 03	ME	211	STATS & PROBABILITY	2.00	C-	EN
Winter 04	CE	205	STRENGTH OF MATERIAL	4.00	D	EN
Use in place of ME 205 STRENGTH OF MATERIALS I						

LOWER DIVISION REQUIRED MATH COURSES

Units/Courses/GPA (actual): 20.00/5.00/2.000

Term	Course		Description	Units	Grade	Code
Spring 99	MATH	206	CALCULUS I	4.00	C+	EN
Winter 00	MATH	207	CALCULUS II	4.00	D	EN
Winter 00	MATH	208	CALCULUS III	4.00	C	EN
Summer 00	MATH	207	CALCULUS II	4.00	A	EN
Fall 00	MATH	209	CALCULUS IV	4.00	D	EN

LOWER DIVISION REQUIRED PHYSICS COURSES

Units/Courses/GPA (actual): 16.00/4.00/2.000

Term	Course		Description	Units	Grade	Code

Fall 99	PHYS	201	GENERAL PHYSICS	4.00	B	EN
Winter 00	PHYS	202	GENERAL PHYSICS	4.00	C	EN
Fall 00	PHYS	203	GENERAL PHYSICS	4.00	C	EN
Winter 01	PHYS	204	GENERAL PHYSICS	4.00	D	EN

ADDITIONAL LOWER DIVISION REQUIRED COURSES (IP)

Requirement Not Satisfied -

Units (required/actual/needed): 13.00/12.00/1.00

The following course(s) may be used to satisfy this requirement:

CHEM 101, CS 290, EE 210, ENGR 100, ENGR 207

Term	Course		Description	Units	Grade	Code
Winter 03	CS	290	INTR FORTRAN PROG	2.00	C	EN
Summer 05	EE	210	ELECTRIC MEASUREMENT	1.00	A	EN
Fall 05	CHEM	101	GENERAL CHEM I	5.00		EN
Fall 05	ENGR	207	MATERIALS SCIENCE &	4.00		EN

UPPER DIVISION REQUIRED COURSES [RQ 351] (IP)

Requirement Not Satisfied -

Units/Courses/GPA (actual): 51.00/15.00/2.000

The following course(s) may be used to satisfy this requirement:

ENGR 300, ENGR 301, ME 303, ME 306, ME 310, ME 312, ME 319, ME 320, ME 323, ME 326A, ME 326B, ME 327, ME 497A, ME 497B, ME 497C

Term	Course		Description	Units	Grade	Code
Fall 00	ENGR	300	ECON FOR ENGRS	4.00	C	EN
Winter 03	ENGR	301	ETHICS PROF ENGR	1.00	B-	EN
Spring 03	ME	326A	THERMODYNAMICS I	4.00	D+	EN
Spring 04	ME	323	MACHINE DESIGN I	4.00	D-	EN
Fall 04	ME	306	HEAT TRANSFER I	4.00	C	EN
Fall 04	ME	323	MACHINE DESIGN I	4.00	C-	EN
Winter 05	CE	303	FLUID MECHANICS I	4.00	D	EN
Use in place of ME 303 FLUID MECHANICS I						
Spring 05	ME	310	MECH ENGN WRITING LA	1.00	A	EN
Spring 05	ME	419	COMPUTER AIDED MECH	4.00	B	EN
Use in place of ME 319 COMP AIDED PROBLEM SOLVING						
Summer 05	CE	320	DYNAMICS I	4.00	B	EN
Use in place of ME 320 DYNAMICS I						
Summer 05	ME	312	STRENGTH OF MATERIAL	1.00	B+	EN
Summer 05	ME	326B	THERMODYNAMICS II	4.00	C+	EN

Fall 05	ME	327	MANUFACTURING PROCES	4.00		EN
Fall 05	ME	497A	MECHANICAL ENGR SENI	4.00		EN
Winter 06	ME	497B	MECHANICAL ENGR SENI	4.00		EN

ELECTIVES [RQ 352]

Select courses in consultation with adviser (IP)

Requirement Not Satisfied -

Units (required/actual/needed): 27.00/18.00/9.00

LECTURE COURSES (IP)

Requirement Not Satisfied -

Units (required/actual/needed): 24.00/16.00/8.00

The following course(s) may be used to satisfy this requirement:

ME 321, ME 402, ME 403, ME 406, ME 407, ME 408, ME 409, ME 410, ME 411, ME 414, ME 415, ME 416, ME 421, ME 422, ME 428, ME 430, ME 454, ME 481

Term	Course		Description	Units	Grade	Code
Winter 05	ME	410	CONTROL OF MECH SYST	4.00	C-	EN
Spring 05	ME	416	ENERGY SYSTEMS	4.00	C-	EN
Winter 06	ME	407	DESIGN OF THERMAL SY	4.00		EN
Winter 06	ME	414	MACH DESIGN II	4.00		EN

LABORATORY COURSES (IP)

Requirement Not Satisfied -

Units (required/actual/needed): 3.00/2.00/1.00

The following course(s) may be used to satisfy this requirement:

ME 313, ME 315, ME 412, ME 413, ME 417, ME 431, ME 499

Term	Course		Description	Units	Grade	Code
Summer 05	ME	315	THERMAL SYS LAB I	1.00	B+	EN
Fall 05	ME	499	UNDERGRAD DIRECTED S	1.00		EN

MAJOR UNIT/GPA REQUIREMENTS [RG 2203]

Overall Requirement Not Satisfied -

194 OVERALL UNITS REQUIRED FOR DEGREE [RQ 700]

A MAXIMUM OF 105 COMMUNITY COLLEGE UNITS MAY BE APPLIED

Units/Courses/GPA (actual): 267.00/84.00/2.289

RESIDENCE UNITS IN MAJOR [RQ 358]

Units/Courses/GPA (actual): 136.00/40.00/2.007

2.00 GPA REQUIRED IN MAJOR [RQ 358]

Requirement Not Satisfied -

GPA (required/actual): 2.000/1.711