Program Self-Study Report
For the Degree of Bachelors of Science and Masters Degree in Mechanical Engineering

Submitted by:

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To

The Program Planning Review Committee
San Jose State University
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November 17, 2006
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A. EXECUTIVE SUMMARY

A.1 Degree Titles

San Jose State University awards a Bachelor of Science and Master of Science in Mechanical Engineering degrees with the following areas of focus for undergraduate study:

- Mechanical Design
- Mechatronics
- Thermal / Fluids

And the areas of specialization for graduate study:

- Mechanical Engineering Design
- Controls and Manufacturing Systems
- Thermal/fluid Systems Engineering

A.2 Contact Information

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A.3 Program Planning Review Summary

BSME Program: All constituents (Department Advisory Committee, Employers, Alumni, faculty, and students) agree that the Program Educational Objectives (PEO) defined are appropriate and confirm that the ME Program is achieving these objectives. For the Fall 2005 ABET evaluation, the BSME Program adopted the eleven outcomes from EC2000 Criteria 3. From the ABET 2005 evaluation, ME Program received a full six-year accreditation. Based on our own assessment data presented in the Self-Study Report, the ME Program for undergraduates satisfies all outcomes except 3f (an understanding of professional and ethical responsibility). As a result of our outcomes assessment, several improvements have been implemented to ensure that ME undergraduate students acquire the highest possible level of the skills defined under each outcome. These improvements are listed below:

A. Students design experiments (ME113, ME114, ME120).
B. Team skills are taught and assessed formally (ME111, ME120, ME195A&B).
C. Students address (i.e. identify, formulate, and solve) open-ended problems (ME111, ME113, ME114).
D. Students study the ASME Code of Ethics and discuss in class safety, ethics, and liability issues in engineering (ME195A&B).

E. Students research, present, and discuss in class contemporary engineering applications and their impact in a global and societal context (ME111, ME113, ME114).

**MSME Program:** The MAE Department has defined five Graduate Program Educational Objectives (GPEO) and validated by the Department Advisory Committee. The GPEO were assessed in Fall 2005 by examining the MS project and thesis reports from AY 04-05. The evaluation criteria were developed to address the GPEO. Though majority of the reports satisfied the GPEO, several recommendations were made to the Department to address the findings:

1. Although the level of mathematics and science may vary from project to project, students are expected to use graduate level mathematics and science in their analysis or modeling. In the Design area, students should be encouraged to be more explicit about the relevant mathematics and science.

2. The Department should organize a presentation on literature search and review every semester.

3. By the end of the 1st month, in ME295A and ME299, students should be required to take the online tutorials offered by the SJSU Library, such as Info-Power.

4. By the end of the 1st month, in ME295A and ME299, students document and present a literature review related to their project / thesis.

5. The Graduate Advisor and Study Committee Faculty Advisors will ensure that the topic area selected by their students is appropriate for the degree and is supported by the courses taken by the student.

6. On the Project Proposal Form, a line should be added to indicate the area of specialization.

7. The MAE Department should develop a uniform MS Project Report guideline. One idea may be to simply adopt the University guidelines for thesis.

8. Students should seek a committee chair and appropriate committee members in their field of study. Once the committee is established, it should not be changed without consent of the committee members. Faculty should advise students in their area of expertise.

These recommendations were discussed and adopted by the MAE faculty and the changes are implemented in the 2006/2007 academic year. The new cycle of assessment will be performed on May 2007 graduates.

**A.4 Program Planning and Strategies Summary**

In the Mechanical Engineering Program, several goals and success paths are identified by the MAE faculty and will be implemented within the next 5 years:

- In the Mechanical Design focus area, the goal is to establish a more comprehensive mechanical design curriculum for the ME undergraduate program. This goal can be reached by:
1. Modifying an existing ME 20 course,
2. Creating a hands-on prototyping and machine shop practice lab course,
3. Developing new design courses such as Design Process, Advanced Materials for Design & System Design Integration.

The above courses will be offered in sequence from freshman to senior years.

- In the Mechatronics focus area, the goals are to increase enrollment of undergraduate ME students pursuing Mechatronics study and to strengthen the Mechatronics curriculum at the graduate level. The goals can be reached by:
  1. Providing undergraduate ME students with more relevant information that describes Mechatronics field,
  2. Enhancing the course offerings in the Mechatronics area to include more exciting and engaging electives,
  3. Modernizing and revising several existing Mechatronics courses (ME30, ME190, ME283, ME285)
  4. Implementing a course on Advanced Sensors for Mechatronics for graduate students
  5. Developing a course on Micro and Nano Mechatronics
  6. Hiring an additional faculty member in Mechatronics area

- In the Thermal/Fluid focus area, the goals are to improve the understanding of the engineering fundamentals of undergraduates, increase interaction with industry/government organization, and improve the quality of graduate program in Thermal/Fluid area. These goals can be reached by:
  1. Improving the laboratory experiences of the undergraduates
  2. Improving the teaching skills of the part-time instructors in the Thermal/Fluid area
  3. Soliciting more funding support for thermal/fluid senior projects from industry
  4. Seeking more government/industry-sponsored research in thermal management of electronics
  5. Introducing more project-based assignments requiring written and oral communication skills into the graduate thermal-fluids core classes
  6. Obtaining more funded MS projects
B. PROGRAM PLANNING REVIEW REPORT

B.1 Last Program Planning Review
From the 2005 ABET visit, the following program strengths were identified:

1. The faculty members possess doctoral degrees from well-known institutions and five are professionally registered. The faculty members show great enthusiasm for the program and are readily available to students outside the classroom.

2. The student body is bright and very diverse. The experiences that the many non-traditional students bring to the classroom add a rich dimension to in-class discussions. Students commented very favorably on the strong hands-on curriculum and the availability of the faculty.

3. The facilities supporting the program are excellent. The teaching laboratories possess the modern equipment needed to provide first-class, hands-on experiences for students. The college maintains eight computer labs that are equipped with modern computers loaded with software appropriate to support both stems of the mechanical engineering program.

4. Over the past 10 years the program faculty has received 10 NSF grants to enhance laboratory experiences in the curriculum. The department chair has also secured equipment donations from corporate friends of the department. This entrepreneurial spirit has undoubtedly provided resources that have led to important program improvements.

The assessment process is well organized and it appears to run well. Substantial reliance is placed on student grades in particular assignments related to specific outcomes to determine if an outcome is achieved. A metric used to assess whether an outcome is achieved that all students must achieve a minimum grade on these assignments (typically between 60 to 70 percent). However, there is not a well-defined specification for what level of student performance is required to achieve a score in this range. Two faculty members grading the same student work could assign very different grades, with different perceptions of outcome achievement. Therefore, the program faculty is encouraged to develop a more specific grading guideline to address the reliability of the outcomes assessment process.

To address the above suggestion, the MAE Department plans to explore the use of rubrics-based approach grading system for some selected pilot courses with multiple sections. Appropriate evaluation rubrics for assessing student performance will be developed to address the outcomes. Students will have to achieve a minimum level of performance in a course (for example, a “C” grade) to satisfy the outcomes. In this way, two faculty members grading the same student work will have specific guideline to assign grade to the student.

B.2 Program Planning Overview

B.2.1 Assessment Life-Cycle Processes
The Mechanical Engineering Undergraduate Program Educational Objectives (PEO) have been developed to be consistent with the mission of (a) San Jose State University (SJSU), (b) the College of Engineering (COE) and (c) the Department of Mechanical and Aerospace Engineering (MAE). The PEOs are achieved primarily through the Program curriculum, which is designed to emphasize problem solving, design skills and experiential learning.

The PEOs are linked to the Program Outcomes as shown in Table B.2.1.

Table B.2.1 Relationship between PEOs and Program Outcomes

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<th>Program Outcomes</th>
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Hence, one (indirect) way to evaluate the achievement of the PEO is through the assessment of the Program Outcomes.

Using ABET Criteria 3 as the basis, Program Outcomes and Assessment require that the ME program must demonstrate that graduates:

a. Have an ability to apply knowledge of mathematics, science and engineering.
b. Have an ability to design and conduct experiments, as well as to analyze and interpret data.
c. Have an ability to design a system, component or process to meet desired needs.
d. Have an ability to function on multi-disciplinary teams.
e. Have an ability to identify, formulate and solve engineering problems.
f. Have an understanding of professional and ethical responsibility.
g. Have an ability to communicate effectively.
h. Have the broad education necessary to understand the impact of engineering solutions in a global/societal context.
i. Have a recognition of the need for, and an ability to engage in, life-long learning.
j. Have knowledge of contemporary issues.
k. Have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Each outcome (a – k) is addressed in several courses of the ME curriculum. A subset of these courses was chosen for a thorough assessment of each outcome, as shown in Table B.2.2. With the exception of the three capstone courses (ME157, ME182, ME190), this subset consists solely of required courses taken by all ME students. E10 is the only lower division course included in this set. Lower division courses typically prepare students at skill levels 1 or 2, while upper division courses prepare students at skill levels 3, 4, 5 or 6 of Bloom’s Taxonomy in the particular outcomes they address.
Table B.2.2  Mechanical Engineering Undergraduate Program – Outcome Matrix

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<th>Outcomes</th>
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A Skill level 1 or 2 in Bloom’s Taxonomy
B Skill level 3 or 4 in Bloom’s Taxonomy
C Skill level 5 or 6 in Bloom’s Taxonomy
✓ Skills relevant but not presently assessed

The process of course assessment flow chart is shown below in Figure B.2.1, and in Figure B.2.2, the outcome assessment flow chart is illustrated. These flow charts are implemented as the guide for the ME Undergraduate Program outcome assessment. Upon successful satisfaction of the ME Program Outcomes, the ME PEO are considered to be met by the curriculum in the ME Program.

Course Assessment

Figure B.2.1 shows the process for assessing each of the selected courses. Course coordinators assess their courses for the specific outcomes they address, as indicated in Table B.2.2. They are responsible for ensuring that performance targets are met for each outcome in each of their courses. If the target for a particular outcome is not met, they make recommendations for improvements in that area and take responsibility for implementing these improvements in the course. If they do not teach the particular course, they coordinate the changes with the faculty who teach the course. After the implementation of the improvements, coordinators re-assess the course and re-evaluate student performance against the targets.

Outcome Assessment

Figure B.2.2 shows the process for assessing outcomes. For each outcome there is a designated outcome champion. The faculty members are the outcome champions for the
assessment and each faculty member is the champion for one to two outcomes. Champions look at the data presented in the course binders for each course assessed for their particular outcome and write a one-page evaluation on how well the ME Program produces this outcome and whether the performance targets are met. Outcome champions may meet with course coordinators and instructors of the courses involved in their outcome, discuss their findings and make recommendations for course improvements. The outcome champion provides an additional level of accountability in the process, as there are always several faculty members involved in the assessment and implementation of the skills required in a single outcome. It is not just the course coordinators whom must show evidence that their courses include the necessary elements to satisfy an outcome and collect / analyze data to show that performance targets are met. The outcome champion must also evaluate all this evidence collected and analyzed for individual courses and has the final word on whether the performance of the ME Program is satisfactory with regard to this outcome.

Because outcomes are rather comprehensive and difficult to assess as stated, outcome elements were extracted from each outcome. These elements represent the different abilities specified in a single outcome that would generally require different assessment measures. For instance, Outcome 3a has three (3) outcome elements: (a) ability to apply knowledge of mathematics, (b) ability to apply knowledge of science, (c) ability to apply knowledge of engineering. Moreover, we have defined outcome attributes, i.e. student actions that explicitly demonstrate mastery of the abilities specified in an outcome element. These attributes have been defined at one of the 6 levels of Bloom’s taxonomy in the cognitive domain or 5 levels in the affective domain. Two outcome indicators are used to assess student attainment of program outcomes: (a) course performance ratings based on graded student work and (b) student surveys. To satisfy ABET Criterion 3, we have defined our performance targets as follows: (a) The scores earned by all students, in the assignments and test questions in each selected course, which pertain to a particular outcome, must meet certain level as specified by the course coordinator and outcome champion (60% to 70%), (b) The ratings pertaining to this outcome, given by at least 70% of the students in each class surveyed, must be “I agree” on a 3-point scale. If these targets are met in the courses chosen for assessment of an outcome, the outcome is achieved and no further action is needed in this course. When performance targets are met, courses are assessed on a 3-year cycle. When performance targets are not met in a course, improvements are implemented and the course is assessed on a yearly basis until the targets are met.

For the Mechanical Engineering Graduate Program, the MAE Department has defined five Graduate Program Educational Objectives (GPEO) and validated by the Department Advisory Committee. The GPEOs were assessed in Fall 2005 by examining the MSME project and thesis reports from AY 04-05. The MS project/thesis report evaluation criteria were developed to address the GPEO. Based on the assessment of the MSME project/thesis reports, conclusions are drawn to determined whether the GPEOs were met or not. If the GPEOs are not all satisfied, then recommendations will be made and implemented for the next academic year. The new cycle of GPEO evaluation will then be performed by assessing the MSME project/thesis reports from the new academic year.
Figure B.2.1. Course assessment flow chart
B.2.2 Assessment Life Cycle Matrix (Three-Year Cycle)

The ME Undergraduate Program Outcome assessment life cycle in general is a three-year cycle as shown in the Table B.2.3. Within the three-year period, the designated ME
courses for assessment are completed and ME Program Assessment Outcomes are performed. The recommendations from the assessment for the Outcomes are implemented for curriculum improvement in the next three-year cycle.

Table B.2.3 Undergraduate ME Program Outcome Assessment Life Cycle

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<th>Outcomes</th>
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<td>Fall 07</td>
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<td>Spring 08</td>
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<td>X</td>
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<td>Fall 08</td>
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<td>Spring 09</td>
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<td>Fall 09</td>
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<td>X</td>
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<tr>
<td>Spring 10</td>
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<td></td>
<td></td>
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<td>X</td>
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<tr>
<td>Fall 10</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Graduate Program Assessment Cycle

The graduate program educational objectives were evaluated based on the assessment of MS projects and theses on an annual basis. The first cycle of graduate program assessment was performed in the Fall 2005 and recommendations for changes were made and presented to the faculty in the Department meeting in the Spring 2006. The implementation of the changes adopted by the Department starts in Fall 2006, and the 2nd cycle of assessment on all the MS thesis and project reports from Spring 2007 graduates will be performed in June 2007. The assessment cycle will repeat itself until all graduate program educational objectives are satisfied.

The typical assessment cycle for 2006-2007 is shown in the table below.

<table>
<thead>
<tr>
<th>Spring/Summer 2006</th>
<th>Convene with the ME Advisory Board to validate and evaluate the GPEOs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2006</td>
<td>1. Implement the changes adopted by the MAE Department in Spring 2006.</td>
</tr>
<tr>
<td></td>
<td>2. Administer exit interviews with MSME graduates.</td>
</tr>
<tr>
<td>Summer 2007</td>
<td>1. Assess all the thesis / project reports from the Spring 2007 graduates.</td>
</tr>
<tr>
<td></td>
<td>2. Administer exit interviews with MSME graduates.</td>
</tr>
</tbody>
</table>

B.3 Students

B.3.1 Student Enrollment for the Last Five Years and Projection
Student enrollment in the ME program has been increased steadily for the past five years (2001 to 2005) and reached the peak in Fall 2006. It is our projection that the enrollment will be stabilized for the next two years and perhaps declined as the outlook for other majors than ME improves in Silicon Valley. The table below shows the Fall semester enrollment figures from Year 2001 to 2005 for both undergraduate and graduate programs in Mechanical Engineering.

<table>
<thead>
<tr>
<th></th>
<th>Fall 2001</th>
<th>Fall 2002</th>
<th>Fall 2003</th>
<th>Fall 2004</th>
<th>Fall 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduates</td>
<td>389</td>
<td>414</td>
<td>439</td>
<td>451</td>
<td>474</td>
</tr>
<tr>
<td>Graduates</td>
<td>53</td>
<td>78</td>
<td>110</td>
<td>120</td>
<td>118</td>
</tr>
<tr>
<td>Total</td>
<td>442</td>
<td>492</td>
<td>549</td>
<td>571</td>
<td>592</td>
</tr>
</tbody>
</table>

**B.3.2 Student Sources**

**B.3.2.1 Direct Entry**
The table below list the number of freshman and transfer students as well as graduate students enrolled in the ME Program from AY 2001 to 2005.

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>45</td>
<td>60</td>
<td>47</td>
<td>71</td>
<td>75</td>
</tr>
<tr>
<td>Transfer Students</td>
<td>73</td>
<td>72</td>
<td>72</td>
<td>76</td>
<td>79</td>
</tr>
<tr>
<td>New Graduate Students</td>
<td>31</td>
<td>60</td>
<td>50</td>
<td>58</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>192</td>
<td>169</td>
<td>205</td>
<td>193</td>
</tr>
</tbody>
</table>

**B.3.2.2 Process for Acceptance of New Students**
Generally, first time freshman applicants will qualify for regular admission if they meet the following requirements:

1. Have graduated from high school, have earned a Certificate of General Education Development (GED) or have passed the California High School Proficiency Examination; and
2. Have a qualifyable minimum eligibility index – the eligibility index is the combination of high school grade point average and score on either the ACT or the SAT (Eligibility Index Table is available in the 2006 SJSU catalog on page 438), and
3. Have completed with grades of C or better each of the courses in the comprehensive pattern of college preparatory subject requirements.
Transfer students who have completed fewer than 60 transferable semester college units are considered lower division transfer students. Students who have completed 60 or more transferable semester college units are considered upper division transfer students.

Generally, applicants will qualify for admission as a **lower division transfer student** if they have a grade point average of at least 2.0 (C or better) in all transferable units attempted, are in good standing at the last college or university attended, and meet any of the following standards:

1. Will meet the freshman admission requirements (grade point average and subject requirements) in effect for the term to which they are applying; or
2. Were eligible as a freshman at the time of high school graduation except for the subject requirements, and have been in continuous attendance in an accredited college since high school graduation, and have made up the missing subjects.

Generally, applicants will qualify for admission as an **upper division transfer student** if they meet the following requirements:

1. They have a grade point average of at least 2.0 (C or better) in all transferable units attempted; and
2. They are in good standing at the last college or university attended; and they have completed at least 30 semester units of college coursework with a grade of C or better in each course to be selected from courses in English, arts, and humanities, social science, science and mathematics at a level at least equivalent to courses that meet general education requirements.

**General admission requirements for the MSME Program:**

Students desiring to pursue a MSME degree must satisfy each of the following requirements:

(1) Must hold a Bachelor of Science in Mechanical Engineering (Aerospace Engineering) degree from a Mechanical Engineering Program (Aerospace Engineering Program) accredited by "Accreditation Board of Engineering and Technology" (ABET), or equivalent.*

(2) A minimum grade point average (GPA) of 3.0 on a 4.0 scale over the last 60 semester units completed in engineering and/or science. Conditional admittance may be granted for grade point averages between 2.5 and 3.0.

(3) Students from non-ABET accredited Engineering programs and international universities must have obtained a minimum score of 1100 in verbal and quantitative, and a minimum score of 3.5 in Analytical Writing on the Graduate Record Examination (GRE).

(4) The university admission requires that the students from non-English speaking countries must achieve a minimum TOEFL score of 550.8
Special programs can be developed for those with degrees from other related disciplines. These programs must be approved by the Graduate Studies Committee of the Department.

* This requirement is waived if the language of instruction at the home country is documented to be in English.

B.3.2.3 Internal Transfer Students for Undergraduates

The table below lists the number of internal transfer undergraduate students from other majors within the College of Engineering.

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Transfer Students</td>
<td>75</td>
<td>80</td>
<td>64</td>
<td>70</td>
<td>72</td>
</tr>
</tbody>
</table>

B.3.3 Program Orientation for New Students

Orientation is a mandatory overnight program for all first-time freshmen at the University. All students are required to stay on campus during Orientation. Throughout the program Orientation Advisors will teach new students about SJSU traditions, introduce them to the many resources available on the SJSU campus, knowledgeable Orientation Advisors will guide students and their family through educational experiences about campus programs and services. This fun overnight program will assist new students in making the transition to college. Also during the program, professional staff and Orientation Advisors will advise students about required General Education courses, major courses, and prerequisites.

When new students visit the Department, information will be given to the new students typically include ME Program layout, course prerequisite requirement.

Transfer students make up a significant share of the department’s undergraduate students. Therefore, procedures for handling transfers are formalized and systematic. Upon entry the transfer student meets with the Department Chair or an academic advisor for orientation and initial evaluation of academic progress. A selection of courses for the first term is developed. In addition, the University has the Transfer Information Program (TIP) which is a one-day program that welcomes new transfers to the campus, introduce them to their College, and provide them with critical academic planning information. In this program, SJSU faculty and staff will:

- Introduce key university services
- Help transfer to avoid the stumbling blocks that detract from making a smooth transition
- Provide a hands-on General Education advising workshop
- Explain Advanced General Education requirements and preparation for the WST
- Introduce transfers to their College and academic advising
- Acquaint them with the campus through tours

For new graduate students, students entering the graduate program are given a brief orientation and initial advising by the graduate program coordinator or the department chair.

B.3.4 Advising

B.3.4.1 Advising of New and Continuing Undergraduate Students
For undergraduate students, students entering the program are given a brief orientation and initial advising by the chair and available department academic advisors. Subsequently, continuing students must see a department academic advisor at least once per semester. The Department has appointed three faculty members as student academic advisors, who receive 20% release time (one course) per semester for this purpose. Advisors monitor progress toward the degree, ensure that students follow the published curriculum for their program, take courses (technical and general education) in the proper order, make adjustments to students’ schedules as appropriate, and provide career guidance. This is particularly important for SJSU students, since most of them are working part-time, about 63%. Each semester, an optional general advising group meeting occurs for making curriculum announcements and clarifications, and answering general questions on advising and degree requirements. Subsequently, students are required to see an advisor by individual appointment. A “registration hold” is placed on each student’s record and removed only after the student has seen an academic advisor. Students are also required to develop with the help of their advisor, an acceptable study program and document it on a “major form”, normally filed 15 months prior to graduation. The Academic Advisor and the Department Chair approve the “major form” and forward it, along with the student's application for graduation to the Records Office.

Transfer students make up a significant share of the department’s undergraduate students. Therefore, procedures for handling transfers are formalized and systematic. Upon entry the transfer student meets with the Department Chair or an academic advisor for an initial evaluation of academic progress. A selection of courses for the first term is developed. All transfer courses must have course equivalencies completed and filed before approval of the transfer student’s Major Form. The vast majority of these transfer courses are from California institutions and most are pre-approved by the Articulation Office of the university. The website for checking course articulation is http://www.artic.sjsu.edu. Courses without pre-approved articulation are evaluated on an individual basis by the SJSU course coordinator from the department providing the course in question. Unique situations involving credit from universities outside the US have an additional requirement that they be evaluated for an appropriate level of units by the university.
Materials used to assist students in developing their plans are available on the Mechanical and Aerospace Engineering website http://www.engr.sjsu.edu/mech/majorforms/index.htm. There is an excellent web site as well for faculty reference in their roles as Academic Advisors: <http://www2.sjsu.edu/ugs/arb/index.html>.

The University has established a very detailed General Education curriculum that all undergraduate students must complete (see Appendix II, Exhibit II-8). The Records Office at the University ensures that all students in the Program fulfill the University General Education requirements, and is not the department or program’s responsibility. In addition, students are required to consult with General Education advisors at the Assessment Center in the Office of Admissions and Records. The College of Engineering has two college-level student advising and supporting units: Engineering Student Advising Center and MESA Engineering Program (MEP).

The Engineering Student Advising Center (EAC) was established in Spring 2005. The center provides the following services to all engineering students: general education requirement advising, probation, and student monitoring and advising, study skills workshops, and new student advising. The College of Engineering and EAC do the initial orientation and advising.

The goal of the MESA Engineering Program is to increase the number of competent and qualified graduates entering the engineering profession from groups with low eligibility rates in college admissions. The program provides the following services: student study center, Academic Excellence Workshops, professional development workshops, freshmen orientation, career advising, and support to student organizations.

The university Academic Services provides academic advising and support to all SJSU students. The Learning Assistance Resource Center (LARC, www.sjsu.edu/larc) and Student Advising Center are the two main services units in the Academic Services. LARC offers a variety of services to registered SJSU students, including:

- Individual or group tutoring
- Assistance in building writing skills
- Assistance in lower and upper division mathematics classes
- Skills improvement Seminars
- Group study/Adjunct classes in specific courses
- CBEST and WST test preparation
- Support in basic computer skills

The Student Advising Center offers a variety of services including:

- Drop-in advising on General Education requirements, undeclared advising, ELM/EPT placement, late add and drop processes, academic probation, and disqualification.
- Assistance with Academic Advising Reports and selecting General Education courses
- Group advising sessions
Graduate school planning
- Seminars/workshops on specific topics, e.g., General Education, Academic Planning, Study Skills, Choosing a Major, Probation/Disqualification

B.3.4.2 Advising for Graduate Students
For the graduate program, the Admissions and Records Office of the University processes all applications for admission to ME graduate program with the input from the MAE Graduate Advisor (hereafter called “Advisor”). The Advisor is responsible for advising all admitted students on matters such as the rules and regulations of the MAE Graduate Programs, the selection of courses, the preparations of theses/projects, etc. Typically, each student is advised twice a year (once every semester) with a written notice from the Advisor. Students may be advised by the Advisor or the Department Chair or a designated faculty member, either in person or by email correspondences.

Each graduate student is provided with a ME program graduate course offering schedule and a “Graduate Student Survival Guide”. The “Graduate Student Survival Guide” can be downloaded from the website: http://www engr.sjsu.edu/ragarwal. Students are advised to take Writing Skill Test (WST) during their first semester in the program. They are also advised to complete the University ‘Competency in Written English’ requirement during their first year at San Jose State University.

B.3.5 Monitoring Student Performance

Undergraduate student performance is monitored at both the University and Department levels. The Office of Admissions and Records places “on probation” any student whose cumulative grade point average (GPA) falls below 2.0 (“C”). Students are “disqualified” from the major if their GPA falls below 2.0 for two consecutive semesters. Department academic advisors monitor student progress and grade performance through the accumulative checklist in the student’s advising folder and the major form filed, normally, 15 months prior to graduation (Appendix D).

Graduate student performance is monitored by the University and the Department Graduate Program Advisor. The graduate advisor who receives a 20% release time for advising graduate students is responsible for making decision for admission, processing all the paperwork related to the program, along with monitoring students’ performance until their completion of the program. Students are not allowed to register for classes without going through advising and evaluation of their performance every semester. A permanent record of students’ current and past coursework and performance is kept by the advisor.

B.3.6 Meeting Program Requirements
To ensure that **undergraduate students** have a good grasp of fundamental concepts that serve as the basis for more advanced design and analysis courses, students are required to earn a minimum grade of “C” in key communication and mathematics courses (English 1A, 1B, Technical Writing E100W, Oral Communication, Math\(^1\) 30, 31, 32), a minimum grade of “C-” in science courses (Chemistry 1A, Physics 50, 51, 52 or 70, 71) and in key engineering courses (CE99, CE112, ME101, ME111, ME113, ME130). Students who do not earn the required minimum grade in any of these courses must repeat them before registering in more advanced courses. Moreover, students need to pass the Writing Skills Test (WST) before registering in E100W and they must receive a minimum score of 6 out of 12 on their exit exam essay to receive a passing grade in the course itself. WST tests and E100W final exam papers are graded by certified instructors.

The graduate advisor is responsible for ensuring that all **graduate students** meet and satisfy the program requirement. Several forms and booklets are made available to students, which outline the requirements for successfully completing the MSME program. The booklet, ‘Survival Guide’ provides a detailed description of program requirements for ME program. An Advising form, which students are require to complete before their hold is cleared, lists students’ completed coursework with the grades obtained, along with the list of courses currently in progress and planned for next semester.

### B.4 Program Educational Objectives

#### B.4.1 Constituencies

The MAE Department has identified the following as its constituents for the undergraduate program:

- ME graduating students
- Department Faculty
- Alumni of the ME program
- Employers of the ME program graduates
- Department Advisory Committee

#### B.4.2 Program Mission

The Mechanical Engineering Undergraduate Program Educational Objectives (PEO) have been developed to be consistent with the mission of (a) San Jose State University (SJSU), (b) the College of Engineering (COE) and (c) the Department of Mechanical and Aerospace Engineering (MAE).

---

\(^1\) The CSU GE Basic Skills Course graduation requirement is that engineering students must receive a “C-” or better in all the courses required for the Program.
B.4.2.1 SJSU Mission Statement

San Jose State University is a major comprehensive public university located in the city of San José and in the heart of Silicon Valley, the world’s center of innovation. Its distinctive character has been forged by its long history, by its location, and by its vision - a blend of the old and the new, of the traditional and the innovative. Among its most prized traditions is a commitment to offer access to high-quality higher education to all persons who meet the criteria for admission. The result is a diverse student community whose members are from various age groups, cultures, and economic backgrounds; and a faculty dedicated to teaching and learning.

The mission of the University is to enrich the lives of its students, to transmit knowledge to its students along with the necessary skills for applying it in the service of our society, and to expand the base of knowledge through research and scholarship. It emphasizes the following goals for both undergraduate and graduate students:

- in-depth knowledge of a major field of study;
- broad understanding of the sciences, social sciences, humanities, and the arts;
- skills in communication and in critical inquiry;
- multi-cultural and global perspectives gained through intellectual and social exchange with people of diverse economic and ethnic backgrounds;
- active participation in professional, artistic, and ethnic communities responsible citizenship and an understanding of ethical choices inherent in human development.

B.4.2.2 Vision and Mission of the College

The College has developed its vision and mission with participation from faculty, students, staff, alumni, and industry during the past year.

Vision

We are a learning community that empowers its students to better the world through innovative applications of engineering knowledge and skills.

Our vision for the College is to provide our students and our faculty, through a community of scholarship and life-long learning, the opportunities and tools needed to succeed in their endeavors to bring technological innovation to bear on problems from a global perspective. We intend to focus our energies on instilling in our students a passion for learning and a framework for its beneficial application.

Mission
The College of Engineering has the mission of providing an empowering educational opportunity to students for their technical professional and social development in a competitive and dynamic global society.

We will accomplish this by building a vibrant community of students, faculty, staff and industry professionals through strategic collaborations with alumni, and Silicon Valley, California, national, and global partners.

Goals

The College has identified three goals to achieve its vision and mission.

- To be preeminent among undergraduate engineering institutions in the U. S.
  - Nationally recognized for engagement with local and global industries
  - Preferred California State University campus for undergraduate engineering education
  - Nationally recognized for curriculum and quality of undergraduate experience

- To be a nationally recognized, professionally oriented graduate engineering program
  - Nationally recognized for an applied technological curriculum
  - Coordinated graduate and outreach programs responsive to regional industry

- To be the preferred partner for applied research and development
  - Initiating centers of excellence and programs

It is noted that our vision is also aligned with the ABET learning outcomes that all of our courses and co-curricular programs strive to provide. Our mission addresses those outcomes by embedding them in a community of scholarship that takes advantage of our unique position in the Silicon Valley and Pacific Rim areas of opportunity and dynamism. Our student internships and partnerships with local and global industry offer students unique opportunities to excel.

B.4.2.3 MAE Department Mission

To serve society, the public sector, and private industry by:

- Providing undergraduate and graduate Mechanical and Aerospace engineering education that prepares students with the knowledge, modern applications and lifelong learning skills required to serve the engineering profession and industry.
- Contributing to the development and application of knowledge through faculty scholarship.
- Preparing students for the modern professional-practice environment.
B.4.3 Mechanical Engineering Program Educational Objectives for Undergraduate Program

The undergraduate Mechanical Engineering Program is designed to fulfill the University, College, and Department mission described in the previous sections. It provides students with a broad understanding of basic Mechanical engineering concepts, as well as the contemporary skills required by industry. The foundation courses provide a basis for professional competence and the required knowledge to focus on a particular specialization upon graduation, either in the work environment or through pursuing advanced degrees. Courses that develop contemporary skills provide students an ability to be immediately competitive and productive as they begin their professional careers. The coursework includes extensive laboratory experiences and many opportunities for students to complete applied projects and designs.

The Mechanical Engineering Program Educational Objectives (PEO) reflects our constituents’ expectations that our graduates should have:

1. A strong foundation in mathematics, basic science and engineering fundamentals, to successfully compete for entry-level positions or pursue graduate studies in ME or related fields.

2. Contemporary professional and lifelong learning skills including hands-on laboratory experience, familiarity with computers, modern software, and information technology, to successfully compete in the local, national and global engineering market.

3. Strong communication and interpersonal skills, broad knowledge, and an understanding of multicultural and global perspectives to work effectively in multidisciplinary teams, both as team members and as leaders.

4. An understanding of the ethical choices inherent in the engineering profession to deal with issues such as public safety, product marketing, and respect for intellectual property.

Development and Evaluation of PEO

In Spring of 2003, our PEO were revised to conform to the new ABET definition, namely that PEO reflect the career and professional accomplishments of our graduates during the first several years after graduation. The input from our constituents is used for two purposes: (a) to validate the definition of our PEO, and (b) to assess the achievement of our PEO. This process is illustrated in Figure B.4.1. Our PEO are revisited periodically every three years. They are evaluated and revised as necessary based on feedback from employers, alumni, faculty, department advising committee, and students.
B.4.4 Program Educational Objectives for Graduate Program

The MAE Department has defined five Graduate Program Educational Objectives (GPEOs) and validated by the Department Advisory Committee. The Graduate Program Educational Objectives (GPEOs) of the MSME Program reflect that graduates are expected to obtain:

1. A strong foundation beyond the undergraduate level in their chosen focus area as well as in mathematics, basic science and engineering fundamentals, to successfully compete for technical engineering positions in the local, national and global engineering market, advance in their current position or pursue doctoral studies.

2. Professional and lifelong learning skills to be able to apply and extend theory to solve practical contemporary engineering problems.

3. The expertise necessary to design mechanical or aerospace engineering systems with possible specialization in areas such as: Energy Systems, Electronics Cooling, Electronics Packaging & Reliability, Finite Element Analysis & CAD, Mechatronics & MEMS, Product Design, Robotics, Automation & Manufacturing.
4. Strong verbal and written communication skills, including the ability to read, write, and comprehend technical documents.

5. Think and work independently to perform design and in-depth analysis in solving open-ended mechanical engineering problems.

When the GPEO were evaluated and satisfied, then the program outcomes for graduate program are met. The GPEO were evaluated by assessing the MS project and thesis reports.

The following criteria were used to evaluate each MS project / thesis report:

**Thesis / Project Evaluation Form**

<table>
<thead>
<tr>
<th>GPEO addressed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1</td>
<td>Application of mathematics appropriate for graduate level</td>
</tr>
<tr>
<td>1 2</td>
<td>Application of science appropriate for graduate level</td>
</tr>
<tr>
<td>1 3</td>
<td>Application of engineering fundamentals appropriate for graduate level</td>
</tr>
<tr>
<td>2 4</td>
<td>Use of modern tools (computational or experimental)</td>
</tr>
<tr>
<td>2 5</td>
<td>Appropriate literature search (# and appropriateness of references cited)</td>
</tr>
<tr>
<td>2 6</td>
<td>Understanding of the cited literature (summary of previous work)</td>
</tr>
<tr>
<td>2 7</td>
<td>Understanding of the work performed in the project</td>
</tr>
<tr>
<td>3 8</td>
<td>In-depth analysis and / or design of an ME or AE system</td>
</tr>
<tr>
<td>4 9</td>
<td>Correct language and terminology</td>
</tr>
<tr>
<td>4 10</td>
<td>Abstract, ability to summarize, draw conclusions</td>
</tr>
<tr>
<td>4 11</td>
<td>Appropriate use of graphs and tables</td>
</tr>
<tr>
<td>5 12</td>
<td>Clear objectives (problem definition)</td>
</tr>
<tr>
<td>5 13</td>
<td>Appropriate assumptions / modeling of the problem</td>
</tr>
</tbody>
</table>

**Scale:** 1 = Lacking, 2 = Weak, 3 = Acceptable, 4 = Good, 5 = Excellent

Total Score (L=13-25, W=26-38, A=39-49, G=50-59, E=60-65)  
L = Lacking, W = Weak, A = Acceptable, G = Good, E = Excellent  
Max Possible Score = 65

A score of three (3) or above is necessary to satisfy each GPEO.
B.4.5 Assessment of Program Educational Objectives

B.4.5.1 Direct Evaluation of the Undergraduate PEO

Table B.4.1 shows the various tools we use to evaluate achievement of the PEO.

<table>
<thead>
<tr>
<th>Faculty evaluation</th>
<th>Exit interviews</th>
<th>Employment data</th>
<th>Graduates completing M.S. degree</th>
<th>Alumni survey</th>
<th>Employer survey</th>
<th>Department Advisory Committee Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEO # 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
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<td>✓</td>
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<tr>
<td>PEO # 3</td>
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</tr>
<tr>
<td>PEO # 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

B.4.5.2 Faculty Evaluation of the PEO

Two department meetings (April 5 and April 12, 2005) were dedicated to the evaluation of the PEO by the faculty. Each PEO was presented and faculty were asked to share their opinion on how well our students meet the PEO by the time they graduate, based on their interactions with students in their courses. A summary of the results, along with the scale used to record faculty input is shown in table B.4.2

5: Students truly excel in these skills!
4: Students have strong skills in this area.
3: Students have adequate skills in this area.
2: Students do not have adequate skills in this area.
1: Students do not have any skills in this area.
In general, the faculty felt that most of our students:

- (PEO # 1) Have adequate skills in mathematics, science, and engineering fundamentals to compete for entry-level positions, but they are less prepared in this area for graduate studies. This observation is reinforced by the fact that most of our students seek employment after graduation and only a small percentage continues their studies in graduate school.
- (PEO # 2) Are well prepared in contemporary professional and lifelong learning skills to compete in the local, national and global engineering market. They are more capable in conducting experiments and building models and applying computer skills than they are in the design of experiments, data analysis and interpretation.
- (PEO # 3) Are excellent presenters but only adequate writers. Our rigorous general education program and multicultural campus environment provide them with broad knowledge, as well as understanding of multicultural and global perspectives. They work well in teams and many of them have excellent leadership skills.
- (PEO # 4) Have a good understanding of the ethical issues that arise in their profession, however, their choices are not always ethical, especially when it comes to issues related to academic honesty and the respect of intellectual property.

B.4.5.3 Evaluation of the PEO through Exit Interviews

Thirty-nine (39) graduating seniors have been interviewed by one department AE faculty member (Fall 2003 through Spring 2005). The three open-ended questions that were used in these interviews, along with a summary of the most frequent student responses, are shown below.

Question 1: What do you think are the most important skills for a ME to compete successfully for entry-level positions in industry or entry to a graduate program?

The top six skills mentioned are as follows:

- 64% (25) communication skills (oral and written, report writing, documentation, ability to debate)
- 46% (18) team / interpersonal skills
- 38% (15) project skills (ability to carry out a project, design-build-test, etc.)
- 36% (14) basic engineering science skills
- 23% (9) management / leadership / business skills / engineering economics
- 23% (9) professionalism (attitude towards responsibilities, good work ethics)

The student responses indicate that all four PEO are valid educational objectives for the ME Program.
Question 2: Do you feel that our ME program prepared you adequately in the skills you consider important? Which courses prepared you for these skills?

- Communication skills:
  - Yes = 51% (20) ME195 (13), ME120 (6), E100W (4), ME154 (4), ME157 (4)
  - No = 13% (5)

- Team / interpersonal skills:
  - Yes = 31% (12) ME195 (8), ME154 (6), ME157 (5), ME106 (3)
  - No = 15% (6)

- Project skills:
  - Yes = 33% (13) ME195 (8), ME110 (7), ME106 (3)
  - No = 5% (2)

- Basic engineering science skills:
  - Yes = 31% (12) ME113 (7), ME114 (7), ME154 (6), CE112 (5), ME111 (4)
  - No = 5% (2)

- Management / leadership / business skills / engineering economics:
  - Yes = 8% (3) ME157 (2), General Education Courses (1), ME195 (1)
  - No = 15% (6)

- Professionalism and ethics:
  - Yes = 13% (5) ME195 (2), E100W (1), ME120 (1), ME154 (1), ASME (1)
  - No = 10% (4)

The student responses indicate that the ME Program achieves PEO # 1, 2, and 3. However, the students were split on whether the Program achieves PEO # 4 (professionalism and ethics).

Question 3: Do you have any comments, positive or negative, about the ME program?

On the positive side students’ top choices were:

- 33% (13) the effectiveness, responsiveness, knowledge, and availability of the faculty
- 23% (9) the overall quality of the ME Program
- 18% (7) the labs in courses such as MatE25 (1), CE113 (1), ME110 (3), ME114 (2)

On the negative side students’ top concerns were:

- 15% (6) the quality of teaching from some of the faculty
- 15% (6) the inadequacy of some of the labs and college facilities

B.4.5.4 Evaluation of the PEO through Employment Data of BSME Graduates

Fifty-five (55) alumni surveys have been received through Spring 2005 (Table B.4.3). The most frequent job titles among the respondents were design engineer, systems
engineer, and mechanical engineer. The types of jobs our ME graduates hold indicate that the ME Program prepares them well for these positions.

<table>
<thead>
<tr>
<th>Job Title</th>
<th># of Alumni</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Engineer</td>
<td>11</td>
</tr>
<tr>
<td>Systems Engineer</td>
<td>9</td>
</tr>
<tr>
<td>Mechanical Engineer</td>
<td>8</td>
</tr>
<tr>
<td>Consultant / Contactor</td>
<td>4</td>
</tr>
<tr>
<td>Project Engineer / Manager</td>
<td>4</td>
</tr>
<tr>
<td>Applications Engineer</td>
<td>3</td>
</tr>
<tr>
<td>Quality / Reliability Engineer</td>
<td>3</td>
</tr>
<tr>
<td>Product Development / Support Engineer</td>
<td>3</td>
</tr>
<tr>
<td>Other engineering jobs</td>
<td>17</td>
</tr>
</tbody>
</table>

B.4.5.5 Evaluation of PEO through M.S. Degree Completion Data

As was mentioned earlier, most of our students seek employment after graduation. Nevertheless, our alumni survey shows that 25% (14) of them were enrolled in a graduate program at the time they filled out the survey, 36% (5) of them in the MSME (SJSU), 36% (5) at Santa Clara University (MBA, Engineering Management), one at CSU Hayward (MBA), and the rest at other SJSU programs. Another 26% (10) of the respondents had already acquired their graduate degree (5 from SJSU, 2 from Santa Clara U., one from Stanford) at the time they filled out the survey.

B.4.5.6 Evaluation of the PEO through Alumni Surveys

Respondents graduated with a BSME as early as 1987 (1) and as late as 2004 (10). Table B.4.4 shows a summary of their responses. The majority of them agreed that the skills described in the PEO are important in the work they do. With the exception of two areas, the majority of the respondents also agreed that the ME Program has adequately prepared them in these skills. The two areas in which respondents gave very low agreement ratings were:

- Students’ preparation for graduate work (statement 1-7, PEO # 1) with an agreement rating of 42% (23)
- Broad knowledge as well as an understanding of multi-cultural and global perspectives in engineering (statement 3-5, PEO # 3), with an agreement rating of 44% (24).

2 Alumni were asked to indicate all the jobs they held since graduation, hence the total number of jobs shown is greater than the number of surveys received.
Table B.4.4  Summary of alumni responses on the importance and achievement of the PEO

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>The ME Program has given me a strong foundation in mathematics.</td>
<td>43</td>
<td>9</td>
</tr>
<tr>
<td>1-2</td>
<td>A strong foundation in mathematics <em>is important</em> for the kind of work I do.</td>
<td>40</td>
<td>9</td>
</tr>
<tr>
<td>1-3</td>
<td>The ME Program has given me a strong foundation in science (physics, chemistry, materials, etc.).</td>
<td>49</td>
<td>6</td>
</tr>
<tr>
<td>1-4</td>
<td>A strong foundation in science <em>is important</em> for the kind of work I do.</td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td>1-5</td>
<td>The ME Program has given me a strong foundation in engineering fundamentals.</td>
<td>53</td>
<td>3</td>
</tr>
<tr>
<td>1-6</td>
<td>A strong foundation in engineering fundamentals <em>is important</em> for the kind of work I do.</td>
<td>54</td>
<td>2</td>
</tr>
<tr>
<td>1-7</td>
<td>The ME Program has given me a strong foundation for graduate work.</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>2-1</td>
<td>The ME Program has prepared me well for hands-on laboratory work.</td>
<td>41</td>
<td>9</td>
</tr>
<tr>
<td>2-2</td>
<td>Hands-on laboratory work <em>is important</em> for the kind of work I do.</td>
<td>46</td>
<td>2</td>
</tr>
<tr>
<td>2-3</td>
<td>The ME Program has given me the necessary skills to work with computers (doing design, simulation, data acquisition and processing).</td>
<td>37</td>
<td>7</td>
</tr>
<tr>
<td>2-4</td>
<td>Computer work (design, simulation, data acquisition and processing) <em>is important</em> for the kind of work I do.</td>
<td>46</td>
<td>2</td>
</tr>
<tr>
<td>2-5</td>
<td>The ME Program has given me the necessary skills to find information and learn on my own.</td>
<td>42</td>
<td>10</td>
</tr>
<tr>
<td>2-6</td>
<td>The ability to find information and learn on my own <em>is important</em> for the kind of work I do.</td>
<td>55</td>
<td>1</td>
</tr>
<tr>
<td>3-1</td>
<td>The ME Program has given me good communication skills.</td>
<td>36</td>
<td>13</td>
</tr>
<tr>
<td>3-2</td>
<td>Good communication skills <em>are important</em> for the kind of work I do.</td>
<td>52</td>
<td>3</td>
</tr>
<tr>
<td>3-3</td>
<td>The AE/ME Program has given me good interpersonal, team, and leadership skills.</td>
<td>37</td>
<td>13</td>
</tr>
<tr>
<td>3-4</td>
<td>Good interpersonal, team, and leadership skills <em>are important</em> for the kind of work I do.</td>
<td>53</td>
<td>3</td>
</tr>
<tr>
<td>3-5</td>
<td>The ME Program has given me a broad knowledge as well as an understanding of multicultural and global perspectives in engineering.</td>
<td>24</td>
<td>15</td>
</tr>
<tr>
<td>3-6</td>
<td>A broad knowledge as well as an understanding of multicultural and global perspectives in engineering <em>are important</em> for the kind of work I do.</td>
<td>36</td>
<td>11</td>
</tr>
</tbody>
</table>
4-1 The ME Program has given me an understanding of the ethical choices inherent in the engineering profession to provide for issues such as public safety, honest product marketing, and respect for intellectual property.

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>14</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

4-2 An understanding of the ethical choices inherent in the engineering profession to provide for issues such as public safety, honest product marketing, and respect for intellectual property is important for the kind of work I do.

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

B.4.5.7 Evaluation of the PEO through Employer Surveys

Six (6) employer surveys were received through Spring 2005 from companies that have hired 14 of our BSME graduates (GE Nuclear Energy, Motion Control Engineering, ATK Thiokol, Therma Corporation, CCS Associates, and Coen Company). Although the number of surveys received is too small to draw any conclusions it is noted that all made positive comments about the mechanical engineers they have hired from SJSU. Table B.4.5 shows a summary of their responses. The majority of them agreed that the skills described in the PEO are important in the kind of work they do. Moreover, the employers who responded agreed that the ME Program adequately prepares our graduates in most of the skills described by the PEO. However, in some of the skills, such as hands-on laboratory work (statement 2-1, PEO # 2), broad knowledge / understanding of multi-cultural and global perspectives (statement 3-5, PEO # 3), and understanding of ethical choices (statement 4-2, PEO # 4)], the agreement ratings were low.

Table B.4.5 Summary of employer responses on the importance and achievement of the PEO

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>We are very satisfied with the SJSU mechanical engineers we have hired.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1-1</td>
<td>SJSU mechanical engineers have a strong foundation in mathematics.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>A strong foundation in mathematics is important for the kind of work we do in our company.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1-3</td>
<td>SJSU mechanical engineers have a strong foundation in science (physics, chemistry, materials, etc.).</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1-4</td>
<td>A strong foundation in science is important for the kind of work we do in our company.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>SJSU mechanical engineers have a strong foundation in engineering fundamentals.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1-6</td>
<td>A strong foundation in engineering fundamentals is important for the kind of work we do in our company.</td>
<td>5, 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SJSU mechanical engineers are well prepared for hands-on laboratory work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>2-2</td>
<td>Hands-on laboratory work is important for the kind of work we do in our company.</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2-3</td>
<td>SJSU mechanical engineers have the necessary skills to work with computers (doing design, simulation, data acquisition and processing).</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2-4</td>
<td>Computer work (design, simulation, data acquisition and processing) is important for the kind of work we do in our company.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2-5</td>
<td>SJSU mechanical engineers have the necessary skills to find information and learn on their own.</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2-6</td>
<td>The ability to find information and learn on their own is important for the kind of work we do in our company.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>3-1</td>
<td>SJSU mechanical engineers have good communication skills.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>3-2</td>
<td>Good communication skills are important for the kind of work we do in our company.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>3-3</td>
<td>SJSU mechanical engineers have good interpersonal, team, and leadership skills.</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>3-4</td>
<td>Good interpersonal, team, and leadership skills are important for the kind of work we do in our company.</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>3-5</td>
<td>SJSU mechanical engineers have a broad knowledge as well as an understanding of multicultural and global perspectives in engineering.</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3-6</td>
<td>A broad knowledge as well as an understanding of multicultural and global perspectives in engineering are important for the kind of work we do in our company.</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>4-1</td>
<td>SJSU mechanical engineers have an understanding of the ethical choices inherent in the engineering profession to deal with issues such as public safety, honest product marketing, and respect for intellectual property.</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4-2</td>
<td>An understanding of the ethical choices inherent in the engineering profession to deal with issues such as public safety, honest product marketing, and respect for intellectual property is important for the kind of work we do in our company.</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

**B.4.5.8 Evaluation of the PEO through Department Advisory Committee Input**

The Department Advisory Committee convened on April 26, 2005 to accomplish two objectives: (a) validate our definition of the PEO, and (b) determine whether the PEO are addressed well through the current ME curriculum.
Table B.4.6  PEO importance rating by the ME Advisory Committee

<table>
<thead>
<tr>
<th>PEO #</th>
<th>Average</th>
<th>CM1</th>
<th>CM2</th>
<th>CM3</th>
<th>CM4</th>
<th>CM5</th>
<th>CM6</th>
<th>CM7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.0</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<tr>
<td>2</td>
<td>3.6</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
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<tr>
<td>3</td>
<td>2.3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
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<td>2</td>
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<tr>
<td>4</td>
<td>2.3</td>
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<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

How important is this PEO?
5: Very important!
4: Important.
3: I am not sure.
2: Not important.
1: Irrelevant / should not be included.

Table B.4.7  PEO evaluation by the Department Advisory Committee

<table>
<thead>
<tr>
<th>PEO #</th>
<th>Average</th>
<th>CM1</th>
<th>CM2</th>
<th>CM3</th>
<th>CM4</th>
<th>CM5</th>
<th>CM6</th>
<th>CM7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.0</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<td>5</td>
</tr>
<tr>
<td>2</td>
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<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>4.3</td>
<td>5</td>
<td>3</td>
<td>5</td>
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<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>3.3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

How well is this PEO addressed through the ME curriculum?
5: Very well!
4: Well.
3: Adequately.
2: Not adequately.
1: It is not addressed at all.

In regards to the importance of our current PEO, the response was unanimous that PEO #1 is very important (Table B.4.6). However, the Committee members felt that PEO #2 is relatively important, and they seemed to agree that PEO #3 and PEO #4 are not important. In regards to how well our current curriculum addresses these objectives, the Committee found that the first three PEO are addressed very well through the ME curriculum while the last one is addressed adequately (Table B.4.7).

B.4.5.9 Conclusions

In summary, faculty, students, and alumni seem to agree that all four of the PEO are important for our ME Program. However, from the limited number of surveys received, it seems that employers of our ME graduates do not consider an understanding of ethical choices as important for the kind of work they do. This was also confirmed through the Department Advisory Committee input, which categorized both PEO #3 and 4 as not very important.

In regards to how well the ME Program addresses the PEO, students felt that they are not getting enough training in professionalism and ethics, while faculty expressed concerns about some students’ academic honesty and respect of intellectual property (PEO #4).
large percentage of ME alumni indicated that the level of preparation for graduate work (PEO # 1) as well as for work in a multi-cultural and global environment was not adequate. The latter was also confirmed by the responses in the employer survey.

B.4.6 Achievement of PEO

The PEO for undergraduate program are achieved primarily through the Program curriculum, which is designed to emphasize problem solving, design skills and experiential learning. Building on a foundation of mathematics, science, and engineering skills, students take courses in the basic engineering disciplines (circuit analysis, statics, mechanics of materials, dynamics, fluid mechanics, and thermodynamics). In addition, they take a series of courses across the disciplines that apply engineering principles to mechanical engineering systems, emphasizing teamwork and communication skills, open-ended problem solving, modern software, and laboratory experiments ranging from basic measurements to systems-level experimentation. Finally, the seniors integrate their skills in a year-long mechanical engineering design project, in which they undertake a team-based design subject to realistic constraints, such as economic, environmental, social, safety, liability, and manufacturability. Additional exposure to these issues comes through case studies, guest speakers and experts from industry, and field trips.

Students take also a minimum of four elective courses plus a capstone course that allows them to explore one mechanical engineering focus area in more depth and develop specialized skills or focus on applications of immediate use in industry. Some electives involve considerable computer-based skills, some involve laboratory hands-on experience, some involve significant design experience, and several require oral presentations and/or written reports.

Non-curriculum mechanisms that support student achievement and growth include:

- Department-level student engineering societies: ASME (American Society of Mechanical Engineers), SAE (Society of Automotive Engineers), ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), AFE (Association of Facilities Engineering), and Pi Tau Sigma (Mechanical Engineering Honor Society).
- College-level student societies: AISES (American-Indian Science and Engineering Society), BASE (Black Alliance of Scientists and Engineers), MESA Engineering Program, (MEP), SME (Society of Manufacturing Engineers), SOLES (Society of Latino Engineers and Scientists), SWE (Society of Women Engineers), VESA (Vietnamese Engineering Students Association), and Tau Beta Pi (Engineering Honor Society).
- Department provision of financial, technician, and technical support for students in the senior design projects and students entering regional and national design competitions.
B.5 Program Outcomes and Assessment
B.5.1 Curriculum and Professional Component
B.5.1.1 Undergraduate Program
B.5.1.1.1 Mechanical Engineering Curriculum Design and Content

<table>
<thead>
<tr>
<th>Thermal-Fluids</th>
<th>Design</th>
<th>Mechatronics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capstone: ME182</td>
<td>Capstone: ME157</td>
<td>Capstone: ME190</td>
</tr>
<tr>
<td>Plus 4 Technical Electives:</td>
<td>Electives: ME188</td>
<td>Electives: ME192</td>
</tr>
<tr>
<td>ME 186</td>
<td>ME186</td>
<td>ME 189</td>
</tr>
<tr>
<td>ME 184</td>
<td>ME184</td>
<td>ME 188</td>
</tr>
<tr>
<td>ME 183</td>
<td>ME165</td>
<td>ME 187</td>
</tr>
<tr>
<td>ME 149</td>
<td>ME160</td>
<td>ME 184</td>
</tr>
<tr>
<td>ME 146</td>
<td>ME 149</td>
<td>ME 169</td>
</tr>
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<td>ME 145</td>
<td>ME145</td>
<td>ME 136</td>
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<tr>
<td>AE 169</td>
<td>ME 136</td>
<td>ME110</td>
</tr>
<tr>
<td>AE 167</td>
<td>ME110</td>
<td></td>
</tr>
<tr>
<td>AE 164</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AE 162</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Experimental Methods: | ME 120 |
| Mechanical Design:   | ME 154 |
| Applied Engineering Analysis: | ME 130 |

<table>
<thead>
<tr>
<th>Thermal-Fluids</th>
<th>Solid Mechanics</th>
<th>Dynamics &amp; Controls</th>
<th>Electronics &amp; Electromechanics</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 114</td>
<td>CE 113</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 113</td>
<td>CE 112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 111</td>
<td>CE 99</td>
<td>ME 147</td>
<td>ME 106</td>
</tr>
<tr>
<td></td>
<td>MatE 25</td>
<td>ME 101</td>
<td>EE 98</td>
</tr>
</tbody>
</table>

| Engineering Fundamentals: | E10 (Introduction to Engineering), ME20 (Design & Graphics), ME30 (Computer Applications), E100W (Engineering Reports) |
| Science:                  | Physics 70 (Mechanics), Physics 71 (Electricity & Magnetism), Physics 72 (Atomic Physics), Chemistry 1A (General Chemistry) |
| Mathematics:             | Math 30 (Calculus I), Math 31 (Calculus II), Math 32 (Calculus III), Math 133A (Differential Equations) |

Figure B.5.1 ME Curriculum Design

The ME curriculum is vertically integrated as shown in Figure B.5.1. Foundational engineering sciences (thermal-fluids, solid mechanics, dynamics & control, electronics &
Electromechanics) build upon mathematics, science, and basic engineering skills. Two additional required courses give students advanced mathematics (ME130), experimentation (ME120), and mechanical design (ME154) skills. The curriculum concludes with both a synthesis of engineering skills in the senior design project, as well as a concentration focusing in one of three specialization areas: thermal-fluids, design, or mechatronics. Students may focus in one area or mix and match electives, however, they must take at least one of the 3 capstone courses.

**General Education:** The ME curriculum includes 33 semester units of GE courses, consistent with a detailed plan established by the University. Courses in written and oral communication, humanities, and social science provide a broad exposure to issues that affect today’s society. In particular, the junior level technical writing course (E100W) requires students to analyze and discuss the environmental impact of engineering processes, products, and systems.

**Mathematics and Basic Sciences:** The ME curriculum includes 33 units of mathematics and basic sciences: five math courses (Calculus I, II, III, Differential Equations, Applied Engineering Analysis), three physics courses (Mechanics, Electricity and Magnetism, Atomic Physics) and a course in General Chemistry.

**Technical Curriculum** (requirement = 1.5 years or 48 units of engineering topics that include engineering sciences and engineering design): The ME curriculum includes 72 units of engineering topics, 15 of which are lower division and 57 are upper division. All upper division courses emphasize engineering problem solving through mathematical and physical modeling, while some of them include open-ended problems (ME111, ME113, ME114, ME147, ME154 among others) and computer modeling / simulations (ME113, ME114, ME160, ME165 among others), and design (ME110, ME145, ME146 ME154, ME157, ME160, ME165, ME182, ME183, ME186, ME188, ME189 among others). The capstone course in each concentration requires system-level synthesis of stem-based skills.

**Experimentation / Laboratory Testing:** The ME curriculum includes 8 required laboratory courses (Phys.70, Phys.71, Phys. 72, Chem.1A, MatE25, ME106, ME120, ME114, CE113) and 4 elective laboratory courses (ME145, ME146, ME110, ME192). In these courses students are taught how to design and perform experiments that meet specific objectives. Moreover, they are taught to analyze, interpret, and present their data in formal laboratory reports and oral briefings.

**B.5.1.1.2 Preparation for Engineering Practice**

**Breadth and Depth:** The ME Program provides graduates with an understanding of the basic principles and applications of all 3 disciplines: thermal-fluids, mechanical design and mechatronics, so that they will be able to work in any of the 3 focus areas. In order to prepare for work in any of the specific disciplines of ME, students are required to take courses in each of the main engineering science disciplines – fluid mechanics,
thermodynamics, heat transfer, dynamics & control, strength of materials, circuits and mechatronics. This foundation of engineering sciences is then applied in more discipline-specific courses, as students choose a stem to specialize, by selecting a capstone course and four electives from that particular area. Some breadth is allowed in the elective choices in that some electives can be chosen across stems and also from other engineering, math or science programs.

**Design throughout the Curriculum:** Engineering design is distinguished from engineering science in 3 ways. First, it involves open-ended problem-solving that require many assumptions and have multiple solutions. Several courses prepare students to develop open-ended problem solving skills (ME111, ME113, and ME114 among others). Second, it requires the synthesis of principles from many different fields (ME195A&B). Third, it requires critical thinking to check the validity of assumptions and evaluate the various design solutions.

Design is first introduced at the freshman level in E10, where students participate in three (3) comprehensive design projects. In each of these projects, they work in teams to design a product that meets certain specifications. They present their results in written as well as in oral reports. In all three (3) of these projects, students have to build a product and test it to verify its performance. Examples of such projects include the design and manufacture of a cup to keep coffee hot for as long as possible (using limited materials) and the design of a rubber-powered airplane for maximum range and endurance.

Design activities are integrated throughout the ME curriculum (ME110, ME145, ME154, ME157, ME160, ME165, ME182, ME183, ME186, ME188, ME189, ME192), not only to serve as a link between theory and practice but also to emphasize the many problems encountered in building and testing a prototype. Students use current tools (AutoCAD, Working Model, EES, Flotherm, Solidworks, ProE, COSMOS, ProMechanica) and practices in completing the various design projects. They typically work in teams and present their final designs in written as well as oral reports. For example, students synthesize a mechanical device to perform a desired task using graphical and analytical methods and use various failure criteria to guard against yielding, fracture and fatigue failures (ME154). Students are also introduced to the ME design process, which includes identification of a need, specification and requirements, conceptual design, evaluation of concepts, product design, design for manufacturing and ease of assembly, cost and human factors and design or select (from catalogs) various machine components, such as mechanical springs, contact bearings, brakes and clutches, gears, shafts, and motors (ME157). They analyze structural safety and cost-effectiveness using the Finite Element Method (ME160) and design / build 3-D solid models of engineering products (ME165). Finally, in ME195A&B, students integrate knowledge and skills from previous courses to design, build and test a full scale ME product. This provides the students with diverse practical design experience and exposure to many design issues and solutions covering different areas of ME.

**Senior Design Project:** The major culminating design experience comes in the two-semester senior project (ME195A&B). Students integrate thermal-fluids, mechanical design, and mechatronics while considering cost, ease of construction and
implementation. The iterative nature of design, as well as the need for compromise is stressed throughout the project. Students are given opportunities to work on industry-sponsored projects or participate in professional society design competitions, such as the ASME Old Guard competition\textsuperscript{3} and Human-Powered Vehicle, and the SAE Mini-Baja, etc.

B.5.1.1.3 Societal Need
San Jose State University (SJSU) is located in the heart of Silicon Valley; there are more than 2,000 technology and engineering companies around this area. There is a constant & tremendous need for new engineers who just graduated from colleges in Silicon Valley for new technology development such as biomedical and nano-technology fields as well as for conventional engineering applications. In recent survey, SJSU provides more engineering graduates to Silicon Valley than any other college or university in the United States. The Department’s ME Program has always served a niche need by providing very cost effective, discipline-specific applied engineering skills and knowledge packaged in a modern curriculum presented in courses conveniently scheduled for the engineering students. Department will continue to do so, with continued review and revision of our program to meet local industry’s needs.

\textsuperscript{3} ME students have received 1\textsuperscript{st} place awards in the past 3 years in the regional competitions.
B.5.1.2 Graduate Program  
B.5.1.2.1 Curriculum Content

There are three categories of courses that are offered by the MSME Program. These are: (1) Required Courses for the Degree, (2) Suggested Courses for Specialization Area, and (3) Elective Courses.

The MSME Curriculum:

<table>
<thead>
<tr>
<th>MECHANICAL DESIGN</th>
<th>THERMAL/FLUID SYSTEMS</th>
<th>CONTROLS &amp; MANUFACTURING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Required Courses for the Degree</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 230 3</td>
<td>ME 230 3</td>
<td>ME 230 3</td>
</tr>
<tr>
<td>ME 270 or ME 273 3</td>
<td>ME 270 or ME 273 3</td>
<td>ME 270 or ME 273 3</td>
</tr>
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<td><strong>UNITS [6]</strong></td>
<td><strong>UNITS [6]</strong></td>
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<tr>
<td><strong>Suggested Courses for Specialization Area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 265 3</td>
<td>ME 200 3</td>
<td>ME 280 3</td>
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<tr>
<td>ME 243 3</td>
<td>ME 210 3</td>
<td>ME 281 3</td>
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<tr>
<td>ME 250 3</td>
<td>ME 211 3</td>
<td>ME 283 3</td>
</tr>
<tr>
<td>ME 260 3</td>
<td>ME 221 3</td>
<td>ME 285 3</td>
</tr>
<tr>
<td><strong>UNITS [12]</strong></td>
<td><strong>UNITS [12]</strong></td>
<td><strong>UNITS [12]</strong></td>
</tr>
<tr>
<td><strong>Elective Courses</strong></td>
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<tr>
<td>Elective 3</td>
<td>Elective 3</td>
<td>Elective 3</td>
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<tr>
<td>Elective 3</td>
<td>Elective 3</td>
<td>Elective 3</td>
</tr>
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</tr>
<tr>
<td><strong>Project/Thesis</strong></td>
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<td></td>
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<tr>
<td>ME 295 A/B or ME 299 6</td>
<td>ME 295 A/B or ME 299 6</td>
<td>ME 295 A/B or ME 299 6</td>
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</tr>
<tr>
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<td><strong>MINIMUM UNITS [30]</strong></td>
<td><strong>MINIMUM UNITS [30]</strong></td>
</tr>
</tbody>
</table>

42
Related graduate courses from other areas of specializations, departments or colleges are allowed with the consent of the Graduate Studies Advisor.

B.5.1.2.2 Preparation for Engineering Practice
The Department offers courses designed to provide Mechanical Engineering MS students with advanced level of knowledge and skills in the three areas of specialization: (1) Mechanical Engineering Design, (2) Thermal/Fluid Systems Engineering, and (3) Controls and Manufacturing Systems Engineering. The Graduate Program Educational Objectives listed below are aligned with the goals of the University and College of Engineering. In particular, preparation for modern engineering practice and for work toward advanced degrees require in-depth knowledge and contemporary-practice skills in a professional discipline, critical thinking skills, ability to engage in lifelong learning and strong communication skills. In achieving these, our students’ lives are enriched and they are well prepared to serve society through their professional contributions.

B.5.1.2.3 Societal Need

Community Need
Clearly, industry activity trends have a heavy influence on enrollments in the MSME program. There are other significant factors affecting program size, such as the availability of alternative programs in the area (Stanford University, UC Berkeley and UC Davis, University of Santa Clara), the shifting and dominant characterization of local industry disciplines (electrical and computer engineering), and the student’s perceptions of need for advantages in job retention or retraining. The Department’s programs have always served a niche need by providing very cost effective, advanced discipline-specific applied engineering skills and knowledge packaged in a modern curriculum presented in courses conveniently scheduled for the practicing engineer. We will continue to do so, with continued review and revision of our programs to meet local industry’s needs.

There are several very pragmatic community needs served by our programs. First, we provide the lowest cost advanced engineering education in the Bay area. Second, our students are practicing professionals who at times (such as the present) face uncertain employment conditions. These conditions dictate a need to both broaden and deepen one’s skills to advance the company’s ability to succeed in a competitive business environment. The same process also provides the student a basis for more secure employment and value-added as an employee. In more prosperous times, increased capabilities of its engineers enable a company to maintain and increase its success developing and applying technology to products that benefit the community. Third, many of our students do not have educational alternatives in the Bay area for any one of several reasons. Some local alternative programs require significant, expensive, industry subsidy to study as a part-time student, some have more stringent admission requirements or are highly specialized, some require much longer commute distances. The most comparable program is the Early Bird Program of University of Santa Clara. In comparison, our programs have a greater capability for laboratory work, the MSME
degree programs of the two universities have much different emphases with Santa Clara’s being much smaller. In summary, our programs fill the niche of advanced, applied engineering education, at a most affordable cost, no company restrictions, and convenient location and schedule. There is a sizable population of engineers in the surrounding industrial community needing the specialization in mechanical engineering and aerospace engineering that our programs offer. We also find many of our BS graduates come back to us to earn the MS degree for the reasons cited in the industry environment.

B.5.2 Program Outcome for Undergraduate Program
B.5.2.1 Relationship between PEO and Program Outcomes

The Mechanical Engineering Program Educational Objectives (PEO) have been developed to be consistent with the mission of (a) San Jose State University (SJSU), (b) the College of Engineering (COE) and (c) the Department of Mechanical and Aerospace Engineering (MAE). The PEOs are achieved primarily through the Program curriculum, which is designed to emphasize problem solving, design skills and experiential learning.

For undergraduate program, the PEO are linked to the Program Outcomes as shown in Table below.

<table>
<thead>
<tr>
<th>Relationship between PEO and Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Outcomes</td>
</tr>
<tr>
<td>3a   3b   3c 3d 3e 3f 3g 3h 3i 3j 3k</td>
</tr>
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<td>PEO # 1</td>
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<tr>
<td>✓    ✓    ✓    ✓    ✓</td>
</tr>
<tr>
<td>PEO # 2</td>
</tr>
<tr>
<td>✓    ✓    ✓    ✓    ✓    ✓</td>
</tr>
<tr>
<td>PEO # 3</td>
</tr>
<tr>
<td>✓    ✓    ✓    ✓    ✓    ✓    ✓    ✓    ✓</td>
</tr>
<tr>
<td>PEO # 4</td>
</tr>
<tr>
<td>✓    ✓    ✓    ✓</td>
</tr>
</tbody>
</table>

Hence, one way to evaluate the achievement of the PEO is through the assessment of the Program Outcomes. Program Outcomes are defined by ABET Criteria 3 which requires that each engineering program seeking accreditation must demonstrate that graduates:

a. Have an ability to apply knowledge of mathematics, science and engineering.
b. Have an ability to design and conduct experiments, as well as to analyze and interpret data.
c. Have an ability to design a system, component or process to meet desired needs.
d. Have an ability to function on multi-disciplinary teams.
e. Have an ability to identify, formulate and solve engineering problems.
f. Have an understanding of professional and ethical responsibility.
g. Have an ability to communicate effectively.
h. Have the broad education necessary to understand the impact of engineering solutions in a global/societal context.
i. Have a recognition of the need for, and an ability to engage in, life-long learning.
j. Have knowledge of contemporary issues.
k. Have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
B.5.2.2 Matrix Mapping of Courses to Program Outcomes

Each outcome (a – k) is addressed in several courses of the ME curriculum. A subset of these courses was chosen for a thorough assessment of each outcome, as shown in below. With the exception of the three capstone courses (ME157, ME182, ME190), this subset consists solely of required courses taken by all ME students. E10 is the only lower division course included in this set. Lower division courses typically prepare students at skill levels 1 or 2, while upper division courses prepare students at skill levels 3, 4, 5 or 6 of Bloom’s Taxonomy in the particular outcomes they address.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>3a</th>
<th>3b</th>
<th>3c</th>
<th>3d</th>
<th>3e</th>
<th>3f</th>
<th>3g</th>
<th>3h</th>
<th>3i</th>
<th>3j</th>
<th>3k</th>
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<td>A</td>
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<tr>
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<td></td>
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</tr>
<tr>
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<td>B</td>
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<td>C</td>
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</tr>
<tr>
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<td>B</td>
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<td>B</td>
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<td></td>
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<tr>
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<tr>
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</tr>
<tr>
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<td>C</td>
<td>✓</td>
<td>C</td>
<td>C</td>
<td>B</td>
<td>C</td>
<td>C</td>
<td>✓</td>
<td>C</td>
</tr>
</tbody>
</table>

A Skill level 1 or 2 in Bloom’s Taxonomy
B Skill level 3 or 4 in Bloom’s Taxonomy
C Skill level 5 or 6 in Bloom’s Taxonomy
✓ Skills relevant but not presently assessed

B.5.3 Assessment Process Overview

B.5.3.1 Undergraduate Program Assessment Summary

B.5.3.1.1 Outcome Assessment Process Overview

The process of course assessment flow chart is shown below in Figure B.2.1, and in Figure B.2.2, the outcome assessment flow chart is illustrated. These flow charts are implemented as the guide for the ME Undergraduate Program outcome assessment. Upon successful satisfaction of the ME Program Outcomes, the ME PEO are considered to be met by the curriculum in the ME Program.

Course Assessment

Figure B.2.1 shows the process for assessing each of the selected courses. Course coordinators assess their courses for the specific outcomes they address, as indicated in
Table above. They are responsible for ensuring that performance targets are met for each outcome in each of their courses. If the target for a particular outcome is not met, they make recommendations for improvements in that area and take responsibility for implementing these improvements in the course. If they do not teach the particular course, they coordinate the changes with the faculty who teach the course. After the implementation of the improvements, coordinators re-assess the course and re-evaluate student performance against the targets.

**Outcome Assessment**

Figure B.2.2 shows the process for assessing outcomes. For each outcome there is a designated *outcome champion*. The faculty members in the Department serve as the outcome champions for the eleven Outcomes. Champions look at the data presented in the course binders for each course assessed for their particular outcome and write a one-page evaluation on how well the ME Program produces this outcome and whether the performance targets are met. Outcome champions may meet with course coordinators and instructors of the courses involved in their outcome, discuss their findings and make recommendations for course improvements. The outcome champion provides an additional level of accountability in the process, as there are always several faculty members involved in the assessment and implementation of the skills required in a single outcome. It is not just the course coordinators whom must show evidence that their courses include the necessary elements to satisfy an outcome and collect / analyze data to show that performance targets are met. The outcome champion must also evaluate all this evidence collected and analyzed for individual courses and has the final word on whether the performance of the ME Program is satisfactory with regard to this outcome.

Because outcomes are rather comprehensive and difficult to assess as stated, *outcome elements* were extracted from each outcome. These elements represent the different abilities specified in a single outcome that would generally require different assessment measures. For instance, Outcome 3a has three (3) *outcome elements*: (a) ability to apply knowledge of mathematics, (b) ability to apply knowledge of science, (c) ability to apply knowledge of engineering. Moreover, we have defined *outcome attributes*, i.e. student actions that explicitly demonstrate mastery of the abilities specified in an outcome element. These attributes have been defined at one of the 6 levels of Bloom’s taxonomy in the cognitive domain or 5 levels in the affective domain. Two *outcome indicators* are used to assess student attainment of program outcomes: (a) course performance ratings based on graded student work and (b) student surveys. To satisfy ABET Criterion 3, we have defined our *performance targets* as follows:

(a) The scores earned by all students, in the assignments and test questions in each selected course, which pertain to a particular outcome, must meet certain level as specified by the course coordinator and outcome champion (60% to 70%), (b) The ratings pertaining to this outcome, given by at least 70% of the students in each class surveyed, must be “I agree” on a 3-point scale. If these targets are met in the courses chosen for assessment of an outcome, the outcome is achieved and no further action is needed in this course. When performance targets are met, courses are assessed on a 3-
year cycle. When performance targets are not met in a course, improvements are implemented and the course is assessed on a yearly basis until the targets are met.

**COURSE ASSESSMENT FLOW CHART**

Create a course binder:
Place course syllabus and divide binder in sections by outcomes to be addressed

Create outcome checklist:
List all outcomes the course is supposed to satisfy. Under each outcome, list pertaining activities & assignments.

Collect student work samples & selected lecture material. A sample may be under several outcomes; place each sample under the 1st outcome it addressed.

Administer end-of-term student surveys w/questions from all outcomes pertaining to the course. Provide survey results summary.

Create a column for each outcome in the course grading spreadsheet. Add points for each outcome in the appropriate column (some assignments may be counted in more than one outcome).

Review and Assess the data:
Student performance by outcome (points) Student confidence by outcome (survey responses). Write outcome analysis.

Performance target 1 met?
70% of students @ designated level in each outcome.

- YES
- NO

Performance target 2 met?
70% of survey responses "agree" in each question.

- YES
- NO

The course meets objectives.

Implement course improvements in the next course offering.

Recommend course improvements in content/delivery as needed.

Try to build higher student confidence in the next course offering.

Students legends in their own minds!
Figure B.2.2. Outcome assessment flow chart
B.5.3.1.2 Outcome Assessment—Results

Based on the assessment data for the selected courses presented in the Appendix B, the ME Program satisfies all outcomes except 3f. The outcome satisfaction also indicates that the PEO for the undergraduate ME Program are met except PEO #4. As a result of our outcomes assessment, several improvements have been implemented since our last ABET visit, to ensure that ME students acquire the highest possible level of the skills defined under each outcome. These improvements are listed below:

1. Students design experiments (ME113, ME114, ME120).
2. Team skills are taught and assessed formally (ME111, ME120, ME195A&B).
3. Students tackle (i.e. identify, formulate, and solve) open-ended problems (ME111, ME113, ME114)
4. Students study the ASME Code of Ethics and discuss in class safety, ethics, and liability issues in engineering (ME195A&B).
5. Students research, present, and discuss in class contemporary engineering applications and their impact in a global and societal context (outcomes 3h, 3j) (ME111, ME113, ME114).

The MAE and COE Curriculum Committees, the MAE Department faculty, and the ME Advisory Board all participate in reviewing the ME curriculum for relevance, adherence to Program Educational Objectives, and fulfillment of the professional component. In addition, the COE Physics, Chemistry and Calculus Task Forces work closely with their respective departments to ensure that the math and science topics covered are appropriate for engineering students.

In summary, the ME curriculum meets the ASME Program Criteria and the ABET 2005 Criteria for the professional component. Materials that will be available at the site visit to show achievement of Outcomes will include:

- Course journals including samples of student work in all engineering and science courses
- Exit interviews with graduating seniors
- Student transcripts
- Summary of alumni and employer survey results
- Senior design projects

B.5.3.2. Graduate Program Assessment Summary

B.5.3.2.1 Outcome Assessment Process Overview
The MAE Department has defined five Graduate Program Educational Objectives (GPEO) and validated by the Department Advisory Committee. The GPEO were assessed in Fall 2005 by examining the MS project and thesis reports from AY 04-05. The evaluation criteria were developed to address the GPEO. Though majority of the reports satisfied the GPEO, several recommendations were made to the Department to address the findings.
B.5.3.2.2 Outcome Assessment Results

B.5.3.2.2.1 DAC Survey on GPEO and Results

Department Advisory Council (DAC) input on the importance of the Graduate Program Educational Objectives as listed in Section B.4

<table>
<thead>
<tr>
<th>How Important is this GPEOs?</th>
<th>DAC m1</th>
<th>DAC m2</th>
<th>DAC m3</th>
<th>DAC m4</th>
<th>DAC m5</th>
<th>DAC m6</th>
<th>DAC m7</th>
<th>DAC m8</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPEO 1</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>GPEO 2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>GPEO 3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>GPEO 4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>GPEO 5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.4</td>
</tr>
</tbody>
</table>

Scale: 5 = Very important
       4 = Important
       3 = I am not sure
       2 = Not important
       1 = Irrelevant, should not be included

B.5.3.2.1.2 Theses and Project Assessment Criteria

For the graduate program assessment, the MS project and thesis reports were used to assess the graduate program learning objectives (GPEO). The MAE Assessment Team targeted for assessment all (21) project / thesis reports for MSME May 2005 graduates to evaluate whether these GPEO were satisfied for the MSME program. A scale of 1 to 5 was used to assess the GPEO, a score of 1 is being lacking and 5 is being excellent. A score of 3 or above is necessary to satisfy the GPEO.

The following criteria were used to evaluate each MS project / thesis report:

<table>
<thead>
<tr>
<th>Thesis / Project Evaluation Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project / Thesis Title</td>
</tr>
<tr>
<td>Student Name</td>
</tr>
<tr>
<td>Faculty Advisor</td>
</tr>
<tr>
<td>GPEO addressed</td>
</tr>
<tr>
<td>1 1 Application of mathematics appropriate for graduate level</td>
</tr>
<tr>
<td>1 2 Application of science appropriate for graduate level</td>
</tr>
<tr>
<td>1 3 Application of engineering fundamentals appropriate for graduate level</td>
</tr>
<tr>
<td>2 4 Use of modern tools (computational or experimental)</td>
</tr>
<tr>
<td>2 5 Appropriate literature search (# and appropriateness of references cited)</td>
</tr>
<tr>
<td>2 6 Understanding of the cited literature (summary of previous</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

**Scale:** 1 = Lacking, 2 = Weak, 3 = Acceptable, 4 = Good, 5 = Excellent

L = Lacking, W = Weak, A = Acceptable, G = Good, E = Excellent  
Max Possible Score = 65

---

**B.6 Data Analysis and Recommendations for Improvement**

**B.6.1 Undergraduate Program**

**B.6.1.1 Data Analysis**

For the undergraduate program, course assessment were performed on selected required courses within the program to evaluate program outcomes. The assessment data for each course is presented in Appendix B. As a result of our outcomes assessment, several improvements have been implemented since our last ABET visit, to ensure that ME students acquire the highest possible level of the skills defined under each outcome.

**B.6.1.2 Recommendations for Improvement**

The recommendations for improvement are listed below:

1. Students design experiments (ME113, ME114, ME120).
2. Team skills are taught and assessed formally (ME111, ME120, ME195A&B).
3. Students tackle (i.e. identify, formulate, and solve) open-ended problems (ME111, ME113, ME114).
4. Students study the ASME Code of Ethics and discuss in class safety, ethics, and liability issues in engineering (ME195A&B).
5. Students research, present, and discuss in class contemporary engineering applications and their impact in a global and societal context (outcomes 3h, 3j) (ME111, ME113, ME114).
B.6.2 Graduate Program

B.6.2. Data Analysis

For graduate program, the MS thesis and project report assessment data analysis, findings, and recommendations are as follows:

MSME Assessment Results Summary

Number of MSME students who graduated in May 2005 = 21
Reports evaluated = 17*

<table>
<thead>
<tr>
<th>PEO</th>
<th>Description</th>
<th>Number of reports</th>
<th>Scores (max = 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Application of mathematics appropriate for graduate level</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>10 (59%) met this objective</td>
<td>4 3 5 1 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 (41%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Application of science appropriate for graduate level</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>11 (65%) met this objective</td>
<td>0 6 6 3 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 (35%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Application of engineering fundamentals appropriate for graduate level</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>16 (94%) met this objective</td>
<td>0 1 9 3 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 (6%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Use of modern tools (computational or experimental)</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>17 (100%) met this objective</td>
<td>0 0 4 5 8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 (0%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Appropriate literature search (# and appropriateness of references cited)</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>12 (71%) met this objective</td>
<td>1 4 3 5 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 (29%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Understanding of the cited literature (summary of previous work)</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>11 (65%) met this objective</td>
<td>3 3 5 4 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 (35%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Understanding of the work performed in the project</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>16 (94%) met this objective</td>
<td>0 1 6 6 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 (6%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>In-depth analysis and / or design of an ME system</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>15 (88%) met this objective</td>
<td>0 2 4 7 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 (12%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Correct language and terminology</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>14 (82%) met this objective</td>
<td>0 3 5 7 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 (18%) did not meet this objective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The following findings emerged from the analysis of the data:

A. The percentage of reports that satisfied the various elements of GPEO #1 ranged from 59% - 94% (MSME). Students seem to perform very well in their application of engineering fundamentals but not so well in the application of graduate level mathematics and science. For example, 41% of the MSME reports were found weak or lacking in application of mathematics and 35% weak in application of science appropriate for graduate level. However, many of these reports came from the Design area, which may only call for more implicit application of mathematics and science.

B. The percentage of reports that satisfied the various elements of GPEO #2 ranged from 65% - 100%. In general, students seem to perform very well in their use of modern tools. They lack, however, in their citations of appropriate literature (29% MSME reports were found weak or lacking) as well as in their understanding of this literature (35% MSME reports were found weak or lacking). On the other hand, almost all of the evaluated reports demonstrated a good understanding of the work performed.

C. Students seem to perform well in GPEO#3 (in-depth analysis / design of a system). One issue that was identified in relationship to this GPEO is that there was a mismatch between the project / thesis topic, project / thesis advisor and the major.

D. Students seem to perform well in GPEO#4 (communication skills). The percentage of reports that satisfied the various elements of GPEO #4 ranged from 76% - 82%. However, the MAE Department needs a more standardized format for the M.S. Project Report.
E. The percentage of reports that satisfied the various elements of GPEO # 5 ranged from 71% - 88%.

B.6.2.2 Recommendations for Improvement

The following recommendations were made to the Department to address the findings.

1. Although the level of mathematics and science may vary from project to project, students are expected to use graduate level mathematics and science in their analysis or modeling. In the Design area, students should be encouraged to be more explicit about the relevant mathematics and science.

2. The Department should organize a presentation on literature search and review every semester.

3. By the end of the 1st month, in ME295A and ME299, students should be required to take the online tutorials offered by the SJSU Library, such as Info-Power.

4. By the end of the 1st month, in ME295A and ME299, students document and present a literature review related to their project/thesis.

5. The Graduate Coordinator and Study Committee Faculty Advisors will ensure that the topic area selected by their students is appropriate for the degree and is supported by the courses taken by the student.

6. On the Project Proposal Form, a line should be added to indicate the area of specialization.

7. The MAE Department should develop a uniform M.S. Project Report guideline. One idea may be to simply adopt the University guidelines for thesis.

8. Students should seek a committee chair and appropriate committee members in their field of study. Once the committee is established, it should not be changed without consent of the committee members. Faculty should advise students in their area of expertise.

These points were discussed and revised by the faculty during multiple meetings in Spring 2006.

B.7 Faculty

B.7.1 Faculty Competency and Size

Appendix C, Tables C-1 and C-II give an analysis of the qualifications, activity levels and workload of full-time and part-time faculty within the Department. Appendix C gives the resumes of all full-time and part-time faculty. The Department has eleven full-time tenure-track faculty members and one FERP-active (Faculty Early Retirement) faculty. All of the full-time faculty hold Ph.D. degrees in their respective subject areas. Five are registered professional engineers, and nearly all have had two or more years of industrial experience. The size of the faculty is nominally adequate to cover all of the curricular areas in the program (as well as responsibilities to the students, the College of Engineering, the University and the profession). All the ME disciplines in the program –
thermodynamics / heat transfer, fluid mechanics, mechanical design, manufacturing / mechatronics are represented on the current faculty.

Experienced practicing engineers are used as lecturers to teach specific courses. Many of these lecturers have had a sustained affiliation with the University and the Department, and have been active in updating the curriculum and the laboratories. The lecturers bring an additional element of professional practice and on-the-job realism to classroom instruction. The faculty has excellent educational credentials, extensive industrial experience, and are from a diverse set of academic and professional backgrounds.

B.7.2 Faculty as Innovative Teachers
Several members of the faculty have been awarded College, University, and National awards for the quality of their teaching. The faculty has been active in experimenting with alternative teaching styles, and have participated in many COE professional-development seminars addressing innovations in teaching and learning. In addition, several faculty have received CSU, SJSU and NSF grants for curriculum and laboratory development.

Faculty Involvement with Students
The faculty maintains a close association with students through advising and counseling, classroom contact, and extra-curricular activities, and continues a close relationship with alumni. Through research, consulting, and participation in local societies, the faculty helps students to obtain internship employment, summer jobs, undergraduate research experience and full-time jobs upon graduation.

B.7.3 New Faculty
B.7.3.1 Reduced Teaching load for New Faculty Members
It is the College’s policy to assist new faculty members to develop their teaching repertoires and initiate research programs by reducing their teaching loads by one-half during their first year and by one-quarter during their second year. This policy pertains to all faculty members newly hired as assistant professors. More experienced faculty members also receive some initial release-time support depending on their needs and qualifications. The College also has a 1:2 matching policy to provide assistance to faculty members who secure external grants to reduce their teaching loads. If a faculty member secures external funding sufficient to reduce his/her teaching load by two courses, the College provides a third course reduction.

B.7.4 Faculty Professional Development and Interactions with Industry
Faculty interaction with industry is considered to be good to excellent. The faculty enjoys this relationship, in particular, through the Senior Design Project program and support from both industry and the alumni. Members of the Department Advisory Committee are also involved in providing a review of curriculum and laboratory facilities. In addition to the Advisory Committee members, local professional society representatives, normally affiliated with industry, provide mentoring, guidance, as well as substantial funding and equipment support. These industry representatives also provide a significant level of support in faculty professional development as they give lectures and offer short courses.
### B.7.5 Faculty Research and Scholarships

There are ten (10) full-time Mechanical Engineering faculty members in the Department. Their specialization and research interests are summarized below:

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Degrees</th>
<th>Specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agarwal, Raghu</td>
<td>Ph.D.-Texas A&amp;M University</td>
<td>Computer-aided design, Machine design and FEA</td>
</tr>
<tr>
<td>Barez, Fred</td>
<td>Ph.D.-University of California-Berkeley</td>
<td>Microelectronics packaging, Disk drive mechanics, Magnetic recording, Vacuum technology, Micro-miniaturization, machining</td>
</tr>
<tr>
<td>DeJong, Nicole</td>
<td>Ph.D.-University of Illinois at Urbana-Champaign</td>
<td>Thermodynamics, Heat transfer, HVAC design</td>
</tr>
<tr>
<td>Du, Winncy</td>
<td>Ph.D.-Georgia Institute of Technology</td>
<td>Mechatronics, Control, Intelligent Systems and Robotics, Machine vision, Pattern recognition</td>
</tr>
<tr>
<td>Furman, Burford</td>
<td>Ph.D.-Stanford University</td>
<td>Machine design, Mechatronic systems design, Microelectromechanical devices, Precision machine design</td>
</tr>
<tr>
<td>Hsu, Tai-Ran</td>
<td>Ph.D.-McGill University</td>
<td>Thermomechanics, Finite element analysis, Computer-aided design, Microelectromechanical systems, Nano engineering</td>
</tr>
<tr>
<td>Lee, John</td>
<td>Ph.D - MIT</td>
<td>Design for manufacturability, microfabrications, fuel cell technology, rapid prototyping</td>
</tr>
<tr>
<td>Rhee, Jinny</td>
<td>Ph.D.-Stanford University</td>
<td>Thermodynamics, Heat transfer, Electronics cooling, Computational fluid dynamics</td>
</tr>
<tr>
<td>Wang, Ji</td>
<td>Ph.D.-University of California-Berkeley</td>
<td>Control systems, Vibrations control, Robotics, Microprocessor applications, Flexible manufacturing systems, Fuzzy control, Neural networks, motion control</td>
</tr>
<tr>
<td>Yee, Raymond</td>
<td>Ph.D.-University of California-Berkeley</td>
<td>Materials behavior, Fracture mechanics, FEA/CAD, solid modeling, Stress analysis</td>
</tr>
</tbody>
</table>

Faculty members of the MAE Department are encouraged to be involved in scholarly activities that include conducting research in specific fields of their specialties, developing curriculum and laboratories, consulting in industry, and servicing professional and learned societies. Recent publications by faculty members during the last five years are presented in their resumes in Appendix C.
B.8 Facilities

B.8.1 Teaching Laboratories

Table B.8.1 provides a summary of the laboratory facilities used for instruction by the MAE Department. All labs are furnished with electronic locks to allow students to enter the labs on an as-needed basis. The Department’s current equipment and instrumentation is in good to excellent condition. Several National Science Foundation Instrumentation Laboratory Initiative (NSF/ILI) grants and generous industry equipment donations have resulted in equipping the laboratories with modern tools and instrumentation.

<table>
<thead>
<tr>
<th>Location / Name</th>
<th>Courses Served</th>
<th>Current Status</th>
<th>Adequacy of Instruction</th>
<th>Number of Students Annually Served</th>
<th>Area (sq ft)</th>
<th>Director</th>
</tr>
</thead>
<tbody>
<tr>
<td>E 107 - Aerodynamics</td>
<td>AE 162, AE 170AB, ME 111</td>
<td>Good</td>
<td>Good</td>
<td>215</td>
<td>1357</td>
<td>Mourtos</td>
</tr>
<tr>
<td>E 111 – Product Design</td>
<td>ME 154, ME 157, ME 195A/B</td>
<td>Good</td>
<td>Good</td>
<td>180</td>
<td>1600</td>
<td>Yee</td>
</tr>
<tr>
<td>E 113 - Energy Conversion &amp; Heat Transfer</td>
<td>ME 113, ME 114</td>
<td>Good</td>
<td>Good</td>
<td>200</td>
<td>1600</td>
<td>Rhee</td>
</tr>
<tr>
<td>E 114A – Electronics Cooling</td>
<td>ME 114, ME 145, ME 146, ME 195A/B</td>
<td>Good</td>
<td>Good</td>
<td>224</td>
<td>1800</td>
<td>Okamoto</td>
</tr>
<tr>
<td>E 115 – Microsystem Fabrication Technology</td>
<td>ME 189, ME 196Q, ME 195A/B</td>
<td>Good</td>
<td>Good</td>
<td>163</td>
<td>1600</td>
<td>Lee</td>
</tr>
<tr>
<td>E 117 – Electronics Packaging &amp; Micro System Design</td>
<td>ME 145, ME 146, ME 147, ME 189, ME 195A/B</td>
<td>Good</td>
<td>Good</td>
<td>220</td>
<td>1600</td>
<td>Barez/Hsu</td>
</tr>
<tr>
<td>E 125 – Mechatronics Engineering</td>
<td>ME 106, ME 190, ME 195AB</td>
<td>Good</td>
<td>Good</td>
<td>160</td>
<td>1800</td>
<td>Furman</td>
</tr>
<tr>
<td>E 125A – Acoustics and Precision Measurements</td>
<td>ME 145, ME 149, ME 195AB</td>
<td>Good</td>
<td>Good</td>
<td>110</td>
<td>1800</td>
<td>Furman</td>
</tr>
<tr>
<td>Course ID</td>
<td>Course Title</td>
<td>Instructor(s)</td>
<td>Classroom</td>
<td>Lecture Sections</td>
<td>Capacity</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------------</td>
<td>------------------------</td>
<td>-----------</td>
<td>------------------</td>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>E 133</td>
<td>Engineering Measurements</td>
<td>ME 120</td>
<td>Good</td>
<td>Good</td>
<td>120</td>
<td>2000</td>
</tr>
<tr>
<td>E 135</td>
<td>Process Control</td>
<td>ME 187, ME 190, ME 195A/B</td>
<td>Good</td>
<td>Good</td>
<td>75</td>
<td>2360</td>
</tr>
<tr>
<td>E 137</td>
<td>Computational Fluid Dynamics</td>
<td>AE 169, AE 170 A/B</td>
<td>Good</td>
<td>Good</td>
<td>40</td>
<td>400</td>
</tr>
<tr>
<td>E 164A</td>
<td>Aero Structures</td>
<td>AE 114, AE 170A/B</td>
<td>Good</td>
<td>Good</td>
<td>30</td>
<td>800</td>
</tr>
<tr>
<td>E 164C</td>
<td>Gas Dynamics</td>
<td>AE 164, AE 170A/B</td>
<td>Good</td>
<td>Good</td>
<td>60</td>
<td>1800</td>
</tr>
<tr>
<td>E 192</td>
<td>Robotics &amp; Manufacturing</td>
<td>ME 192, ME 195AB</td>
<td>Good</td>
<td>Good</td>
<td>45</td>
<td>3200</td>
</tr>
<tr>
<td>E 213</td>
<td>Multi Media Computer</td>
<td>Several ME and AE courses</td>
<td>Excellent</td>
<td>Excellent</td>
<td>150</td>
<td>1600</td>
</tr>
<tr>
<td>E 215</td>
<td>Department Student Computer</td>
<td>All ME and AE students</td>
<td>Excellent</td>
<td>Excellent</td>
<td>800</td>
<td>1600</td>
</tr>
<tr>
<td>E 217</td>
<td>Product Reliability</td>
<td>ME 145, ME 196R</td>
<td>Good</td>
<td>Good</td>
<td>85</td>
<td>1600</td>
</tr>
<tr>
<td>E 236</td>
<td>Space Engineering</td>
<td>AE 110, AE 170 AB</td>
<td>Good</td>
<td>Good</td>
<td>25</td>
<td>1318</td>
</tr>
<tr>
<td>E 240</td>
<td>Aircraft Design</td>
<td>AE 170AB</td>
<td>Good</td>
<td>Good</td>
<td>15</td>
<td>400</td>
</tr>
<tr>
<td>E 272</td>
<td>Spacecraft Design</td>
<td>AE 170AB</td>
<td>Good</td>
<td>Good</td>
<td>25</td>
<td>1975</td>
</tr>
</tbody>
</table>

The MAE Department maintains an ME clubroom that serves as the headquarters for the student chapters of ASME, AFE (Association for Facilities Engineering), ASHRAE (American Society of Heating; Refrigeration, & Air Conditioning Engineers), and Pi Tau Sigma (ME Honor Society). The clubs are invited to maintain their own web pages linked to the Department web page. The ASME chapter maintains a fairly large lending library.

**B.8.2 Teaching Classrooms**

The engineering building contains 15 lecture rooms shared by all engineering programs. The classroom capacities are listed in the following table. Overflow lecture sections are scheduled in other facilities on campus through the Academic Scheduling Office.
Table B.8.2  COE classroom capacities

<table>
<thead>
<tr>
<th>Room #</th>
<th>Capacity</th>
<th>Room #</th>
<th>Capacity</th>
<th>Room #</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>232</td>
<td>40</td>
<td>331</td>
<td>100</td>
<td>341</td>
<td>100</td>
</tr>
<tr>
<td>301</td>
<td>40</td>
<td>337</td>
<td>70</td>
<td>343</td>
<td>100</td>
</tr>
<tr>
<td>303</td>
<td>40</td>
<td>338</td>
<td>30</td>
<td>395</td>
<td>35</td>
</tr>
<tr>
<td>327</td>
<td>30</td>
<td>339</td>
<td>70</td>
<td>401</td>
<td>40</td>
</tr>
<tr>
<td>329</td>
<td>70</td>
<td>340</td>
<td>50</td>
<td>403</td>
<td>40</td>
</tr>
</tbody>
</table>

B.8.3 Other Facilities

The College of Engineering also manages a 210-seat auditorium (E189), several meeting rooms (E247, E335, E285, E287), and an open study area on the third floor. The auditorium is regularly used for professional presentations, symposiums, and occasionally, for large class lectures and exams. The meeting rooms are used for faculty and staff meetings and events.

The College’s Engineering Computing Systems group manages eight computer laboratories as listed in the following table. These laboratories are exclusively for COE students, faculty, and staff use. These computers are loaded with programs including Matlab, AutoCAD, Unigraphics, ProModel, Visual Studio, Minitab, Pspice, ProEngineer, C compiler, word processing, spreadsheet and web browser. These labs primarily support engineering common courses such as programming and writing classes. The open laboratories (E390 and E305) are available five days a week on a walk-in basis. Wireless Internet access is available in the most of the Engineering Building.

Table B.8.3  COE computer laboratories

<table>
<thead>
<tr>
<th>Room #</th>
<th>No. of PCs</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>E333</td>
<td>30</td>
<td>Engineering classes using multimedia presentation or cooperative learning</td>
</tr>
<tr>
<td>E390</td>
<td>25</td>
<td>Open Lab</td>
</tr>
<tr>
<td>E391</td>
<td>25</td>
<td>Engineering core writing and programming classes such as: E10, E100W, CmpE46, ME20, and ME30.</td>
</tr>
<tr>
<td>E392</td>
<td>25</td>
<td>Engineering core writing and programming classes such as: E10, E100W, CmpE46, ME20, and ME30.</td>
</tr>
<tr>
<td>E393</td>
<td>25</td>
<td>Engineering core writing and programming classes such as: E10, E100W, CmpE46, ME20, and ME30.</td>
</tr>
<tr>
<td>E394</td>
<td>25</td>
<td>Engineering core writing and programming classes such as: E10, E100W, CmpE46, ME20, and ME30.</td>
</tr>
<tr>
<td>E405</td>
<td>27</td>
<td>Open Lab</td>
</tr>
<tr>
<td>E407</td>
<td>25</td>
<td>Engineering core writing and programming</td>
</tr>
</tbody>
</table>
Engineering students can also take advantage of the computer lab located in the Student Union (adjacent to the Engineering Building) and computing services in the King Library. The Student Union computer lab has one hundred computer stations managed by the Associated Students Computer Services Center. The lab supports major operating systems (Windows, Linux, and Macintosh) and provides DVD and CD burners, high-speed Internet access, and document scanning capability. The King Library provides the following computer resources to all SJSU students:

- Laptop checkout for students (80 laptop computers and 20 tablet computers)
- Four (4) computer classrooms (total of 123 computers)
- Reserve-a-computer with office software & internet access (208 computers)
- Research information computers with Internet access (51 computers)
- Library catalog computers for quick look-up (27 computers)
- Personal laptop computer connections (180 ports)

### B.9 Institutional Support and financial Resources

#### B.9.1 Financial Resources

The primary financial resource for the College is the state-supplied general fund allocated by the University. The Dean of the College allocates the College’s general fund to each program, primarily based on the program’s student enrollment as measured by the number of its Full-Time Equivalent Students (FTES). The general fund supports the program’s basic operating needs: faculty and staff salaries, supplies and services, and equipment requisitions. The College also receives a significant amount of financial support from three major external sources: funds from Extended Studies, contracts and grants, and donations and gifts. Funding from these sources supports college-wide initiatives for faculty and student development.

#### B.9.1.1 General Fund

The University establishes the College’s general fund allocation. The University assigns a FTES (full-time equivalent students) target and a Student-Faculty Ratio (SFR) to each college. Historically, the College of Engineering has been assigned an SFR of approximately 17.5, which is considerably less than that assigned to the College of Humanities and the Arts, for example. This lower SFR assignment is in recognition of the fact that engineering programs, because of their heavy emphasis on laboratory and project work, require a lower SFR than those disciplines whose courses are taught almost entirely in lecture mode. The assigned FTES and SFR are translated into the number of
Full-Time Equivalent Faculty (FTEF). The difference between the FTEF and the number of tenure-track faculty members determines the number of full-time equivalent non-tenure-track lecturers, whose average salary is budgeted at $45,708 per academic year. The total faculty salary allocation is the sum of the actual salaries of tenure-track faculty and the budgeted amount for full-time equivalent lecturers. In addition to the faculty salary allocation, the University allocates a higher percentage of funding for equipment requisitions and maintenance to the laboratory-based disciplines such as engineering.

The annual budget allocation for each program is made by the Dean of the College with assistance from the Associate Deans and the College’s budget analyst. For the most part, the allocation is made by formula, especially in the areas of supplies, services, and travel. The formulas are based on each program’s fraction of the College’s FTES. Travel allocations, however, are based on the number of tenure-track faculty in each program. The $45,708 funding for hiring a full-time equivalent lecturer is generally inadequate. However, this problem is mitigated by the fact that the College has been able to tap into a vast pool of practicing engineering professionals in Silicon Valley, who don’t rely on teaching as a primary source of income.

B.9.1.2. Funds from Extended Studies

Funds from Extended Studies are derived from two sources: Open University and Off-Campus programs. Through the Open University program, non-matriculated students may be permitted, on a space-available basis, to take a regular course being offered. The Off-Campus programs include degree programs offered on company sites and the Rose-Orchard site which is managed by the College of Business. The net revenue from the Extended Studies programs has been approximately $300K per year for the last several years. A portion of the net revenue is distributed to the academic programs which contribute to the teaching of the programs. The remaining funds are used for supporting activities that would otherwise not be funded. Examples are travel expenses for faculty to present papers at professional meetings, expenses for hiring and recruiting new faculty members, start-up packages for new faculty, and matching support for equipment grants.

B.9.1.3. Contracts and Grants

The College also derives support from the return on indirect charges collected by the San Jose State University Foundation in connection with contracts and grants. The funding distributed to the College, which is used to support research-related activities, is divided into three equal portions: one-third goes to the Dean, one-third to the principal investigator’s department, and one-third to a research account controlled by the principal investigator. Over the past five years the funds available to the Dean, departments, and principal investigators have been approximately $50K - $60K each per year. In addition, grants for supporting instructional materials and laboratory development typically include budgets for lab equipment or computers.
**B.9.1.4. Donations and Gifts**

The College receives significant donations and gifts from our industry partners and individual contributors. These contributions take the form of equipment donations and cash grants. For instance, the College received an average of $1.5 million in cash gifts per year over the last five years from friends, alumni, and Silicon Valley companies such as AMD, Applied Materials, Atmel, Cadence, Cisco, IBM, Intel, Lam Research, Lockheed Martin, Maxim Integrated Products, National Semiconductor, Rockwell Collins, Solectron, Synopsys, and Xilinx. Major contributors of laboratory and instructional equipment are Agilent Technologies, Applied Materials, Atmel, Cadence, Cisco, HP, Intel, Novellus, and Xilinx.

Another significant financial source for the College is the interest income generated from the College’s endowment funds. Currently, the College has endowment funds of about $7.3 million dollars that support faculty development and hiring, student scholarships, and student co-curricular programs.

**B.9.2 Instructional Support**

Funding from the general fund allocated to the academic programs is used primarily to support their basic needs. Such funding, however, is inadequate to provide the high-quality educational programs needed by our students. The additional support provided by the College to the departments is funded by the general fund held by the Dean at the College level, special funds provided by the University, and external financial resources described in the previous section. The additional support covers four main areas: endowed chairs and faculty development, student scholarships, student support and co-curricular programs, and technical support.

**B. 9.2.1 Endowed Chairs and Faculty Development**

Acquiring teaching resources and supporting faculty development are a high priority in the College of Engineering. Currently, the College has two endowed chairs: the Pinson Chair, and the Charles W. Davidson Chair in Construction Management which is earmarked for the Department of Civil and Environmental Engineering. The goal of the Pinson Chair is to help programs to develop new curricular areas. For instance, in AY 1999/2001 Pinson Chair Tom Boag helped develop the microelectronics process engineering program in the Department of Chemical and Materials Engineering. In AY 2001/03 Anthony Chan with the Department of Electrical Engineering helped develop the network engineering program. For AY 2003/05, Russell Smith with the Department of Computer Engineering has assisted in the development of the software engineering program. These Pinson chairs have extensive industry experience which is critical in their developing new curriculum at the College. In the area of faculty development, the College provides sabbatical leave opportunity, reduced teaching load for new faculty members, and faculty development grants.
B.9.2.2 Sabbatical Leave
The purpose of sabbatical leave is to benefit the University, its students, and its programs through the professional development of the faculty. Sabbatical projects include scholarly and professional activities, activities which enhance a faculty member's pedagogical and professional competencies, and projects which contribute significantly to the development of a discipline or curricular area. Faculty can either take a one-semester sabbatical with full pay or a two-semester sabbatical with half pay. The number of awards given to the engineering faculty is typically between three to five annually.

B. 9.2.3 Faculty Development Grants

Faculty development grants provide a way to advance the faculty’s career aspirations and the College’s objective of becoming a premier undergraduate engineering educational institution by recognizing, promoting, and supporting faculty’s research achievements and excellence in teaching. The research and teaching goals are mutually supportive with research providing vitality and vision in technical issues and teaching providing focus for research and a channel for dissemination of knowledge gained in research efforts. Since 2002, the College has offered the Engineering Research Development Grant and the Teaching Development Grant to the faculty of the College of Engineering. These two grant programs are entirely supported by external funding.

The Engineering Research Development Grant provides support to enable, to initiate, or to coordinate research efforts of the faculty members and their departments. Faculty members are encouraged to collaborate on project proposals and pursue team-oriented projects. The Engineering Teaching Development Grant is intended to support faculty efforts in curricular development, assessment, and improvement for subjects aligned with departmental priorities as well as enhancing students’ learning effectiveness. The funding level of both development grants has been about $90K per year with one course release time budgeted at $5K.

In addition to the College’s faculty development grants, the University offers two faculty grant programs: the CSU Research Grant and Professional Development Grant. The CSU Research Grant offers funding for “seed” money or summer fellowships. "Seed" money ($5k) is for testing promising ideas and obtaining preliminary results prior to seeking external support. “Seed” money can be used for research, clerical assistance, equipment, software, or travel which is essential to the project. Summer fellowships ($7,500) are awarded in whole-month increments to faculty members at their regular monthly rate of pay. The grants fund the time needed by the faculty to initiate, continue, or complete research projects. The funding level for engineering awards has been about $20K per year for the past five years.

The Professional Development Grant supports professional development for faculty, staff, and students. Categories for which funds may be used include participating in training/education programs, conferences, hiring student assistants, travel, software, equipment and supplies. Staff and student organizations are also eligible to apply. The
total grant awards for engineering faculty have been about $36K per year for the past several years.

B. 9.2.4 Student Scholarships

The College started the Silicon Valley Engineering Scholarship program in 2001 by offering scholarship awards to top incoming students. The funding is provided by Silicon Valley companies and individual supporters. In addition, the Silicon Valley Engineering Scholarship recipients have opportunities for summer internships with sponsoring companies. The sponsoring companies include Applied Materials, Atmel, Cadence, Lam Research, Lockheed Martin, National Semiconductor, Rockwell Collins, and Solectron. The typical scholarship award is $20K per student at $5K per year for a four-year period. There have been 25 scholarship recipients since 2001. In addition, the College, in collaboration with Hewlett-Packard Company, has an HP Scholar program targeting underrepresented minority engineering students. The HP Scholar program provides each student not only financial assistance, but also a support program of mentoring, advising, and internship.

B. 9.2.5 Student Support and Co-Curricular Programs

The College, in collaboration with the departments, has provided student advising in the areas of General Education and transfer evaluations. Further, special advising has been offered to underrepresented minority students and students on academic probation. Taking advantage of its location in Silicon Valley, the College has been proactive in developing co-curricular programs that complement students’ classroom learning.

Student Support

The College of Engineering funds two student advising and support units: the Engineering Student Advising Center and the MESA Engineering Program. The Engineering Advising Center, established in Spring 2005, provides General Education advising, new student advising, and special advising for students on academic probation. The goal of the MESA Engineering Program is to increase the number of engineering graduates entering the engineering profession from groups with low eligibility rates in college admissions. Engineering students can also take advantage of the services provided by the University Academic Services including free tutoring and various study skills workshops. A detailed description of these support units is presented in Appendix II Section B.10 Non-academic Support Units.

Co-Curricular Programs

Co-curricular programs have been an integral part of the educational experience that the College offers its students with the goal of providing opportunities to students to learn about the context and domain of current and future engineering practices. There are three on-going programs sponsored by the College: Co-op Project Course, Global Technology Initiative, and Silicon Valley Leaders Symposium.
Co-op Project Course (ENGR 197)

This course is designed to provide students practical work experience with innovative technology companies in Silicon Valley. Students are also taught to further their communication and interpersonal skills as practiced in a professional setting. This course is coordinated jointly by an engineering faculty member and an industry instructor, and is in collaboration with the University Career Center. The Career Center assists students in obtaining internship positions with local companies.

Global Technology Initiative (GTI)

With an increasingly globalized technical workforce, the College established the Global Technology Initiative (GTI) in 2004 with a goal of providing our students a global perspective. The focus is on technology and business developments in the Asia-Pacific region, which has strong links with Silicon Valley. The Initiative is funded by a one-million-dollar endowment supported by industry leaders with strong ties to Silicon Valley and the Asia-Pacific area. Each year this funding supports about 25 students and three faculty members on a two-week all-expense-paid study-tour to Asia. For instance, in summer 2004, 25 engineering students and four faculty members visited a variety of technology enterprises as well as educational and research institutions in China and Taiwan. They witnessed first-hand the advancement of the high tech industry in that region and the high level of interconnectedness of Taiwan’s and China’s businesses with those in Silicon Valley. This study program also included significant components in pre-trip acculturation and post-trip dissemination of lessons learned. Assessments indicate that many students change their study and career plans because of their own trip experience or lessons learned from their classmates who went on the study tour.

B.9.2.6 Silicon Valley Leaders Symposium

Each Thursday the College invites an industry or technology leader to campus to speak on topics of importance to engineering faculty and students: emerging technologies, business practices, and industry trends. This is the College’s Silicon Valley Leaders Symposium. Further, the Symposium provides an opportunity for our faculty and students to interface with industry leaders and learn from their insights and experience. The following two tables list the speakers and their topics presented in the last two semesters.

<table>
<thead>
<tr>
<th>Fall 2004 Silicon Valley Leaders Symposium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speaker</strong></td>
</tr>
<tr>
<td>Dr. Regis McKenna</td>
</tr>
<tr>
<td>Dr. Court Skinner</td>
</tr>
<tr>
<td><strong>Title</strong></td>
</tr>
<tr>
<td>Marketing consultant</td>
</tr>
<tr>
<td>Director of Research, National Semiconductor</td>
</tr>
<tr>
<td><strong>Presentation</strong></td>
</tr>
<tr>
<td>Total Access: New Marketing Strategies</td>
</tr>
<tr>
<td>Staying Out Of the Box</td>
</tr>
<tr>
<td>Speaker</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Mr. G. Dan Hutcheson</td>
</tr>
<tr>
<td>Mr. Sridhar Vajapey</td>
</tr>
<tr>
<td>Dr. Aram M. Mika</td>
</tr>
<tr>
<td>GTI Scholars</td>
</tr>
<tr>
<td>Mr. Harry Blount</td>
</tr>
<tr>
<td>Mr. Richard Walker</td>
</tr>
</tbody>
</table>

### Spring 2005 Leading Technology Symposium

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Title</th>
<th>Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Jen-Hsun Huang</td>
<td>President and CEO, NVIDIA</td>
<td>The Digital Media Era – Challenges and Opportunities</td>
</tr>
<tr>
<td>Dr. Lee Galbraith</td>
<td>KLA-Tencor</td>
<td>The End of Moore’s Law? And What Comes Next?</td>
</tr>
<tr>
<td>Mr. Young K. Sohn</td>
<td>Group President, Agilent Technologies</td>
<td>The Changing Face of the Worldwide Semiconductor Industry, and the Growing Needs for Innovation</td>
</tr>
<tr>
<td>Dr. Kris Pister</td>
<td>Founder and CTO, Dust Networks</td>
<td>Wireless Sensor Networks: From Smart Dust to Commercial Products</td>
</tr>
<tr>
<td>Mr. Hong Liang Lu</td>
<td>CEO and Chairman, UTStarcom, Inc.</td>
<td>B to 4B: The Future of Telecommunications Market</td>
</tr>
<tr>
<td>Mrs. Jeanette Horan</td>
<td>Vice President, Silicon Valley Lab, IBM</td>
<td>Shattering the Past: A New Era in Technology</td>
</tr>
<tr>
<td>Mr. Russell Hancock</td>
<td>President &amp; CEO, Joint Venture: Silicon Valley Network</td>
<td>Building the Next Silicon Valley</td>
</tr>
<tr>
<td>Dr. Aart J. de Geus</td>
<td>CEO&amp; Chairman, Synopsys</td>
<td>From the Garage to the Globe</td>
</tr>
<tr>
<td>Mr. Edward W. (Ned) Barnholt</td>
<td>Chairman Emeritus, Agilent Technologies</td>
<td>Silicon Valley as a Global Leader: What’s Next?</td>
</tr>
<tr>
<td>Mr. John P. Daane</td>
<td>President, CEO, and Chairman, Altera Corporation</td>
<td>Keeping Innovation Alive in Silicon Valley</td>
</tr>
</tbody>
</table>
### Fall 2005 Leading Technology Symposium

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Title</th>
<th>Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Robert J. Perlmutter</td>
<td>Vice President and General Manager, WIN Division, KLA-Tencor</td>
<td>Developing Leading Edge Inspection System for Semiconductor Industry</td>
</tr>
<tr>
<td>Mr. Dave Purvis</td>
<td>Executive Vice President, Design and Engineering Solectron</td>
<td>Engineering in a Global Economy</td>
</tr>
<tr>
<td>Mr. Robert Ragusa</td>
<td>Senior Vice President of Global Operations Affymetrix</td>
<td>The Globalization of Genomics</td>
</tr>
<tr>
<td>Mr. Ric Telford</td>
<td>Vice President of Autonomic Computing Architecture &amp; Technology IBM</td>
<td>Autonomic Computing: Moving Towards Self-Managing Systems</td>
</tr>
<tr>
<td>Dr. Stefan Lai, Fellow IEEE</td>
<td>Vice President of Technology and Mfg Group Intel Corporation</td>
<td>TBA</td>
</tr>
<tr>
<td>Mr. Pat Cavaney</td>
<td>Senior Vice President of Operations and IT HP</td>
<td>HP’s Global Delivery Story: How, Where, When, Why, and Who</td>
</tr>
<tr>
<td>Dr. Steven F. Zornetzer</td>
<td>Deputy Director for Research NASA Ames Research Lab.</td>
<td>Technology Challenges at NASA: Achieving the Exploration Vision</td>
</tr>
<tr>
<td>Sass Somekh, PhD</td>
<td>President Novellus</td>
<td>The Role of Innovation and Leadership in Product and Business Development</td>
</tr>
</tbody>
</table>

### Spring 2006 Leading Technology Symposium

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Title</th>
<th>Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Tommy Lee</td>
<td>Vice President NVIDIA</td>
<td>Engineering in a High Velocity Collaborative Environment, a Globalization Challenge</td>
</tr>
<tr>
<td>Mr. Barry James Folsom</td>
<td>Corporate Vice President &amp; General Manager Motorola, Inc.</td>
<td>Seamless Home Mobility</td>
</tr>
<tr>
<td>Dr. Mark Dean</td>
<td>Vice President &amp; IBM Fellow IBM, Almaden Research Center</td>
<td>Opportunities for Innovation in the IT Industry</td>
</tr>
<tr>
<td>Dr. Geoffrey West</td>
<td>President Santa Fe Institute, New Mexico</td>
<td>Size Matters; Growth, Innovation and the Pace of Life from Cells to Cities</td>
</tr>
<tr>
<td>Mr. Robert</td>
<td>Vice President, Molecular</td>
<td>Made in China, Designed in</td>
</tr>
</tbody>
</table>
B.10 Interdependence of Program

B10.1 Service to SJSU
The department offers ME 198 (cross-listed with Tech 198) as the approved upper division general education V-area course for students at SJSU.

B10.2 Services to Programs of College of Engineering
The Department offers the following service courses at the undergraduate level:

ME 20 Design and Graphics (cross-listed with Tech 20) offers to ME, AE, CompE students
ME 110 Manufacturing Processes (cross-listed with ISE 110)
ME 109 Heat Transfer in Electronics (cross-listed with ChemE 109) offers to EE and CompE students

At the graduate level the Department offers the following service courses:

ME296E BioMedical Device (permanent course ME 267) for MSE program in support of Biomedical Devices (focus area to become concentration in 2007).

B10.3 Service to MSE Program
The Department offers course in support of the MSE Program focus area such as ME296E. In addition, the faculty members play a project advisor/committee member role to general engineering master’s degree students for ENGR 295A and ENGR 295B courses.

B10.4 Service to the Off-Campus Programs

In the summer of 2000, the MAE Department & College of Engineering signed an agreement with the Lockheed-Martin Company in Sunnyvale, California to establish special-session cohort programs at Lockheed, one each in the MSAE and MSME programs. The agreement also provided Lockheed-Martin employees with an opportunity to apply for conversion to matriculating status in each program, and most have done so. The cohort programs started in Fall 2000. The student enrollment in that program was 10 in Fall 2000. It had grown to 34 graduate students by Fall 2004, and the current enrollment is about 26 students in this semester (Fall 2006). As of today, the ME and AE cohort programs at Lockheed-Martin continue.
C. Program Planning and Strategies

C.1 Five-Year Plan and Strategies Overview

C.1.1 Goals and Alignment with Department and College Mission

College of Engineering Mission Statement
The College of Engineering has the mission of providing an empowering educational opportunity to students for their technical professional and social development in a competitive and dynamic global society.

We will accomplish this by building a vibrant community of students, faculty, staff and industry professionals through strategic collaborations with alumni, and Silicon Valley, California, national, and global partners.

MAE Department Mission
The mission of the Mechanical & Aerospace Engineering Department is to serve society, the public sector, and private industry by:

- Providing undergraduate and graduate Mechanical and Aerospace engineering education that prepares students with the knowledge, modern applications and lifelong learning skills required to serve the engineering profession and industry.
- Contributing to the development and application of knowledge through faculty scholarship.
- Preparing students for the modern professional-practice environment.

The undergraduate Mechanical Engineering Program is designed to fulfill the University, College, and Department mission described in the previous sections. It provides students with a broad understanding of basic Mechanical engineering concepts, as well as the contemporary skills required by industry. The foundation courses provide a basis for professional competence and the required knowledge to focus on a particular specialization upon graduation, either in the work environment or through pursuing advanced degrees. Courses that develop contemporary skills provide students an ability to be immediately competitive and productive as they begin their professional careers. The coursework includes extensive laboratory experiences and many opportunities for students to complete applied projects and designs.

The Mechanical Engineering Program Educational Objectives (PEO) reflects our constituents’ expectations that our graduates should have:

1. A strong foundation in mathematics, basic science and engineering fundamentals, to successfully compete for entry-level positions or pursue graduate studies in ME or related fields.

2. Contemporary professional and lifelong learning skills including hands-on laboratory experience, familiarity with computers, modern software, and information technology, to successfully compete in the local, national and global engineering market.
3. Strong communication and interpersonal skills, broad knowledge, and an understanding of multicultural and global perspectives to work effectively in multidisciplinary teams, both as team members and as leaders.

4. An understanding of the ethical choices inherent in the engineering profession to deal with issues such as public safety, product marketing, and respect for intellectual property.

**C.1.2 List of Goals and Definition**

For the next five years, the Department has developed six goals for the ME Program as follows:

**Goal 1:**
Undergraduate Mechatronics Focus Area: To stimulate ME students’ interest in pursuing mechatronics as their focus area.

**Goal 2:**
Graduate Mechatronics Curriculum: To strengthen the mechatronics curriculum at the Master’s level.

**Goal 3:**
Faculty in Mechatronics: To seek one additional faculty member in the area of Mechatronics because Professor Wang is planning to retire within two years.

**Goal 4:**
Thermal and Fluid Focus Area: To improve engineering fundamentals of our undergraduates and graduate Students.

**Goal 5:**
Thermal and Fluid area: To increased Interaction with industry and government organizations

**Goal 6:**
Mechanical Design Focus Area: To establish a more comprehensive mechanical design curriculum for the ME Undergraduate Program.

These goals will enhance the quality of the ME Program and help to maintain the student enrollment within the Department. In the Fall 2006, the Department has obtained approval for hiring one new Mechanical Design faculty member for Fall 2007. In addition, the Department plans to hire two more faculty members (one in Mechatronics area and one in Thermal/Fluid area) during the next 5 years.

Currently the Department has only one technician, to meet the needs of all three focus areas of study (Mechanical Design, Mechatronics, Thermal & Fluid) for the next five years, one additional technician will be sought for hiring. To reach the goal of Mechanical Design area for introducing hands-on prototyping and basic machine shop practices early in the ME program, machine shop facility will be required. This need is planned to be met by collaborating with other Department within the College of Engineering such as Technology Department.
C.2 Strategies and Actions Plan

GOAL 1: Undergraduate Mechatronics Focus Area: Stimulate ME students’ interest in pursuing mechatronics as their focus area.

The MAE Department initiated an undergraduate focus area in mechatronics in 1996, which gave students an additional choice of specialization in addition to Design and Thermal-Fluids. Within a few years, approximately 40% of undergraduates were specializing in mechatronics. After the dot com bust in 2001, the number of students choosing mechatronics shrunk to approximately 20% currently. There is definitely a need in local industry for graduates with skills in mechatronics, but the impression of ME students is that mechatronics focus area is “hard”, and, by and large, they don’t like electronics and computer programming, which are part of mechatronics.

We need to overcome the negative perceptions and help ME students see that mechatronics is an exciting and important area for mechanical engineers.

Objective 1.1: Provide undergraduate ME students with information that describes what mechatronics is all about before they decide on which focus area they will choose for the major.

Most students have little if any clear understanding about what the focus areas are, let alone what engineers do with what they chose to study in industry.

Action 1.1.1: Develop a poster, brochure, and web page that clearly and engagingly describes what mechatronics is all about.

The MAE Department advisors can direct students to these resources as they plan their studies.

Responsibility: Mechatronics Focus Area Committee
Resources: Some staff support to make and post brochures around the Department office and on the Department web site.
Timeline: Implement by Fall 2007
Success Metric: Analyze responses to a question addressing the efficacy of the information on the graduating senior exit exam

Objective 1.2: Enhance the course offerings in the mechatronics area to include more exciting and engaging electives

The mechatronics focus area would do well to develop an advanced mechatronics elective class that includes mechatronics product design and advanced sensors and actuators.

Action 1.2.1: Develop an experimental advanced mechatronics course

This course will be engaging and practical.

Responsibility: Mechatronics Focus Area Committee
Resources: Release time for major contributors, laboratory space in E192, and equipment to support: test and measurement equipment, lab benches, prototyping equipment
Timeline: Implement by Fall 2008
Success Metric: Course materials, functional lab experiments that have been piloted, positive feedback by a majority of students from surveys, consistent enrollment of at least 15 students after its second offering.

**Action 1.2.2: Review the ME 136 Design for Manufacturability course**

The original intent of this course was to address design for manufacturability for mechatronics products, but its focus may have shifted more to design.

**Responsibility:** Mechatronics Focus Area Committee

**Resources:** Equipment to develop a manufacturing process showcase for embedded systems, lab-on-a-chip, system-on-a-chip, CMOS technology, micro-machining techniques, computer integrated manufacturing system (from design to manufacturing), and some design software.

Timeline: Implement by Fall 2009

Success Metric: Positive feedback by a majority of students from surveys and consistent enrollment of at least 15 students after its second offering following revamping.

**Action 1.2.3: Modernize the ME 190 Mechatronic Systems Engineering course**

The lab associated with ME 190 is badly in need of modernization with new computers, sensors, and data acquisition hardware and software.

**Responsibility:** Mechatronics Focus Area Committee

**Resources:** Approximately $20K funding for equipment and software plus student assistant help

Timeline: By the end of Fall-2007, most of the lab stations will be upgraded with modern Lab View data acquisition boards and Quanser data acquisition boards. Sensors and actuators at each station will be modernized.

Success Metric: Working lab stations with modern software and hardware. A lab manual will be generated. Consistent enrollment of at least 15 students after its second offering following revamping.

**Objective 1.3: Overcome the distaste for electronics and programming of ME students.**

As mentioned earlier, ME students by and large are not inclined toward electronics and programming. Facility with both of these subject areas is important for a student to be successful in mechatronics.

**Action 1.3.1: Revise ME 30 Computer Applications to make it more exciting and relevant to the needs of the mechatronics focus area**

ME 30 (or its equivalent at Community Colleges) is likely the first course on computer programming that ME students have. The current ME 30 at San José State is entirely focused on numerical computation and is being taught largely the same as it has been for over 20 years. General purpose engineering computation tools, such as Excel, Matlab, and TKsolver have grown more powerful and widely available in the last 20 years, so the need to program personal computers for purely computational needs has been largely superseded by these tools. The courses in mechatronics are really the only ones that require understanding of computer programming, particularly in C, so ME 30 needs to be
revised to reflect the current realities of engineering computation and better address the needs of subsequent courses in mechatronics.

**Responsibility:** Mechatronics Focus Area Committee  
**Resources:** Release time for the individuals who will revise the course, funds for purchasing any needed hardware or software  
**Timeline:** Implement by Fall 2007  
**Success Metric:**

**Action 1.3.2: Work with the EE Department to address the needs of ME students in EE 98**

EE 98 Introduction to Circuit Analysis is a required course for ME/EE106. It covers circuit laws and nomenclature, resistive circuits with DC sources, the ideal operational amplifier, controlled sources, natural and complete response of simple circuits, steady-state sinusoidal analysis and power calculations. Students need to have a firm grasp on the concepts presented in EE 98 before they take ME/EE106 and not be turned off by the subject.

**Responsibility:** Mechatronics Focus Area Committee  
**Resources:** Support from MAE Department Chair in discussions with the EE Department  
**Timeline:** Implement by Fall 2007  
**Success Metric:** Improvement in attitudes towards electronics as noted in exit surveys

**Action 1.3.3: Implement engaging laboratory experiment in the new E 10 course that demonstrates how electronics and programming can be used to solve ME problems.**

The College of Engineering is moving ahead to revamp E 10 Introduction to Engineering. Departments in the College will be asked to come up with engaging laboratory experiments that effectively show what their respective engineering disciplines are all about. We propose to develop an experiment with one or more of the discipline groups in MAE that will involve elements of mechatronics.

**Responsibility:** Mechatronics Focus Area Committee  
**Resources:** Release time for the individuals to develop the experiments, funds for purchasing hardware and software  
**Timeline:** Implement by Fall 2007  
**Success Metric:** A majority of positive reactions to questions asking about mechatronics related aspects of the laboratory on exit surveys in E10.

**GOAL 2: Graduate Mechatronics Curriculum:** Strengthen the mechatronics curriculum at the Master’s level.

**Objective 2.1: Standardize the curriculum and laboratory in ME 285.**

What has been taught in ME 285 has depended on the instructor who taught it in any particular semester. The curriculum and laboratory needs to be defined and implemented.

**Action 2.1.1: Develop a common curriculum**
We need to identify some current mechatronic technologies, e.g., wireless communication, serial/parallel communication protocols, smart sensors/actuators/systems, vision/fiber optic/medical imaging, biorobotics/biomechatronics, etc., and then develop courseware or materials to support these topics.

**Responsibility:** Mechatronics Focus Area Committee

**Resources:** Release time for the individuals to develop the experiments, funds for purchasing hardware and software

**Timeline:** Implement by Fall 2008

**Success Metric:** Consistent enrollment of at least 15 students after its second offering following revamping.

**Action 2.1.2: Develop a common laboratory curriculum**

Four or five laboratory experiments need to be developed - each one supporting an identified topic. Some software skills like image processing, Labview or Matlab need to be incorporated into the labs.

**Responsibility:** Mechatronics Focus Area Committee

**Resources:** Equipment TBD, computer, software, hardware, and lab space

**Timeline:** Implement by Spring 2009

**Success Metric:** Positive student feedback on exit surveys and student performance in the class

**Objective 2.2: Review and revise ME 283**

ME 283 Automatic Control of Manufacturing Processes was originally conceived by a faculty member who is no longer with the MAE department.

**Action 2.2.1: Review ME 283 scope and coverage**

The scope and coverage of ME 283 needs to be reviewed to see if it is serving the needs of graduate students who are focusing in mechatronics at the graduate level.

**Responsibility:** Mechatronics Focus Area Committee

**Resources:** none

**Timeline:** Complete by Fall 2007

**Success Metric:** Action plan that outlines any needed changes to the course

**Objective 2.3: Implement a course on Advanced Sensors for Mechatronics**

There is a need for students to know about the ever widening array of sensors and sensor technology.

**Action 2.3.1: Offer ME 297A**

ME 297A Advanced Sensors for Mechatronics has been proposed and developed by Prof. Winncy Du

**Responsibility:** Prof. Winncy Du

**Resources:** Hardware to support five laboratory experiments: (1) mechanical sensor lab; (2) electromagnetic sensor lab; (3) bio/chemical sensor lab, (4) sensor signal conditioning and data acquisition lab, and (5) sensor integration and data fusion lab.
Timeline: Implement by Fall 2008
Success Metric: Functional lab experiments and lab manuals (piloted by students in Spring 2007), student survey and interview, student performance in the class and labs

**Objective 2.4: Develop a course on Micro and Nano Mechatronics**

There is a need to develop a graduate level course on Dynamic Modeling and Control System Design for micro- and nano-scale mechatronics products. This course will enhance the current MEMS design and fabrication program of the MAE department.

**Action 2.4.1: Develop curriculum and lab**
Responsibility: Prof. Ji Wang  
Resources: Seek donations from local industry, Lottery Grant from the COE, and apply for an NSF laboratory development grant  
Timeline: Lecture part of the course can start by Fall 2007. The lab station development will depend on the available resources and student assistant help. It is expected to take about two years.  
Success Metric: Well developed course material, and minimum number of working educational experimental stations and manuals. Consistent enrollment of at least 15 students after its second offering.

**GOAL 3: Faculty in Mechatronics**

One additional faculty member is needed in the area of mechatronics, because Prof. Wang is planning to retire within two years.

**Objective 3.1: Hire an additional faculty member in the area of mechatronics.**

The sought after faculty member should have experience in the following areas:

- Dynamic and control
- Modern electronics and microprocessor and micro controllers
- Modern sensors and actuators
- Modern application software (MATLAB, Simulink, Labview etc)
- Integration of mechatronics with engineering systems.
- Smart and intelligent mechatronics product development
- Nano-Micro scale mechatronics product design and implementation.

**Action 3.1.1: Work with the MAE Chair to develop a case for hiring an additional faculty member in mechatronics**

Responsibility: Mechatronics Focus Area Committee  
Resources: Funding support from Dept and COE  
Timeline: Get authorization to hire by Fall 2007  
Success Metric: Having a suitable candidate hired to begin Fall 2008
GOAL 4: Improve Engineering Fundamentals of our Undergraduates and Graduate Students in Thermal-fluid Area.

Objective 4.1: Improve the laboratory experiences of our undergraduates.
The main laboratory experience for students in the thermal-fluids area is the 1-unit ME 114 lab associated with the 3-unit lecture. In general, 4 to 5 sections of 20 students each are required each semester. Experiments covering thermodynamics, fluid mechanics, and heat transfer principles are covered. In addition, written and oral communication skills are emphasized. A huge amount of time has been invested into development of new and better experiments for this lab by the current thermal-fluids faculty since 2002. The current practice of using undergraduate and graduate students is adequate and cost-effective for the department; however, there are numerous disadvantages. The students require a lot of time-intensive training, and there is new group to train every year. Also, they are not qualified to give critical feedback on writing and oral presentation skills, handle the wide range of questions encountered from the students in the class, or to make improvements to the experiments.

Action 4.1.1: Hire a qualified part-time instructor to teach and coordinate the laboratory sections of ME 114. Even if a student assistant or two is required to handle the semesters with 5+ lab sections, a qualified part-time instructor with continuity in teaching the bulk of the lab sections from year to year will be the best person to maintain quality and consistent standards.

Responsibility: Department chair, thermal-fluids full-time faculty
Resources: $$$
Timeline: ASAP
Success metric: Part-time instructor in-place, student evaluation via SOTES/SOLATES, peer evaluation by full-time thermal-fluids faculty

Objective 4.2: Improve the teaching of our part-time instructors in the thermal-fluids area.
Our part-time instructors are a big variable in the consistency of our program. Often, they do not follow the syllabus prepared for them by the course coordinator, and they grade with vastly different standards.

Action 4.2.1: More peer reviews and feedback by full-time faculty.

Responsibility: thermal-fluids full-time faculty
Resources: time
Timeline: 5 yrs.
Success metric: SOTES/SOLATES, student preparedness for subsequent classes and research projects.

Objective 4.3: Cover a greater fraction of the thermal-fluids curriculum with full-time faculty.
In 2002, all of ME113, ME114, and ME111 were taught by full-time faculty, as well as some graduate and elective classes. These core courses recruit students into the thermal-fluids area, and prepare them technically for related advanced topics and research. Since 2002, our regular ME111 instructor has retired without being replaced, and the enrollment in the ME and CE programs as well as the students interested in specializing in the area have increased substantially, dramatically increasing our teaching and project supervision duties. We are currently depend too heavily on part-timers and are very vulnerable to changes in their availability. Lastly, it would be nice to expand the areas of expertise of the full-time faculty to cover other contemporary topics such as alternative energy.

**Action 4.3.1:** Hire tenure-track position in thermal-fluids area, preferably with expertise in alternative energy area.

**Responsibility:** Department chair, search committee, department faculty  
**Resources:** $$  
**Timeline:** 5 years  
**Success metric:** Assistant Professor in thermal-fluids joins faculty

**Objective 4.4:** Improve written and oral communication skills of our graduate students, as well as research skills.

**Action 4.4.1:** Introduce more project-based assignments requiring written and oral communication skills into the graduate thermal-fluids core classes.

**Responsibility:** Course coordinators  
**Resources:** Minimal preparation time  
**Timeline:** 5 years  
**Success metric:** # of projects in courses and quality

**GOAL 5:** Increased Interaction with Industry and Government Organizations

**Objective 5.1:** Have more funded senior projects.

**Responsibility:** thermal-fluids faculty  
**Resources:** time  
**Timeline:** 5 years  
**Success metric:** $$ in grants, number of grants

**Action 5.1.1:** Nurture and continue efforts with existing industry collaborators (e.g. Rockwell-Collins)

**Responsibility:** thermal-fluids faculty  
**Resources:** time  
**Timeline:** 5 years  
**Success metric:** $$ in grants, # years of support
Objective 5.2: Market our department and programs better

Action 5.2.1: Invest in a better department website that advertises our capabilities and successes.
Responsibility: Department chair
Resources: $$ for professional web design, input from faculty
Timeline: 5 years
Success metric: # of hits to new website, anecdotal feedback from website browsers

GOAL 6: Mechanical Design Program: To establish a more comprehensive mechanical design curriculum for the ME Undergraduate Program. The U/G curriculum prepares ME students well for performing mechanical design upon graduation.

Objective 6.1: To modify existing ME20 with solid modeling emphasis for product design
The current ME20 course syllabus emphasizes on 2-dimensional drawings and graphics using the AutoCad program. The effort focused on geometric design and solid modeling for creating products/parts in this class is rather minimal. To stimulate freshman students’ interest in designing mechanical products, curriculum change for this course is proposed to integrate more solid modeling emphasis so that ME students would develop a good appreciation/interest and know-how for designing 3-dimensional products.

Action 6.1.1: ME mechanical design faculty will meet with ME20 course coordinator to work out the details in ME20 curriculum changes. This information will pass on to ME20 instructors for syllabus change and course preparation.
Responsibility: Mechanical Design faculty & ME20 course coordinator
Resources: Minimum, faculty time for curriculum change and preparation
Timeline: Phase in to reach goal within 3 years
Success Metric: ME20 student performance and student survey feedback

Objective 6.2: To introduce hands-on prototyping and basic machine shop practices early in the ME program
To prepare students for design and prototype fabrication, a hands-on prototyping and machine shop course/lab will be developed to train students familiar with machine shop equipment operation and the associated safety procedures. This course will be part of the 2nd year ME curriculum so that the acquired knowledge can be applied in the upper division engineering courses.

Action 6.2.1: Review the lab portion of the current ME110 course “Manufacturing Processes” and develop new 1-unit prototyping and machine shop course
Responsibility: ME faculty & ME110 course coordinator
Resources: Staff support, machine shop facility, faculty time for lab development
Timeline: Phase in to reach goal within 3 years (course development, pilot implementation, final implementation in F2009)
**Success Metric:** New course being offered within 3 years, student performance in prototype fabrication

**Objective 6.3: To develop an engineering design process course**
ME Students should acquire knowledge in engineering design process methodology and practice before performing their senior projects. An Engineering Design Process course will be developed as part of the 3rd year ME curriculum. The design methodology and practical approach plus case study for illustration will be the core content for the new course. The learned knowledge from this course will complement with existing ME154 Mechanical Engineering Design which emphasizes on kinematics mechanism and component design and analysis.

Action 6.3.1: ME Design Faculty will develop the contents for this course.
**Responsibility:** ME Design Faculty & Mechanical Design stem coordinator
**Resources:** Faculty time for course development
**Timeline:** Phase in to reach goal within 5 years
**Success Metric:** New course being offered within 5 years

**Objective 6.4: To develop an advanced materials and system design course**
ME students should familiar with conventional engineering materials such as steel & aluminum as well as advanced materials such as plastics, composites, & polymers for mechanical design applications. In addition, students should acquire the knowledge of system design methodology and approach prior to graduation. To meet this goal, a new course on advanced material applications and system design approach will be developed and introduced in the senior year.

Action 6.4.1: ME Design Faculty will develop the contents for this course.
**Responsibility:** ME Design Faculty
**Resources:** Faculty time for course development
**Timeline:** Phase in to reach goal within 5 years
**Success Metric:** New course being offered within 5 years
## C3. Strategies and Actions Plan Summary Matrix

### GOAL 1: Undergraduate Mechatronics Focus Area: Stimulate ME students’ interest in pursuing Mechatronics as their focus area.

**Objective 1.1: Provide undergraduate ME students with information that describes mechatronics field.**

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Resources</th>
<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action 1.1.1: Develop a poster, brochure, and web page that clearly and engagingly describes what mechatronics is all about.</td>
<td>Mechatronics Faculty</td>
<td>Staff support</td>
<td>Implement by Fall 2007</td>
</tr>
</tbody>
</table>

**Objective 1.2: Enhance the course offerings in the mechatronics area to include more exciting and engaging electives.**

<table>
<thead>
<tr>
<th>Responsibility</th>
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<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action 1.2.1: Develop an experimental advanced mechatronics course</td>
<td>Mechatronics Faculty</td>
<td>Release time, laboratory space, and equipment</td>
<td>Implement by Fall 2008</td>
</tr>
<tr>
<td>Action 1.2.2: Review the ME 136 course</td>
<td>Mechatronics Faculty</td>
<td>Equipment and software to develop a manufacturing process showcase</td>
<td>Implement by Fall 2009</td>
</tr>
<tr>
<td>Action 1.2.3: Modernize the ME 190 Mechatronic Systems Engineering course</td>
<td>Mechatronics Faculty</td>
<td>$20 K funding plus student assistant</td>
<td>By the end of Fall 2007</td>
</tr>
</tbody>
</table>

**Objective 1.3: Overcome the distaste for electronics and programming of ME students**

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Action 1.3.1: Revise ME 30 Computer Applications to make it more exciting and relevant to the needs of the mechatronics focus area</td>
<td>Mechatronics Faculty</td>
<td>Release time for revising the course, funds for purchasing any needed hardware or software</td>
<td>Implement by Fall 2007</td>
</tr>
<tr>
<td>Action 1.3.2: Work with the EE Department to address the needs of ME students in EE 98</td>
<td>Mechatronics Faculty</td>
<td>Support from MAE Department Chair</td>
<td>Implement by Fall 2007</td>
</tr>
</tbody>
</table>
**Action 1.3.3:** Implement engaging laboratory experiment in the new E10 course

**Responsibility:** Mechatronics Faculty

**Resources:** Release time for developing the experiments, funds for purchasing hardware and software

**Timeline:** Implement by Fall 2007

**Success Metric:** Positive reactions on exit surveys in E10

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**GOAL 2:** Graduate Mechatronics Curriculum: Strengthen the mechatronics curriculum at the Master's level.

**Objective 2.1:** Standardize the curriculum and laboratory in ME 285

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Action 2.1.1:</strong> Develop a common curriculum</td>
<td>Mechatronics Faculty</td>
<td>Release time to develop the experiments, funds for purchasing hardware and software</td>
<td>Implement by Fall 2008</td>
</tr>
</tbody>
</table>

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<tr>
<th>Responsibility</th>
<th>Resources</th>
<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action 2.1.2:</strong> Develop a common laboratory</td>
<td>Mechatronics Faculty</td>
<td>Equipment, computer, software, hardware, and lab space</td>
<td>Implement by Spring 2009</td>
</tr>
</tbody>
</table>

**Objective 2.2:** Review and revise ME 283

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Resources</th>
<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action 2.2.1:</strong> Review ME 283 scope and coverage</td>
<td>Mechatronics Faculty</td>
<td>none</td>
<td>Complete by Fall 2007</td>
</tr>
</tbody>
</table>

**Objective 2.3:** Implement a course on Advanced Sensors for Mechatronics

<table>
<thead>
<tr>
<th>Responsibility</th>
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<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action 2.3.1:</strong> Offer ME 297A</td>
<td>Prof. Winncy Du</td>
<td>Hardware support</td>
<td>Implement by Fall 2008</td>
</tr>
</tbody>
</table>

**Objective 2.4:** Develop a course on Micro and Nano Mechtronics

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Resources</th>
<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
</table>
Action 2.4.1: Develop curriculum and lab
Prof. Ji Wang
Seek donations from local industry, Lottery Grant from the COE, and apply for an NSF laboratory development grant
Lecture part starts by Fall 2007. Lab is expected to take place in about two years
Well developed course material

GOAL 3:
Faculty in Mechatronics: One additional faculty member is needed in the area of mechatronics, because Prof. Wang is planning to retire within two years.
Objectives 3.1: Hire an additional faculty member in the area of mechatronics

<table>
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<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action 3.1.1: Work with the MAE chair to develop a case for hiring an additional faculty member in mechatronics</td>
<td>Mechatronics Faculty</td>
<td>COE Funding</td>
<td>Get authorization to hire by Fall 2007</td>
</tr>
</tbody>
</table>

GOAL 4:
Improve Engineering Fundamentals of our Undergraduates and Graduate Students in Thermal-fluid Area
Objective 4.1: Improve the laboratory experiences of our undergraduates

<table>
<thead>
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<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action 4.1.1: Hire a qualified part-time instructor to teach and coordinate the laboratory sections of ME 114</td>
<td>Department chair / thermal-fluids faculty</td>
<td>Funding</td>
<td>ASAP</td>
</tr>
</tbody>
</table>

Objective 4.2: Improve the teaching of our part-time instructors in the thermal-fluids area

<table>
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<tr>
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<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action 4.2.1: More peer reviews and feedback by full-time faculty</td>
<td>Thermal-fluids faculty</td>
<td>Time</td>
<td>5 years</td>
</tr>
</tbody>
</table>

Objective 4.3: Cover a greater fraction of the thermal-fluids curriculum with full-time faculty

<table>
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<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action 4.3.1: Hire tenure-track position in thermal-fluids area, preferably with expertise in alternative energy</td>
<td>Department chair</td>
<td>Funding</td>
<td>5 years</td>
</tr>
</tbody>
</table>
**Objective 4.4: Improve written and oral communication skills of our graduate students, as well as research skills**

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<th><strong>Success Metric</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Action 4.4.1:</strong> Introduce more project-based assignments requiring written and oral communication skills into the graduate thermal-fluids core classes</td>
<td>Course coordinators</td>
<td>Minimal preparation time</td>
<td>5 years</td>
</tr>
</tbody>
</table>

**GOAL 5: Increased Interaction with Industry and Government Organizations**

**Objective 5.1: Have more funded senior projects**

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<th><strong>Success Metric</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action 5.1.1:</strong> Nurture and continue efforts with existing industry collaborators (e.g. Rockwell-Collins)</td>
<td>Thermal-fluids faculty</td>
<td>Time</td>
<td>5 years</td>
</tr>
</tbody>
</table>

**Objective 5.2: Market our department and programs better**

<table>
<thead>
<tr>
<th><strong>Responsibility</strong></th>
<th><strong>Resources</strong></th>
<th><strong>Timeline</strong></th>
<th><strong>Success Metric</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action 5.2.1:</strong> Invest in a better department website that advertises our capabilities and successes</td>
<td>Department chair</td>
<td>Funding for professional web design, input from faculty</td>
<td>5 years</td>
</tr>
</tbody>
</table>

**GOAL 6: Mechanical Design Program: To establish a more comprehensive mechanical design curriculum for the ME Undergraduate Program.**

**Objective 6.1: To modify existing ME 20 with solid modeling emphasis for product design**

<table>
<thead>
<tr>
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<th><strong>Timeline</strong></th>
<th><strong>Success Metric</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action 6.1.1:</strong> ME mechanical design faculty will meet with ME 20 course coordinator to work out the details in ME 20 curriculum changes. This information will pass on to ME 20 instructors for syllabus change and course preparation</td>
<td>Mechanical Design faculty &amp; ME 20 course coordinator</td>
<td>Minimum, faculty time</td>
<td>Within 3 years</td>
</tr>
</tbody>
</table>

**Objective 6.2: To introduce hands-on prototyping and basic machine shop practices early in the ME program**

<table>
<thead>
<tr>
<th><strong>Responsibility</strong></th>
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<th><strong>Timeline</strong></th>
<th><strong>Success Metric</strong></th>
</tr>
</thead>
</table>
**Action 6.2.1:** Review the lab portion of the current ME 110 course "Manufacturing Processes" and develop new 1-unit prototyping and machine shop course  
**ME faculty and ME 110 course coordinator**  
**Staff support, machine shop facility, faculty time for lab development**  
**within 3 years**  
**New course being offered**  

**Objective 6.3:** To develop an engineering design process course  
<table>
<thead>
<tr>
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<th>Resources</th>
<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
</table>
| **Action 6.3.1:** ME Design Faculty will develop the contents for this course | ME Design Faculty & Mechanical Design stem coordinator  
Faculty time | **within 5 years** | New course being offered within 5 years |

**Objective 6.4:** To develop an advanced materials and system design course  
<table>
<thead>
<tr>
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<th>Timeline</th>
<th>Success Metric</th>
</tr>
</thead>
</table>
| **Action 6.4.1:** ME Design Faculty will develop the contents for this course | ME Design Faculty  
Faculty time | **within 5 years** | New course being offered within 5 years |
C.4 Five-Year Faculty and Staff Hiring

C.4.1 Faculty Hiring and Justification
The Department has identified current curricular responsibilities and the number of full-time equivalent faculty required for each for the ME Program. In addition, we have identified full-time faculty currently performing these responsibilities, and also indicated faculty retirement anticipated in the next five years.

<table>
<thead>
<tr>
<th>Curricular Responsibilities</th>
<th>Equivalent Full-Time Faculty</th>
<th>Names of Faculty</th>
<th>Retirement Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Design</td>
<td>6.3</td>
<td>R. Yee&lt;br&gt;R. Agarwal&lt;br&gt;J. Lee</td>
<td></td>
</tr>
<tr>
<td>Thermal/Fluids</td>
<td>4.3</td>
<td>N. Okamoto&lt;br&gt;J. Rhee</td>
<td></td>
</tr>
<tr>
<td>Mechatronics</td>
<td>3</td>
<td>B. Furman&lt;br&gt;W. Du&lt;br&gt;J. Wang (FERP)</td>
<td>May 2008</td>
</tr>
<tr>
<td>Curricula Support</td>
<td>3.7</td>
<td>F. Barez&lt;br&gt;T-R Hsu</td>
<td></td>
</tr>
<tr>
<td>ME Program Total</td>
<td>17.3</td>
<td>9.5 full-time faculty members</td>
<td></td>
</tr>
</tbody>
</table>

Based on the above faculty numbers and the 80/20 rule calculations, the Department should justify to hire three (3) new faculty members for the ME Program. The Department has received approval in the Fall 2006 for hiring one full-time faculty starting in Fall 2007 in Mechanical Design Area of the Program. In addition, the Department plans to hire two more faculty members within the next five years, one for Thermal/Fluid Area and one for Mechatronics Area to replace the retiring professor in 2008.

C.4.2 Staff Hiring Plan and Justification
The Department offers two programs (Aerospace Engineering Program and Mechanical Engineering Program) and student enrollment is close to 1,000 students in Fall 2006. Currently the Department only has one technician to maintain 20 instructional & research laboratory facilities. The technician is responsible for upgrading and maintaining both software programs and hardware equipment within the laboratory facilities as well as helping faculty members to set up experiments for instruction and research. In addition, the technician also oversees and maintains the senior project machine shop for the Department. There is an urgent need to hire one more technician in this Department to share the heavy-scheduled responsibilities so that the six goals identified in Section C of this report can be realized within the next five years.