ABET
Self-Study Report

for the

Department of Mechanical Engineering

at

California State University, Sacramento

6000 J St.
Sacramento, California 95819

June 2015

CONFIDENTIAL

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Self-Study Report
Mechanical Engineering
Bachelor of Science
California State University, Sacramento
for
EAC of ABET
Reaccreditation

BACKGROUND INFORMATION

A. Contact Information

List name, mailing address, telephone number, fax number, and e-mail address for the primary pre-visit contact person for the program.

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B. Program History

Include the year implemented and the date of the last general review. Summarize major program changes with an emphasis on changes occurring since the last general review.

The Department of Mechanical Engineering at California State University, Sacramento was established in 1958. There has been consistently strong enrollment in the Department's B.S. and M.S. programs with a steady increase in the last decade. The program is designed to provide students with a strong theoretical background and opportunities to apply their knowledge in laboratory and experiential learning settings. There was a major change to the curriculum implemented in Fall 2009 at the time of our last ABET evaluation. Since then there have been no major changes to the curriculum. Minor changes include expanding elective offerings, modifying pre-requisites, and implementing University General Education/Graduation Requirement modifications.

At the time of our 2009 ABET Accreditation visit Program weaknesses, concerns and observations were related to effective assessment of Program Educational Objectives and Program Outcomes. These were addressed comprehensively in the Interim Report of June 2010 (Appendix G).

C. Options

List and describe any options, tracks, concentrations, etc. included in the program.

The title of the degree awarded by the program under review is: Bachelor of Science in Mechanical Engineering. All students take the same program except for the choice of six units of approved upper division electives.

D. Program Delivery Modes

Describe the delivery modes used by this program, e.g., days, evenings, weekends, cooperative education, traditional lecture/laboratory, off-campus, distance education, web-based, etc.

The Mechanical Engineering program is day offering only. Courses are offered throughout the day from early morning to early evening. Most courses are offered in a traditional face-to-face lecture and laboratory setting. Some courses are offered partially on-line in a hybrid mode.

E. Program Locations

Include all locations where the program or a portion of the program is regularly offered (this would also include dual degrees, international partnerships, etc.).

The program is located in Sacramento, California on the main California State University, Sacramento campus.

F. Public Disclosure

Provide information concerning all the places where the Program Education Objectives (PEOs), Student Outcomes (SOs), annual student enrollment and graduation data is posted or made accessible to the public. If this information is posted to the Web, please provide the URLs.

The Program Education Objectives, Student Outcomes, annual student enrollment and graduation data are available on the Department of Mechanical Engineering website. http://www.ecs.csus.edu/wcm/me/ Additionally, other data including graduation and retention data are compiled in the "Department Factbook" by the Office of Institutional Research.
http://www.csus.edu/oir/Data%20Center/Department%20Fact%20Book/Mechanical14.pdf

G. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

Summarize the Deficiencies, Weaknesses, or Concerns remaining from the most recent ABET Final Statement. Describe the actions taken to address them, including effective dates of actions, if applicable. If this is an initial accreditation, it should be so indicated.

From the 2009 ABET Accreditation visit the program weaknesses, concerns and observations were all related to effective assessment of the Program Educational Objectives and the Program Outcomes. These were addressed comprehensively in the Interim Report of June 2010 (Appendix G). Assessment efforts have been continuous and have resulted in minor modifications to pre-requisites and sequencing of courses. A comprehensive curriculum review was completed in Spring 2015.

GENERAL CRITERIA

CRITERION 1. STUDENTS

For the sections below, attach any written policies that apply.

A. Student Admissions

Summarize the requirements and process for accepting new students into the program.

Students may be admitted to the major if they are qualified for admission to the university. Generally, applicants will qualify for consideration for first-time freshman 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;
2. Have a verified minimum eligibility index (see section on Eligibility Index); and
3. Have completed with grades of "C" or better each of the courses in the comprehensive pattern of college preparatory subject requirements also known as the "a-g" pattern (see "Subject Requirements").

   Some students, such as International Students, must also take the TOEFL (Test of English as a Foreign Language) Test.

Honors Courses

Up to eight semesters of approved honors courses taken in the last two years of high school including up to two approved courses taken in the tenth grade, can be accepted toward students' high school GPA (see "Eligibility Index"). Each unit (one year) of grade "A" in an honors course will receive 5 points; grade "B," 4 points; and grade "C," 3 points.

Test Requirements

All Freshman applicants regardless of grade point average, must submit scores from either the SAT or the ACT.

Subject Requirements

The California State University requires that first-time freshman applicants complete, with grades of "C" or better, a comprehensive pattern of college preparatory study totaling 15 units (a "unit" is one year of study in high school).

Area	Subject	Units	
A	History/Social Science	2 years	Must Include one year of US History and government
B	English	4 years	
C	Mathematics*	3 years	(Algebra, Geometry, and Intermediate algebra)
D	Laboratory Science*	2 years	(One Biological, one Physical; both with a lab)
E	Language other than English*	2 years	Subject to waiver; must demonstrate equivalent competence
F	Visual Performing Arts (VPA)	1 year	Must be a year-long VPA course in a single area
G	College Prep Elective	1 year	Selected from the above areas or other approved A-G courses

High school grade point average (GPA) is based on grades earned in 10th, 11th, and 12th grade courses taken from the A-G area list above.

Eligibility Index

The eligibility index is the combination of the high school grade point average and test score on either the American College Test (ACT) or the Scholastic Assessment Test (SAT). The grade point average is based on grades earned during the final three years of high school (excluding physical education and military science) and bonus points for each C or better in approved honors courses. Up to eight semesters of honors courses taken in the last two years of high school can be accepted. Each unit of A in an honors course receives a total of 5 points; B, 4 points; and C, 3 points.

A CSU Eligibility Index (EI) can be calculated by multiplying a grade point average by 800 and adding the total score on the ***mathematics and critical reading scores*** of the SAT. For students who took the ACT, multiply the grade point average by 200 and add ten times the ACT composite score. Persons who are California high school graduates (or residents of California for tuition purposes) need a minimum index of 2900 using the SAT or 694 using the ACT. The University has no current plans to include the writing scores from either of the admissions tests in the computation of the CSU Eligibility Index.

Persons who neither graduated from a California high school nor are a resident of California for tuition purposes, need a minimum index of 3502 (SAT) or 842 (ACT).

The CSU may offer early, provisional admission based on work completed through the junior year of high school and planned for the senior year.

B. Evaluating Student Performance

Summarize the process by which student performance is evaluated and student progress is monitored. Include information on how the program ensures and documents that students are meeting prerequisites and how it handles the situation when a prerequisite has not been met.

The California State University, Sacramento evaluates students using a conventional A-F (4.0 – 0.0) grading system, with ± 0.3 resolution. The maximum overall Grade Point Average (GPA) possible is 4.0.

Students are evaluated based on performance in courses. These evaluations are based on a combination of testing, homework, class participation, written reports and oral presentations. The responsibility for assigning course grades lies with instructor of each course. The University maintains official student records. Transcripts are evaluated with each student every semester during the advising process.

An incomplete grade (I) may be assigned if a student has completed a substantial portion of the course with a passing grade and is unable to complete the course because of reasons beyond his/her control. An "I" grade becomes an F if the remaining work is not completed within a year.

An unauthorized withdrawal grade (WU) is assigned when a student stops attending class and turning in work without officially withdrawing from the course. The "WU" grade is assigned 0 grade points, so counts as an F in the student's grade point average. The California State University, Sacramento catalog description for the grades A through D is:

> **A** Exemplary achievement of the course objectives. In addition to being clearly and significantly above the requirements, work exhibited is of an independent, creative, contributory nature.
>
> **B** Superior achievement of the course objectives. The performance is clearly and significantly above the satisfactory fulfillment of course requirements.
>
> **C** Satisfactory achievement of the course objectives. The student is now prepared for advance work or study.
>
> **D** Unsatisfactory achievement of course objectives, yet achievement of a sufficient proportion of the objectives to that it is not necessary to repeat the course unless required to do so by the academic department.
>
> **F** Unsatisfactory achievement of course objectives to the extent that the student must repeat the course to receive credit.

An overall grade point average of 2.0 is required in five areas:

1. total courses attempted;
2. Sacramento State courses attempted;
3. upper division courses applied to the major;
4. courses applied to the minor, and
5. courses used to complete General Education requirements.

Additionally the Mechanical Engineering program graduation requirements include earning a C- or better in each major course.

In computing grade point averages the first grade assigned in any course that is repeated is excluded from the calculation. The second, and any subsequent grades, are included in the grade point average.

The five year mean GPA for students graduating with a B.S. in Mechanical Engineering is 2.97. This is similar to the College mean GPA for all B.S. students of 2.98 and is slightly lower than the University mean GPA at graduation of 3.08.

C. Transfer Students and Transfer Courses

Summarize the requirements and process for accepting transfer students and transfer credit. Include any state-mandated articulation requirements that impact the program.

The responsibility for ensuring that entering transfer students meet CSU, Sacramento requirements belongs to the Admissions and Records Office. The Mechanical Engineering program is required to accept any student who meets admissions criteria. Policies and procedures for admission of transfer students, and acceptance of transfer credit for courses taken elsewhere are developed by the department and implemented and enforced by the University's Articulation Office.

In cooperation with the University's Articulation Office, the Mechanical Engineering department maintains articulation agreements with most of the community colleges in northern and central California. These agreements list specific lower division preparation required for our major and convey to faculty, counselors and students, precise information about courses which may be identified as acceptable equivalents of CSUS courses. Each articulated course has been reviewed for topical coverage, content and rigor by subject area University faculty or designees, and has been approved as comparable to the corresponding CSUS course. Equivalencies are determined by state-wide articulation agreements, catalog descriptions, textbooks employed and detailed material that describes course content. The Admissions and Records Office follows articulation agreements for individual courses requested by each community college (CC) in California and the Mechanical Engineering Department. The faculty member responsible for a particular major course review an articulation request submitted to the Department chair. The chair forwards the Department's recommendations to the Dean and then to the Articulation Officer, who notifies the CC of the final decision.

The University's full-time articulation officer works with University faculty and transfer institutions to maintain these agreements. The College has also developed programmatic articulation agreements with the main transfer institutions. In these agreements a series of specified courses are accepted as a package that fulfills the entire lower division requirement in the major.

In addition to the stated articulation agreements, the department chair has the final responsibility in accepting individual courses offered by students transferring from other schools.

Most of our students transfer some credits from either community colleges or other four year institutions. These students are successful in passing their courses in their first semester in the Mechanical Engineering program. This indicates that our mechanism of transfer credit evaluation is effective.

Lower division transfer requirements:

Generally, applicants will qualify for CSU admission consideration 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.

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 missing college preparatory subject requirements, have been in continuous attendance in an accredited college since high school graduation, and have made up the missing subject requirements with a 2.0 or better GPA.

Upper division transfer requirements:

Generally, applicants will qualify for consideration for upper-division transfer admission if they meet all of the following requirements:

1. The have a grade point average of at least 2.0 (C or better) in all transferable units attempted;
2. They are in good standing at the last college or university attended; and
3. They have completed at least sixty (60) transferable semester (90 quarter) units of college level coursework with a grade point average of 2.0 or higher and a grade C or better in each course used to meet the CSU general education requirements in written communication, oral communication, critical thinking, and quantitative reasoning, e.g. mathematics.

The 60 units must include at least 30 units of courses, which meet CSU general education requirement including all of the general education requirements in communication in the English language (both oral and written) and critical thinking and the requirement in mathematics/quantitative reasoning (usually 3 semester units) OR the Intersegmental

General Education Transfer Curriculum (IGETC) requirements in English communication and mathematical concepts and quantitative reasoning.

D. Advising and Career Guidance

Summarize the process for advising and providing career guidance to students. Include information on how often students are advised, who provides the advising (program faculty, departmental, college or university advisor).

Curricular Advising

The University offers a mandatory comprehensive New Student Orientation program for both freshmen and transfer students prior to the students enrolling in courses. During the New Student Orientation program students are introduced to the University and its requirements. The Department provides an introduction to the Mechanical Engineering program as well as a meeting with department faculty for curricular advising. Each student receives a copy of the Mechanical Engineering B.S. roadmap (Figure 1-1), which sets out a typical course sequence that would assure graduation in four years. The roadmap includes all prerequisite information and is a useful advising tool for planning the student's career. Additionally each student receives program specific material including an Advising Plan that is specific to their situation.

Most Freshmen are admitted for Fall enrollment; they attend mandatory New Student Orientation in the summer prior to their first semester. In addition to the major advising provided by the Mechanical Engineering faculty, freshmen and sophomores are required to participate in University level advising each of their first four semesters. These sessions are individual meetings held in the University Academic Advising Center; discussion topics focus on helping with student success in managing their transition to the University, understanding general University requirements and other issues associated with success at the University.

Since 1993 the University has used a computerized registration system. In Fall 2007 a new comprehensive system, MySacState, was brought on line. This system provides students with information about their registration status and advises them of any holds that have been placed on their account that prevents them from registering for classes. The system allows the Mechanical Engineering Department to prevent students from registering until they have met with a major advisor.

Major advising is done by Mechanical Engineering Department faculty. Each incoming student in the Department of Mechanical Engineering meets with a faculty member for an introductory advising session at New Student Orientation. All Mechanical Engineering majors are required to meet with a faculty advisor for a formal advising session every semester. Advising months are designated as April, for planning the Fall semester courses, and October, for planning Spring semester courses. A registration hold is placed on each student's account ensuring that each student in the major sees an academic advisor. In addition to email and posted advising notices, students are notified of the hold on their MySacState page. Students cannot enroll in courses until the hold is removed after their mandatory major advising session. To facilitate the advising process a web-based appointment system is used in which students can see all available appointments and select which is most convenient. Students receive timely notice reminding them of the advising process. First, "Advising Reminder" notices are sent by e-mail in September and again in February. Additionally, "Mandatory Advising Reminder" notices are posted in prominent locations throughout the College's buildings prior to and throughout the advising period.

Advising meetings typically include review of the student's past progress, current status and anticipated courses for the upcoming semester, a plan to complete the BS in Mechanical Engineering program semester-by-semester through to graduation, status of the student's satisfaction of GE requirements and all other University requirements. Students are encouraged to apply for graduation when they are within one year of completing the program. Advising discussions may also include overall career goals including internship and study-abroad possibilities. A long-range plan through the student's final semester is always developed with a focus on career and graduate school opportunities as the student nears graduation.

Students meet all Program Outcomes and ABET requirements by taking the required courses in the Mechanical Engineering curriculum. Each student is required to take six units of upper division ME electives in their final year. The BS in Mechanical Engineering Roadmap (Figure 1-1) contains the recommended sequencing of the major courses and always includes the most recent curriculum changes. Copies of the roadmap are available on the Mechanical Engineering department web page, in the department office and at student advising sessions. At the end of each formal advising session, the student's advisor updates the "Advising Plan" (Figure 1-2) through to graduation, checks the student's Academic Requirements page on the University records system noting any additional requirements, and updates the "Graduation expected" date. The student is emailed a copy of the updated "Advising Plan" and a copy is retained in the student's Department e-file.

All mechanical engineering students follow a modified University GE pattern (Figure1-3). General Education (GE) advising is provided to new students during the University's orientation sessions that are held before the semester starts. Students are encouraged to use the "drop in" University Academic Advising Center for additional help with GE, however all faculty have access to the University records system where progress in meeting each specific University and major requirement is displayed. Students are encouraged to track their progress toward completion of all degree requirements using the Progress to Degree meters and the Academic Requirements page in the MySacState system.

If a student is currently majoring in another subject, or has unclassified status, and wants to major in Mechanical Engineering, an appointment with the Department Chair is required. The Change of Major form (Figure 1-4) and all the other Mechanical Engineering advising materials are discussed, an Advising Plan is made and the Change of Major form signed by the Department Chair. It is the Department Chair's responsibility to review the student's records and make a final decision regarding acceptance into the Mechanical Engineering program. The student is responsible for submitting the signed Change of Major form to the Registrar.

Articulation Agreements between CSUS and most community colleges and some universities in California are used in the evaluation of transfer student credits. Much of this information can be found at www.assist.org. For college courses that have not been articulated, the chair, with assistance from faculty as needed, determines equivalency on a case-by-case basis.

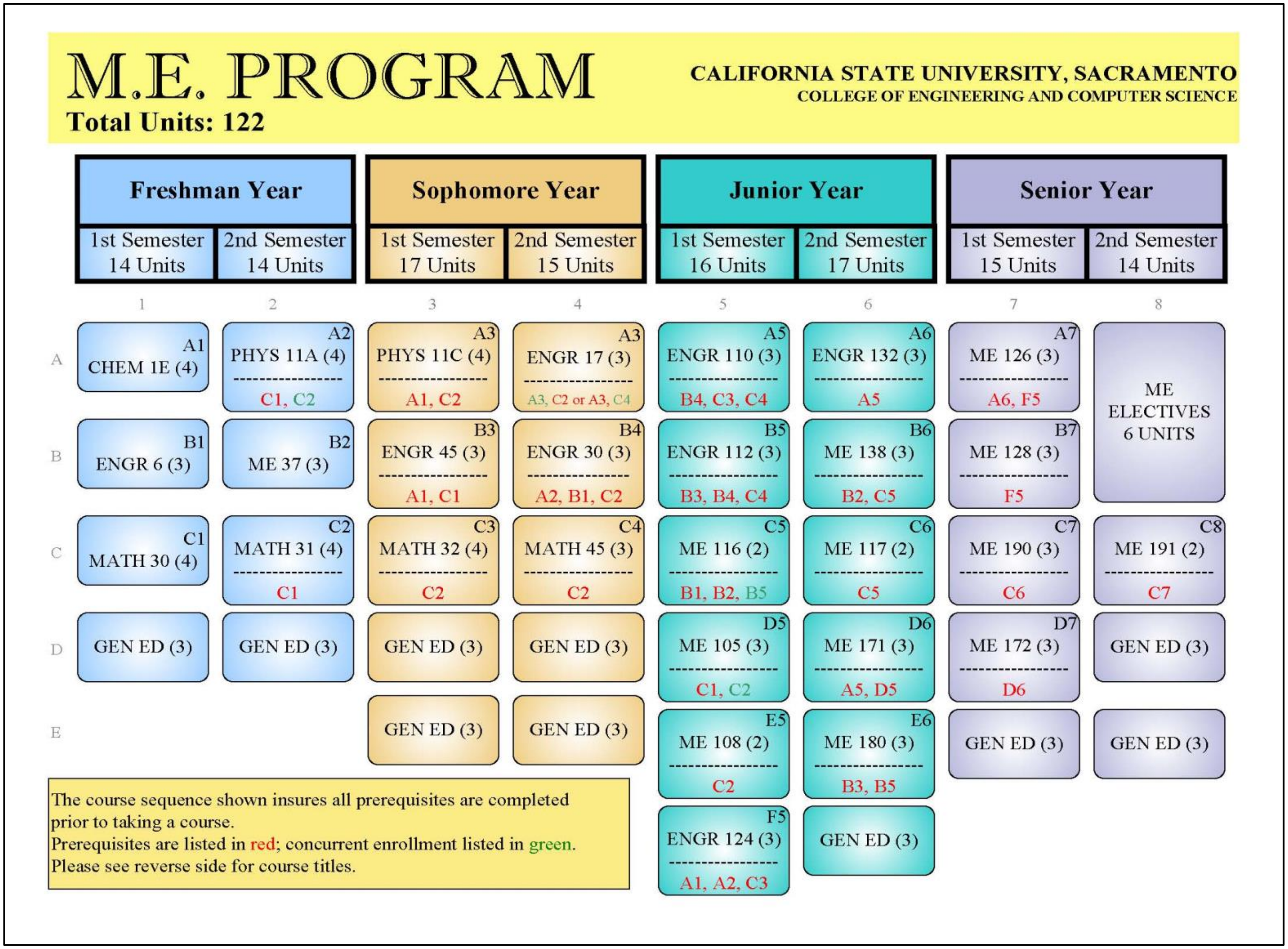

Figure 1-1 Mechanical Engineering Roadmap (front)

Mechanical Engineering Course Titles

Course	Course Title
CHEM 1E	General Chemistry for Engineers
PHYS 11A	General Physics: Mechanics
PHYS 11C	General Physics: Electricity and Magnetism
MATH 30	Calculus I
MATH 31	Calculus II
MATH 32	Calculus III
MATH 45	Differential Equations
ENGR 6	Engineering Graphics and CADD
ENGR 17	Circuit Analysis
ENGR 30	Analytic Mechanics: Statics
ENGR 45	Engineering Materials
ENGR 110	Analytic Mechanics: Dynamics
ENGR 112	Mechanics of Materials
ENGR 124	Thermodynamics
ENGR 132	Fluid Mechanics
ME 37	Manufacturing Processes
ME 105	Introduction to Technical Problem Solving
ME 108	Professional Topics in Mechanical Engineering
ME 116	Machinery Design I
ME 117	Machinery Design II
ME 126	Heat Transfer
ME 128	Thermal-Fluid Systems
ME 138	Concurrent Product and Process Design
ME 171	Modeling & Simulation of Mechatronics & Control Systems
ME 172	Control System Design
ME 180	Mechanical Properties of Materials
ME 190	Project Engineering I
ME 191	Project Engineering II

Mechanical Engineering Electives

Course	Course Title
ME 114	Vibrations
ME 115	Dynamics of Machinery and Multi-Body Systems
ME 121	Solar Thermal & Energy Storage Systems
ME 122	Geo-Thermal & Bio-Energy Systems
ME 123	Wind, Hydro and Ocean Energy
ME 136	Numerical Control Programming
ME 137	Product Design for Manufacturing & Automation
ME 140	Introduction to Motors and Actuators
ME 141	Introduction to Tolerance Analysis
ME 143	Vehicle Dynamics & Design
ME 152	Turbomachinery Design
ME 154	Alternative Energy Systems
ME 155	Gas Dynamics
ME 156	Heating and Air Conditioning Systems
ME 173	Application of Finite Element Analysis
ME 176	Product Design and Pro/Engineer
ME 177	3-D Parametric Modeling
ME 182	Introduction to Composite Materials
ME 184	Corrosion and Wear
ME 186	Fracture Mechanics in Engineering Design
ME 196T	Introduction to Test Automation
ME 196A	Motion & Dynamic Analysis of Solid Modeling
ME 196B	Engineering System Approach to Product Design
ME 196C	Computer Programming for Mechanical Engineering Application
	See Department Chair for other approved electives

Figure 1-1 Mechanical Engineering Roadmap (back)

Plan:

ID:

current email:

If you have trouble registering for the courses you are advised to take please email Laura O'Neill in the ME office (RVR 4024), loneill@csus.edu. Send your name, your student ID, the names and sections of the courses you are trying to get and the 5 digit course call number for each.

Advisor		Courses Advised	Courses Taken
	Summer 2014		
	Fall 2014		
	Spring 2015		
	Summer 2015		
	Fall 2015		
	Spring 2016		
	Summer 2016		
	Fall 2016		
	Spring 2017		
	Summer 2017		
	Fall 2017		
	Spring 2018		

Graduation expected:

Advisor Comments:

Figure 1-2 Mechanical Engineering Advising Plan

General Education/Graduation Engineering Worksheet
For ME Students Beginning Fall 2014 and Later

Academic Advising, Lassen 1012

Name: ______________ Student ID: ______________

A grade of C- or better is required	COURSE	UNITS	WHERE TAKEN	NEED 3 UPPER DIVISION COURSES
A. BASIC SUBJECTS (9 units)	*Example COMS 4*	*3*	*CSUS*	
A1. Oral Communication (3 units)				
A2. Written Communication (3 units)				
A3. Critical Thinking (3 units)	Met by Major Requirements	3		
B. PHYSICAL UNIVERSE & ITS LIFE FORMS (12 units)				
B1. Physical Science (3 units)	Met by Major Requirements	3		
B2. Life Forms (3 units)				
B4. Quantitative Reasoning (3 units)	Met by Major Requirements	3		
B5. Additional Course to total 12 units	Met by Major Requirements	3		
C. THE ARTS AND HUMANITIES (12 units)				
C1. Introduction to Arts (3 units)				
C2. Introduction to Humanities (3 units)				
C. Arts or Humanities				
Second Semester Composition (3 units)	ENGL 20 at CSUS	3		
D. THE INDIVIDUAL & SOCIETY (12 units)				
D. Social Sciences (3 units)				
D. ME 108/ME 191 (3 units)	Met by Major Requirements	3		X
D. American Institutions (6 units)	U.S. History			
	U.S. Const/California Govt			
E. UNDERSTANDING PERSONAL DEVELOPMENT (3 units)				
	Met by Major Requirements	3		X

Race and Ethnicity in American Society	
Writing Intensive	
WPJ or Equivalent	

The Race and Ethnicity in American Society and Writing Intensive Requirements can overlap with GE areas.

Figure 1-3 General Education for Mechanical Engineering Students

Change of Major Request Form
College of Engineering and Computer Science

Student Name: ______________________ Student ID: ______________________

Address: ______________________ Phone Number: ______________________

Overall GPA: ______________________

What is your current major? ________________________________

Select your requested Pre-major or Major:

☐ Civil Engineering ☐ Pre-Construction Management

☐ Computer Engineering ☐ Construction Management

☐ Pre-Computer Science ☐ Electrical & Electronical Engineering

☐ Computer Science ☐ Mechanical Engineering

Student Signature: ______________________________ Date: ______________

Department/Program Recommendation

☐ Approved Change to: ____________ Comments: ______________________

☐ Deny Request (see comments)

By: ______________________________ Date: ______________

Department Chair/Program Coordinator

Figure 1- 4 Change of Major Form

Career Guidance

Career advising is available from a number of sources. First, faculty advisers are available to discuss their advisees' career plans and career goals are always a topic of discussion at each advising meeting. More formally the college and the campus offer extensive resources for students. ECS Career Services with information about jobs, resumes, career planning, and other aspects of building a career. The University Career Center offers similar resources and provides workshops, career advising, and systems designed to help students evaluate their strengths and highlight their interests. Career fairs with regional and national employers are held at least twice a year, seminars by local industry leaders are presented throughout the semester, and students receive weekly updates on job/career opportunities via email.

The Mechanical Engineering program offers ME 194 – Career Development in Mechanical Engineering every semester. This course is taught by a mechanical engineering industry professional and provides the foundation for professional development. Additionally, a "Professional Development in Engineering and the Sciences" seminar series is offered each Spring co-sponsored by the College and the University Career Center.

The Mechanical Engineering department routinely schedules thesis and project presentations open to all students and interested parties, as well as colloquia offered by experts from regional industry and other universities. Students are also encouraged to join the student sections of the professional engineering societies and to attend professional chapter meetings of the ASME, SAE, AIAA, ASHRE, SME, and SWE. Additionally, local clubs that focus on specific interests, such as Competitive Robotics, provide opportunities for professional growth.

E. Work in Lieu of Courses

Summarize the requirements and process for awarding credit for work in lieu of courses. This could include such things as life experience, Advanced Placement, dual enrollment, test out, military experience, etc.

The Mechanical Engineering Program does not award credit for work in lieu of courses except in the case of Advanced Placement tests.

Credit for Advanced Placement tests is granted according to campus standards which are described in the University Catalog. The tests applicable to courses in the major are as follows:

AP Exam	Score required	Course Equivalency
Calculus A/B	3, 4 or 5	Math 30
Calculus B/C	3, 4 or 5	Math 30 & 31
Chemistry	3, 4 or 5	Chem 1E
Physics C Mechanics	4 or 5	Physics 11A
Physics C Electricity/Magnetism	4 or 5	Physics 11C

F. Graduation Requirements

Summarize the graduation requirements for the program and the process for ensuring and documenting that each graduate completes all graduation requirements for the program. State the name of the degree awarded (Master of Science in Safety Sciences, Bachelor of Technology, Bachelor of Science in Computer Science, Bachelor of Science in Electrical Engineering, etc.)

The Bachelor of Science in Mechanical Engineering requires that students complete 122 semester units of major and General Education/University requirements. The major consists of 15 units of Mathematics, 4 units of Chemistry, 8 units of Physics, 15 units of lower division engineering courses, 50 units of upper division engineering courses, and a General Education program which includes an additional 6 units of written and oral communication, 3 units of Life Science, 21 units of Arts, Humanities and Social Science, and University Graduation Requirements. The MySacState system tracks each of these requirements.

After the student has completed 85 semester units an application to graduate may be made. In order to officially graduate, each student must apply to graduate and all major requirements are checked by the Department Chair at the time the application is approved at the Department level. Before the degree is awarded a graduation evaluator must make sure that all University requirements are met. If the graduation evaluator finds any deficiencies the student is notified. Notification occurs soon enough before graduation so that the student may take corrective action to ensure all requirements will be met by the end of the final semester. . Once grades are available at the end of the student's final semester, successful completion of all degree requirements is verified. When the Registrar is notified that a student has satisfactorily completed all requirements for the degree is posted to the student's transcript and a diploma is awarded.

G. Transcripts of Recent Graduates

The program will provide transcripts from some of the most recent graduates to the visiting team along with any needed explanation of how the transcripts are to be interpreted. ***These transcripts will be requested separately by the team chair.*** *State how the program and any program options are designated on the transcript. (See 2015-2016 APPM, Section II.G.4.a.).*

Transcripts will be available for review.

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

A. Mission Statement

California State University, Sacramento Mission Statement

The mission statement of Sacramento State recognizes the role of the university within the greater Sacramento region and California. The educational objectives of the Mechanical Engineering program were developed to be in support of that mission and in support of the needs of the community. The mission statement of the University, listed below, can be found on the University webpage at http://www.csus.edu/universitystrategicplan

Mission
As California's capital university, we transform lives by preparing students for leadership, service, and success

Vision
Sacramento State will be a recognized leader in education, innovation, and engagement.

Values

- Student Success
- Scholarship, Research, and Creative Activity
- Diversity and Inclusion
- Community Engagement
- Innovation
- Integrity and Accountability

California State University, Sacramento is an integral part of the community, committed to access, excellence and diversity.
http://www.csus.edu/universitystrategicplan August 28, 2014

B. Program Educational Objectives

List the program educational objectives and state where these can be found by the general public.

Program educational objectives are broad statements that describe what graduates are expected to attain within a few years of graduation.

The Mechanical Engineering program will prepare graduates who:

1. Will enter professional employment and/or graduate study in the following areas of mechanical engineering practice: machine design, thermal and fluids systems, materials, and manufacturing;
2. Will use knowledge of the principles of science, mathematics, and engineering, to identify, formulate, and solve problems in mechanical engineering;

3. Will apply creativity in the design of systems, components, processes, and/or experiments and in the application of experimental results, working effectively on multi-disciplinary teams;
4. Will communicate effectively through speaking, writing, and graphics, including the use of appropriate computer technology;
5. Will use their understanding of professional, ethical, and social responsibilities, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of their professional careers.

The objectives describe the features that are considered important in an outstanding education in Mechanical Engineering.

C. Consistency of the Program Educational Objectives with the Mission of the Institution

Describe how the program educational objectives are consistent with the mission of the institution.

The program educational objectives are consistent with the University Mission, " As California's capital university, we transform lives by preparing students for leadership, service, and success."

The University has also adopted the following

Sacramento State Baccalaureate Learning Goals for the 21st Century:

- **Competence in the Disciplines:** The ability to demonstrate the competencies and values listed below in at least one major field of study and to demonstrate informed understandings of other fields, drawing on the knowledge and skills of disciplines outside the major.

- **Knowledge of Human Cultures and the Physical and Natural World** through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts. Focused by engagement with big questions, contemporary and enduring.

- **Intellectual and Practical Skills, Including**: inquiry and analysis, critical, philosophical and creative thinking, written and oral communication, quantitative literacy, information literacy, teamwork and problem solving, practiced extensively, across the curriculum, in the context of progressively more challenging problems, projects, and standards for performance.

- ***Personal and Social Responsibility, Including**: civic knowledge and engagement—local and global, intercultural knowledge and competence, ethical reasoning and action, foundations and skills for lifelong learning anchored through active involvement with diverse communities and real-world challenges.

- ****Integrative Learning, Including**: synthesis and advanced accomplishment across general and specialized studies.

All of the above are demonstrated through the application of knowledge, skills, and responsibilities to new settings and complex problems.

*Understanding of and respect for those who are different from oneself and the ability to work collaboratively with those who come from diverse cultural backgrounds.
** Interdisciplinary learning, learning communities, capstone or senior studies in the General Education program and/or in the major connecting learning goals with the content and practices of the educational programs including GE, departmental majors, the co-curriculum and assessments.

Together the University Mission and the Baccalaureate Learning Goals (BLGs) inform the Mechanical Engineering Program Learning Objectives. The mission of providing a transformative learning experience “by preparing students for leadership, service and success” and the BLGs including competency in the major discipline and significant breadth and depth in an integrative manner are consistent with all of the specific Mechanical Engineering Program Objectives.

By preparing students to “enter professional employment and/or graduate study” and to use their understanding of professional, ethical, and social responsibilities, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of their professional careers.” the program offers individuals the opportunity to realize their highest aspirations. By preparing students to “use knowledge of the principles of science, mathematics, and engineering, to identify, formulate, and solve problems in mechanical engineering” the program emphasizes the development of critical thought processes and by preparing students to “apply creativity in the design of systems, components, processes, and/or experiments and in the application of experimental results” the program emphasizes the acquisition and synthesis of knowledge. Finally, by preparing students to “communicate effectively through speaking, writing, and graphics, including the use of appropriate computer technology”, “to work effectively on multi-disciplinary teams” and to “use their understanding of professional, ethical, and social responsibilities, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of their professional careers" the program enables graduates to become active and involved citizens for the good of the individual and society.

The program educational objectives are also consistent with ABET educational criteria. The objectives provide for educating students to be able to conduct engineering work (analysis and design) in a professionally responsible and ethical manner, and to be able to communicate the results of their work to all stakeholders

D. Program Constituencies

List the program constituencies. Describe how the program educational objectives meet the needs of these constituencies.

Constituencies of CSU, Sacramento's undergraduate Mechanical Engineering Department are:

- Prospective students
- Students
- Graduates of the program
- Graduate schools
- Employers hiring our graduates
- Local industry and community
- Faculty
- Industry Advisory Council.

E. Process for Review of the Program Educational Objectives

Describe the process that periodically reviews the program educational objectives including how the program's various constituencies are involved in this process. Describe how this process is systematically utilized to ensure that the program's educational objectives remain consistent with the institutional mission, the program constituents' needs and these criteria.

The Mechanical Engineering Department began developing the program educational objectives in the 2000 – 2001 academic year. These objectives were developed through a series of faculty meetings, meetings with industry, and employer interviews. The objectives were also written to be consistent with the mission of the university and the criteria specified by ABET.

The faculty established the initial department objectives through a series of departmental meetings in which the overall program goals were discussed. These initial objectives were reviewed by the Mechanical Engineering Industrial Advisory Committee (IAC) to obtain the perspective of industry representatives and alumni of the program. The process used to develop the initial objectives and program outcomes is shown in Figure 2-1.

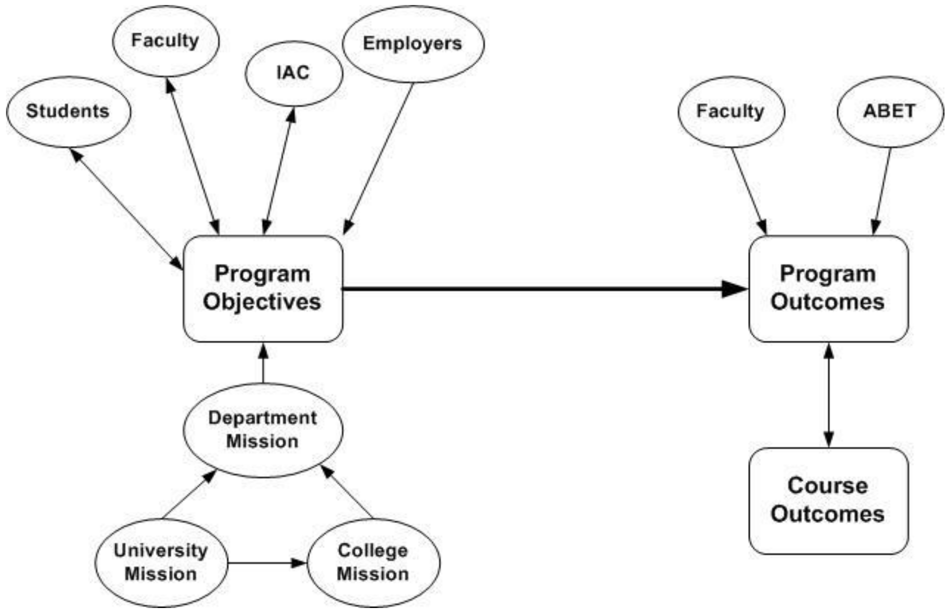

Figure 2-1: Objectives and Outcomes Development Plan

In 2003, a strategic planning committee was formed of Mechanical Engineering faculty and the IAC. The goal of this committee was to establish a long range plan for the department including reviewing and updating the program outcomes and objectives. The long range plan established for achieving the program objectives and beyond is shown in Figure 2-2.

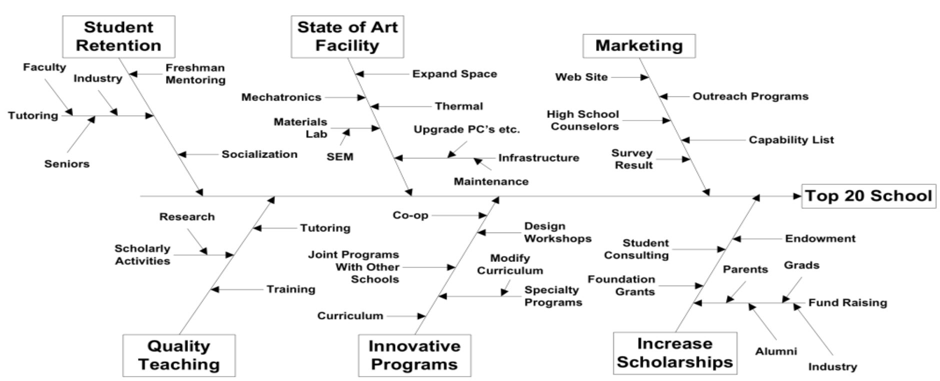

Figure 2-2. Long-Range Plan for Mechanical Engineering Program

The program educational objectives are periodically reviewed through several different methods involving as many of the constituencies as possible. These methods include alumni surveys, employer visits, program assessment, faculty reviews, and graduating senior exit interviews. The primary method for assessing the program objectives is to connect the objectives to the student outcomes by assessing each student outcome at multiple points in the curriculum. The process of assessing achievement of the student outcomes allows for assessment of the program educational objectives. In addition to these assessment tools we also solicit feedback from our Industrial Advisory Committee. Table 2-1 shows the constituencies, methods and timeframe for evaluation.

Table 2-1: Methods for Assessing Program Objectives

Constituency	**Specific Group**	**Timeframe**	**Method**
Students	Graduating Seniors	Every Semester	Exit Interviews
Alumni	Out Five Years	Every five years	Survey
	IAC members	Every Semester	Meetings
Faculty	Full time faculty	Every Semester	Meetings
Employers	Industry Site Visits	Every Year	Meetings
	IAC members	Every Semester	Meetings

The first method for assessing the program objectives is through exit interviews for graduating seniors. The students are asked the following questions:

1. What are the things you like about the ME program?
2. What are the things would like to change about the ME program?
3. What course did you find to be the most useful? Why was this course the most useful?
4. What course or courses would you like to change? What are the changes you would like to see?
5. Do you feel prepared to go into industry and develop new technology? Explain
6. Do you feel your education is complete? Please explain.
7. How do you plan to keep yourself current?
8. Are you taking a permanent job? If so, where will you be working?
9. Are you going to grad school?
10. Do you have any other comments?

Additionally each graduating senior is asked to complete a survey related to the learning outcomes. The survey is presented in Appendix E.

The results of the Graduating Senior exit interview and survey are reviewed by the Mechanical Engineering faculty and the IAC. Programmatic and curricular adjustments are made based on recommendations from the faculty and IAC after the data are discussed.

The alumni are surveyed every five years as part of both the assessment process. Both the learning outcomes and the program objectives are evaluated. Appendix E shows a sample of the questions asked on the alumni survey. The responses to the survey are compiled by the University office of institutional research and made available to the faculty. The faculty and IAC review the results and use the data to improve the program and specific components of the curriculum.

Visits to local industry in which ME graduates are employed are conducted every year. During these visits, a faculty groups meet with industry professionals some of whom are graduates of our program. Both alumni and managers with responsibility for hiring are present at the meeting. The employers are asked a set of questions, listed below, and their responses are recorded and transcribed for faculty review. As the answers are given, additional follow-up questions are asked with regard to specific aspects of the program.

1) What CSUS *learning experiences* were most valuable to you in your career?
2) What *knowledge and skills* that you acquired during your education have you used most?
3) What knowledge do you use the least?
4) What do you wish you had learned in school but did not?
5) What are the emerging and expanding fields in mechanical engineering and mechanical engineering technology?
6) What critical skills and knowledge will mechanical engineers need for the future?
7) For Managers: What are the strengths and what are the weaknesses of graduates of the ME program?

Additional employer and alumni surveys are conducted at our annual Mechanical Engineering Evening with Industry (see Appendix E).

Finally, faculty keep an ongoing dialog with both the students and the members of the Industry Advisory Committee. The students are regularly engaged in discussions about the program both individually and in group settings. Faculty meet with the IAC every semester to discuss the program. IAC members work with faculty to address specific issues with regard to the program such as improving the senior project, incorporating safety and ethical issues, and developing new electives. Additionally, the long range strategic plan for the department is evaluated annually.. The students and IAC members interact as well through IAC participation in the senior project reviews; seminars given by IAC members on engineering careers; and a social events such as the “Homecoming” and “Evening with Industry”.

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes

List the student outcomes for the program and indicate where the student outcomes are documented. If the student outcomes are stated differently than those listed in Criterion 3, provide a mapping to the (a) through (k) Student Outcomes.

Student learning outcomes describe what students are expected to know and be able to do by the time of graduation. These outcomes relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. The student learning outcomes required by ABET and assessed in Mechanical Engineering are:

a. An ability to apply knowledge of mathematics, science, and engineering
b. An ability to design and conduct experiments, as well as to analyze and interpret data
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. An ability to function on multidisciplinary teams
e. An ability to identify, formulate, and solve engineering problems
f. An understanding of professional and ethical responsibility
g. An ability to communicate effectively
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. A recognition of the need for, and an ability to engage in life-long learning
j. A knowledge of contemporary issues
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The Mechanical Engineering Department involves all identified constituencies except prospective students and graduate schools in our assessment of the effectiveness of our program. Program outcomes were established with input from faculty, students, graduates, employers and the IAC . We continue to solicit input from these constituencies to monitor and refine these outcomes.

Assessment of our curriculum began over 20 years ago and was originally focused mainly on course based assessment with course outcomes linked to programmatic outcomes. Reviewing, updating, and revising the Mechanical Engineering curriculum always begins with assessing specific program objectives and learning outcomes. The program objectives and learning outcomes were developed and have been updated over the years through a series of department meetings, meetings with alumni, industry employer visits, meetings with the department's Industry Advisory Committee and evaluating the results from our graduating senior exit interviews and alumni surveys.

Outline of Assessment Process

The sequence of steps in the assessment process are:

i. Evaluate objectives, and learning outcomes
ii. Evaluate performance criteria and measurement metric for each learning outcome and identify the courses that support the outcome.
iii. Identify assessment tools and provide data relevant to each learning outcome
iv. Assess achievement of program goals and learning outcomes
v. Identify problem areas and develop strategies for improving student achievement of learning outcomes
vi. Implement strategies targeted at improving specific learning outcomes and assess the effectiveness of the changes
vii. Reassess objectives and learning outcomes and continue the process

The Mechanical Engineering Educational Objectives were updated prior to the last ABET review cycle. In conjunction with a California State University system-wide mandate to reduce the units in all curricula the Mechanical Engineering faculty completed a major curriculum revision that was implemented in Fall 2009. As part of the process the Program Learning Objectives and Program Outcomes were updated based on the responses from the faculty and IAC to the following questions:

- If you were hiring a Mechanical Engineer for your own company in your area of expertise, what attributes would you consider to be the most important?
- What would you want to see from the student before you offered him/her a job?
- How would you want to verify the student actually had the attributes you wanted?

The results were used to create key outcomes on which to focus a direct assessment plan consistent with the program Student Outcomes. The areas that were identified were:

a. **Documentation** – the student must be able to write a coherent technical report (e.g. lab, analysis, test, etc.), they must be able to create and understand an engineering drawing (e.g. machine drawing, process diagram, schematic, etc.), and they must be able to create and understand a technical graph/illustration/diagram.
b. **Expertise in Technology** – the students must be able to demonstrate competence (i.e. understand and apply key concepts) in dynamics and statics; thermodynamics, heat transfer, and fluids; manufacturing and mechanical design; and have an understanding of other engineering disciplines and technology tools.
c. **Design** – the student must be able to solve an open-ended design problem.
d. **Teamwork** – the student must be able to work in teams and demonstrate the ability to delegate responsibilities, communicate requirements, and interact with teammates.
e. **Professional Practice** – the students will demonstrate an understanding of the necessity for continuing education and an understanding of the engineering code of ethics.

An assessment plan was established to monitor these key areas and the outcomes they represent.

B. Relationship of Student Outcomes to Program Educational Objectives

Describe how the student outcomes prepare graduates to attain the program educational objectives.

The Mechanical Engineering program will prepare graduates who:

1. Will enter professional employment and/or graduate study in the following areas of mechanical engineering practice: machine design, thermal and fluids systems, materials, and manufacturing;
2. Will use knowledge of the principles of science, mathematics, and engineering, to identify, formulate, and solve problems in mechanical engineering;
3. Will apply creativity in the design of systems, components, processes, and/or experiments and in the application of experimental results, working effectively on multi-disciplinary teams;
4. Will communicate effectively through speaking, writing, and graphics, including the use of appropriate computer technology;
5. Will use their understanding of professional, ethical, and social responsibilities, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of their professional careers.

The relationship between the student outcomes and the program objectives are listed below in Table 3-1.

Table 3-1: Relationship Between Student Outcomes and Objectives

	Student Outcomes										
Program Objectives	a	b	c	d	e	f	g	h	i	j	k
1	X	X	X	X	X	X	X				X
2	X	X	X	X	X						X
3	X	X	X	X							
4							X				X
5								X	X	X	

The curriculum is designed to meet the student outcomes stated with courses designed as a coherent portion of the comprehensive whole. The student outcomes are supported on a course by course basis with each course in the Mechanical Engineering curriculum designed to produce the programmatic student outcomes identified in the Outcomes/Course matrix in Table 3-2.

Table 3-2. Courses Contributing to Program Student Outcomes

ABET Learning Outcome	E 6	ME 37	E 30	E 45	E 17	E110	E112	ME 116	ME 105	ME 108	E124	E132	ME 117	ME 138	ME 171	ME 180	ME 172	ME 126	ME 128	ME 190	ME 191
a	I	I	D	D	D	D	D	D	D	D	D	M	D	D	D	D/M	D/M	M	M	M	M
b	-	-	-	D	-	I	-	-	-	-	-	D	-	-	-	D/M	-	-	M	-	M
c	I	I	-	-	-	-	I	I	I	-	D	D	D	-	D	-	D/M	-	-	D/M	M
d	I	I	D	I	-	I	-	D	I	-	-	-	D	-	D	D/M	-	M	M	D/M	M
e	I	-	D	I	D	D	D	D	D	D	D	D	D	D	D	D/M	D/M	M	M	M	M
f	-	-	-	I	-	-	I	-	I	D	D	I	D	-	-	D/M	-	-	-	D	D
g	I	-	D	I	-	I	D	D	I	D	-	D	D	-	D	D/M	D/M	D/M	M	D	M
h	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	D	-	D	M
i	-	-	I	I	-	I	D	D	I	D	D	D	D	-	-	D/M	D/M	-	-	D	D
j	-	-	-	-	-	-	D	-	-	D	-	I	-	-	-	-	-	M	-	D/M	M
k	I	-	I	I	-	-	D	D	D	D	D	M	D	D	D	D/M	D/M	M	M	M	M

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

Documentation

Information for review of all Student Outcomes will be available. The materials are organized by course. Starting with a specific course, one can access the syllabus, sample work of the students, exams, and homework assignments. This information will be available for the visiting team in a hard copy format and soft copy (electronic). The materials are also organized by student outcomes that lead to the courses that contribute to the outcome in questions. This information will also be available in a hard copy format and soft copy (electronic).

The assessment plan was developed in 2008 to focus on the key areas discussed in Section 3 A above. The plan utilized direct and indirect assessment methods to evaluate the learning outcomes at the course level. The assessment plan was reviewed after the ABET visit in 2009 and updated in 2010 to evaluate student outcomes and programmatic objectives at the program level.

Methods

The student outcomes are assessed using a variety of methods. The direct assessment methods include:

1. Evaluation of project documentation for the senior project classes.
   Senior project reports for ME 190 and ME 191 are evaluated using a standardized rubric. The reports are evaluated for composition, technical content, and completeness. In addition, the design drawing packages within the senior project reports are evaluated.

2. Evaluation of senior project presentations.
   The Senior Project Showcase is held every semester. At the Showcase the ME 190 students present their project designs with a poster display and the ME 191 students present their hardware and test results. All ME 190 and ME 191 groups have a formal

presentation. The senior project presentations are evaluated by students, faculty and industry representatives. The evaluations are based on content, presentation material, and teamwork.

3. Evaluation of technical competence using targeted assignments in key classes. Student outcomes are evaluated at multiple places in the curriculum. Evaluations are used to ensure that student outcomes are mastered at the time of graduation.
4. Data from the FE exam.

Indirect assessment methods include:
1. Graduating senior, industry, and alumni surveys.
2. Targeted surveys of students at different levels of the program.
3. Interviews with local employers.

Table 3-3 shows the relationship between assessment methods and student outcomes.

Table 3-3: Assessment Procedures versus Student Outcomes.

Assessment Procedure	Student Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
Graduating Senior Survey	x	x	x	x	x	x	x	x	x	x	x
Alumni Survey	x	x	x	x	x	x	x	x	x	x	x
Writing/Documentation Reviews			x				x				x
Pass Rate on FE Exam	x				x						
Targeted Surveys	x	x	x	x	x	x	x	x	x	x	x
Targeted Courses	x	x	x	x	x	x	x	x	x	x	x
Senior Project Presentation Evaluation	x	x	x		x		x				
Employer Surveys	x	x	x	x	x	x	x			x	x
Interviews with Employers						x	x	x		x	

Faculty Assessment

Faculty assess student work by traditional means including grading homework, exams, lab reports, term papers, project reports (both oral and written), and classroom participation. Students must earn a C- grade or better in all major courses. A standard 4.0 grade scale is used (A= 4.0) with a C grade described in the CSUS catalog as: *Satisfactory achievement of the course objectives. The student is now prepared for advanced work or study*.
Students must earn a grade point average of 2.0 or better in four categories:

All upper division courses in the major
All CSUS coursework
General Education
All coursework

College Evaluation of Faculty Teaching

Each faculty is also evaluated each term as part of the College of Engineering and Computer Science "Teaching Effectiveness" survey. These results are primarily used in the Retention, Tenure and Promotion process, and also provide feedback to faculty regarding student perception of their teaching effectiveness and areas for improvement. After the results have been compiled, the individual comments and scores, and the department average score are provided to the faculty member. Each faculty member is encouraged to review the material and strive for improvement in teaching effectiveness.

College Level Assessment

The Mechanical Engineering Department collaborates on assessment issues with faculty from other departments within the college. A College Assessment Committee was established to coordinate assessment activities across the College. These activities include: writing and presentation assessment between departments; cooperation on developing rubrics for evaluating different outcomes; methods for assessing ethics; and coordinating assessment through the use of outside agencies. Appendix E shows the writing rubric developed by the college assessment committee and the questions asked as part of the ethics assessment.

CRITERION 4. CONTINUOUS IMPROVMENT

This section of your Self-Study Report should document your processes for regularly assessing and evaluating the extent to which the student outcomes are being attained. This section should also document the extent to which the student outcomes are being attained. It should also describe how the results of these processes are utilized to affect continuous improvement of the program.

Assessment is defined as one or more processes that identify, collect, and prepare the data necessary for evaluation. Evaluation is defined as one or more processes for interpreting the data acquired though the assessment processes in order to determine how well the student outcomes are being attained.

Although the program can report its processes as it chooses, the following is presented as a guide to help you organize your Self-Study Report.

Student Outcome Rubrics were developed at the College level assessment committee to provide continuity of evaluation strategies across engineering programs. These are altered only slightly from the rubrics developed by the Mechanical Engineering faculty for the 2012 assessment cycle. The addition of two Outcome g rubrics (one for oral and one for written communication) was implemented for the 2015 evaluation cycle. Additional indicators were also added to the **Outcome g** rubric (Appendix F).

A. Student Outcomes

It is recommended that this section include (a table may be used to present this information):

1. *A listing and description of the assessment processes used to gather the data upon which the evaluation of each student outcome is based. Examples of data collection processes may include, but are not limited to, specific exam questions, student portfolios, internally developed assessment exams, senior project presentations, nationally-normed exams, oral exams, focus groups, industrial advisory committee meetings, or other processes that are relevant and appropriate to the program.*
2. *The frequency with which these assessment processes are carried out*
3. *The expected level of attainment for each of the student outcomes*
4. *Summaries of the results of the evaluation process and an analysis illustrating the extent to which each of the student outcomes is being attained*
5. *How the results are documented and maintained*

The assessment results for each student outcome are presented in the following tables (Table 4 -1 through Table 4 -12)

Table 4 – 1 Outcome a. ***An Ability to Apply Knowledge of Mathematics, Science and Engineering***						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1. Apply math, scientific, or engineering principles to analyze engineering problems	E 6, ME 37, E 45, E 110, ME 116, ME 105, ME 108, E 124, ME 117, ME 138, ME 171, ME 172, ME 126, ME 128, ME 190, ME 191	Faculty evaluations	Engr 110, ME 128	3 years	2012, 2015	80%
		Senior surveys	Exit interview			
2. Interpret mathematical or scientific work	E 6, ME 37, E 45, E 110, ME 116, ME 105, ME 108, E 124, ME 117, ME 138, ME 171, ME 172, ME 126, ME 128, ME 190, ME 191	Faculty evaluations	Engr 110, ME 128	3 years	2012, 2015	80%
		Senior Surveys	Exit Interview			

2012 cycle: (direct measure): A sample of 42 students in ME 128 (50% of the 2011-12 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 85%; Indicator 2 – 84%
A sample of 98 students in Engr 110 (81% of Spring 2012) were assessed. This represents 2 of 3 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 72%; Indicator 2 – 70%
Actions 2012-13: Based on analysis of the results the faculty determined that students experience significant progress in their ability to meet the student outcome as they progress from the junior to senior courses. The faculty decided to explore the content of the math and science pre-requisites and work with the faculty to ensure that our expectations are appropriate.

2015 cycle: (preliminary direct measure): A sample of 73 students in ME 128 (54% of the 2014-15 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 93%; Indicator 2 – 91%
A sample of 78 students in Engr 110 (51% of Spring 2012) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 75%; Indicator 2 – 72%

Table 4 – 2 Outcome b. ***An Ability to Design and Conduct Experiments, Analyze and Interpret Data***						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1. Identify Constraints	E 45, E 110, ME 180, ME 128, ME 191	Faculty Evaluations	ME 180, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			
		Industry Evaluation	ME 191 presentations			
2.Follow Data Collection Procedures	E 45, E 110, ME 180, ME 128, ME 191	Faculty Evaluations	ME 180, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			
		Industry Evaluation	ME 191 presentations			
3.Analyze Data	E 45, E 110, ME 180, ME 128, ME 191	Faculty Evaluations	ME 180, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			
		Industry Evaluation	ME 191 presentations			
4.Interpret Results	E 45, E 110, ME 180, ME 128, ME 191	Faculty Evaluations	ME 180, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			
		Industry Evaluation	ME 191 presentations			

2012 cycle: (direct measure): A sample of 51 students in ME 180 (52% of the 2011-12 cohort) were assessed. This represents 3 of the 6 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 82%; Indicator 2 – 87%; Indicator 3 – 90% ; Indicator 4 – 82%

A sample of 53 students in ME 191 (44% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 100%; Indicator 2 – 88%; Indicator 3 – 90% ; Indicator 4 – 90%
Actions 2012-13: Based on analysis of the results the faculty determined that students were prepared to address the student outcome by ME 180 and could use some additional focus on experimental work to be addressed in Engr 45 as preparation for the upper division expectations.

2015 cycle: (preliminary direct measure): A sample of 42 students in ME 180 (53% of the 2014-15 cohort) were assessed. This represents 3 of the 6 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 86%; Indicator 2 – 89%; Indicator 3 – 90% ; Indicator 4 – 83%
A sample of 67 students in ME 191 (49% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 100%; Indicator 2 – 90%; Indicator 3 – 91%; Indicator 4 – 90%

Table 4 – 3 Outcome c. ***An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability***						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1.Define Design Constraints	E 6, E 124, ME 37, ME 105, ME 116, ME 117, ME 171, ME 172, ME 190, ME 191	Faculty Evaluations	ME 117, ME 190	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			
2.Identify Design Strategies	E 6, E 124, ME 37, ME 105, ME 116, ME 117, ME 171, ME 172, ME 190, ME 191	Faculty Evaluations	ME 117, ME 190	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			
3. Propose Design Strategy	E 6, E 124, ME 37, ME 105, ME 116, ME 117, ME 171, ME 172, ME 190, ME 191	Faculty Evaluations	ME 117, ME 190	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			
4.Evaluate Design Strategy	E 6, E 124, ME 37, ME 105, ME 116, ME 117, ME 171, ME 172, ME 190, ME 191	Faculty Evaluations	ME 117, ME 190	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			

2012 cycle (direct measure)**:** A sample of 59 students in ME 117 (49% of the 2011-12 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 98%; Indicator 2 – 94%; Indicator 3 – 96%; Indicator 4 – 88%
A sample of 33 students in ME 190 (49% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 95%; Indicator 2 – 95%; Indicator 3 – 100%; Indicator 4 – 92%
Actions 2012-13: Based on analysis of the results the faculty determined that that by the end of ME 117 students were prepared in the areas of the student outcome. They were able to demonstrate continued success with this learning outcome in ME 190. The faculty determined that more complex projects would be to the students' benefit.

2015 cycle (preliminary direct measure): A sample of 77 students in ME 117 (51% of the 2014-15 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 94%; Indicator 2 – 929%; Indicator 3 – 95% ; Indicator 4 – 90%
A sample of 81 students in ME 190 (52% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 94%; Indicator 2 – 94%; Indicator 3 – 99%; Indicator 4 – 93%

Table 4 -4 Outcome d. *An ability to function on multidisciplinary teams*						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1.Contributes to Team Meetings	E 6, ME 37, E 45, E 110, ME 116, ME 105, ME 117, ME 171, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluations	ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
		Alumni Survey	On line survey			
2.Contributes Outside of Team Meetings	E 6, ME 37, E 45, E 110, ME 116, ME 105, ME 117, ME 171, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluations	ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
		Alumni Survey	On line survey			
3.Fosters Constructive Team Climate	E 6, ME 37, E 45, E 110, ME 116, ME 105, ME 117, ME 171, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluations	ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
		Alumni Survey	On line survey			
4.Responds to Conflict	E 6, ME 37, E 45, E 110, ME 116, ME 105, ME 117, ME 171, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluations	ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
		Alumni Survey	On line survey			

2012 cycle (direct measure):
A sample of 33 students in ME 190 (49% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 95%; Indicator 2 – 95%; Indicator 3 – 95%; Indicator 4 – 90%
Actions 2012-13: Based on analysis of the results the faculty determined that the students were prepared to address the student outcome. Faculty determined that the indicators would be more effectively demonstrated and evaluated with smaller senior project groups. Additionally, more efforst are required to fully develop the “multi-disciplinary team” approach to increase graduates’ long term career success.

2015 cycle (preliminary direct measure): A sample of 81 students in ME 190 (52% of the 2014-15 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 94%; Indicator 2 – 929%; Indicator 3 – 95% ; Indicator 4 – 90%
A sample of 81 students in ME 190 (52% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the satisfactory or above level were as follows:
Indicator 1 – 94%; Indicator 2 – 94%; Indicator 3 – 99%; Indicator 4 – 93%

Tabe 4 – 5 Outcome e. ***An ability to identify, formulate, and solve engineering problems***						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1.Identify problem requirement and problem limitations	E 6, E 45, E 110, ME 116, ME 105, ME 108, E 124, ME 117, ME 138, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 117, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
2.Define problem scope	E 6, E 45, E 110, ME 116, ME 105, ME 108, E 124, ME 117, ME 138, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 117, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
3.Perform experiment to determine engineering properties	E 6, E 45, E 110, ME 116, ME 105, ME 108, E 124, ME 117, ME 138, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 117, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
4.Analyze engineering alternatives	E 6, E 45, E 110, ME 116, ME 105, ME 108, E 124, ME 117, ME 138, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 117, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			

2012 cycle (direct measure): A sample of 59 students in ME 117 (49% of the 2011-12 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 98%; Indicator 2 – 94%; Indicator 3 – 96%; Indicator 4 – 88%
A sample of 33 students in ME 190 (49% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 95%; Indicator 2 – 95%; Indicator 3 – 100%; Indicator 4 – 92%

Actions 2012-13: Based on analysis of the results the faculty determined that that by the end of ME 117 students were prepared in the areas of the student outcome. They were able to demonstrate continued success with this learning outcome in ME 190. The faculty determined that more complex projects would be to the students' benefit.

2015 cycle (preliminary direct measure): A sample of 77 students in ME 117 (51% of the 2014-15 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 94%; Indicator 2 – 92%; Indicator 3 – 95% ; Indicator 4 – 90%
A sample of 81 students in ME 190 (52% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 94%; Indicator 2 – 94%; Indicator 3 – 99%; Indicator 4 – 93%

Table 4 – 6 Outcome f. *An understanding of professional and ethical responsibility*						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1.Demonstrates understanding of role of ethics in professional practice	E 45, ME 105, ME 108, E 124, ME 117, ME 180, ME 190, ME 191	Faculty Evaluations	ME 108, ME 190	3 years	2012, 2015	80%
		Senior Surveys	Exit Interview			
2. Assesses an engineer's responsibility for public health and safety	E 45, ME 105, ME 108, E 124, ME 117, ME 180, ME 190, ME 191	Faculty Evaluations	ME 108, ME 190	3 years	2012, 2015	80%
		Senior Surveys	Exit Interview			
3.Weighs how an engineer's actions affect other professionals	E 45, ME 105, ME 108, E 124, ME 117, ME 180, ME 190, ME 191	Faculty Evaluations	ME 108, ME 190	3 years	2012, 2015	80%
		Senior Surveys	Exit Interview			
4.Weighs how an engineer's actions affect his/her career	E 45, ME 105, ME 108, E 124, ME 117, ME 180, ME 190, ME 191	Faculty Evaluations	ME 108, ME 190	3 years	2012, 2015	80%
		Senior Surveys	Exit Interview			

2012 cycle (direct measure): A sample of 56 students in ME 108 (48% of the 2011-12 cohort) were assessed. This represents 1 of the 2 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 88%; Indicator 2 – 90%; Indicator 3 – 90%; Indicator 4 – 98%
A sample of 33 students in ME 190 (49% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 90%; Indicator 2 – 96%; Indicator 3 – 89 ; Indicator 4 – 96%
Actions 2012-13: Based on analysis of the results the faculty determined that that by the end of ME 117 students were prepared in the areas of the student outcome. They were able to demonstrate continued success with this learning outcome in ME 190. The faculty determined that more complex projects would be to the students' benefit.

2015 cycle (preliminary direct measure): A sample of 106 students in ME 108 (52% of the 2014-15 cohort) were assessed. This represents 3 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 89%; Indicator 2 – 92%; Indicator 3 – 90%; Indicator 4 – 99%
A sample of 81 students in ME 190 (52% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 91%; Indicator 2 – 94%; Indicator 3 – 91%; Indicator 4 – 99%

Table 4 – 7 Outcome g. *An ability to communicate effectively (written)*						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1.Meets audience needs	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 138, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
2.Organizes material in a logical manner	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 138, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
3.Provides adequate explanations, justifications, or supporting evidence	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 138, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
4.Develop visual materials which effectively support narrative (e.g., figures and tables)	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 138, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
5.Apply appropriate language, sentence structure, and terminology	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 138, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			
6.Construct grammatically correct text	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 138, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interview			

2012 cycle (direct measure):
A sample of 58 students in ME 138 (58% of the 2011-12 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 (1&2 were combined) – 88%; Indicator 2 – 88%; Indicator 3 – 90%; Indicator 4 (5&6 of the new rubric combined) – 85%
A sample of 33 students in ME 190 (49% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 (1&2 were combined) – 90%; Indicator 2 – 90%; Indicator 3 – 89%; Indicator 4 (5 & 6 of the new rubric combined) – 90%
Actions 2012-13: Based on analysis of the results the faculty determined that the students continue to need practice and instruction in effective communication. The College Assessment Committee recommended developing two rubrics – one for written communication and one for oral. The new rubric will be used for the next cycle. Additionally the projects and report topics were evaluated with suggestions for modernization. The senior project sequence will benefit from the changes to ME 138.

2015 cycle (preliminary direct measure): A sample of 82 students in ME 138 (60% of the 2014-15 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 89%; Indicator 2 – 92%; Indicator 3 – 90% ; Indicator 4 – 95%; Indicator 5 – 88% ; Indicator 6 – 90%;
A sample of 81 students in ME 190 (52% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 91%; Indicator 2 – 94%; Indicator 3 – 91% ; Indicator 4 – 96%; Indicator 5 – 90% ; Indicator 6 – 92%;

Table 4 – 8 Outcome g. *An ability to communicate effectively (oral)*						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1.Devise an organized presentation	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	**Faculty Evaluation**	**ME 138, ME 190**	**3 years**	**2012, 2015**	**80%**
		Senior Survey	**Exit Interview**			
2.Apply appropriate language	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	**Faculty Evaluation**	**ME 138, ME 190**	**3 years**	**2012, 2015**	**80%**
		Senior Survey	**Exit Interview**			
3.Deliver content effectively	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	**Faculty Evaluation**	**ME 138, ME 190**	**3 years**	**2012, 2015**	**80%**
		Senior Survey	**Exit Interview**			
4.Develop visual materials which effectively support narrative (e.g., slides)	E 6, E 45, E 110, ME 105, ME 108, ME 116, ME 117, ME 171, ME 172, ME 180, ME 126, ME 128, ME 190, ME 191	**Faculty Evaluation**	**ME 138, ME 190**	**3 years**	**2012, 2015**	**80%**
		Senior Survey	**Exit Interview**			
		Senior Survey	**Exit Interview**			

2012 cycle (direct measure) – Oral Communication was not assessed separately from written.

Actions 2012-13: The faculty determined that the students continue to need practice and instruction in effective communication. The College Assessment Committee recommended developing two rubrics – one for written communication and one for oral. The new rubric will be used for the next cycle. Additionally, the projects and report topics were evaluated with suggestions for modernization. The senior project sequence will benefit from the changes to ME 138.

2015 cycle (preliminary direct measure): A sample of 82 students in ME 138 (60% of the 2014-15 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 88%; Indicator 2 – 86%; Indicator 3 – 95%; Indicator 4 – 88%;
A sample of 81 students in ME 190 (52% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 90%; Indicator 2 – 88%; Indicator 3 – 87%; Indicator 4 – 90%;

Table 4 – 9 Outcome h. ***The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context***						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1.Comprehend the role of infrastructure in quality of life and economic activity	ME 108, ME 126, ME 190, ME 191	Faculty Evaluations	ME 108, ME 190	**3 years**	**2012, 2015**	**80%**
		Senior Survey	Exit Interview			
2.Comprehend the environmental/ sustainability impact of engineering decisions	ME 108, ME 126, ME 190, ME 191	Faculty Evaluations	ME 108, ME 190	**3 years**	**2012, 2015**	**80%**
		Senior Survey	Exit Interview			
3.Understand role of engineering in reducing risks from known hazards	ME 108, ME 126, ME 190, ME 191	Faculty Evaluations	ME 108, ME 190	**3 years**	**2012, 2015**	**80%**

2012 cycle (direct measure): A sample of 56 students in ME 108 (48% of the 2011-12 cohort) were assessed. This represents 1 of the 2 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 88%; Indicator 2 – 82%; Indicator 3 – 82%
A sample of 53 students in ME 191 (44% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 90%; Indicator 2 – 95%; Indicator 3 – 90%
Actions 2012-13: Based on analysis of the results the faculty determined that students were not as well versed in the importance of the engineering profession to the success of accomplishing societal goals. It was determined that additional materials would be developed and presented in multiple places in the curriculum beginning in the first year.

2015 cycle (preliminary direct measure): A sample of 106 students in ME 108 (52% of the 2014-15 cohort) were assessed. This represents 3 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 92%; Indicator 2 – 92%; Indicator 3 – 95%
A sample of 67 students in ME 191 (49% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 93%; Indicator 2 – 90%; Indicator 3 – 94%

Table 4 – 10 Outcome i. ***A recognition of the need for, and an ability to engage in life-long learning***

Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1. Recognizes the need for lifelong learning	E 45, E 110, E 124, ME 105, ME 108, ME 116, ME 117, ME 180, ME 172, ME 190, ME 191	Faculty Evaluations	ME 108, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			
2.Engages in lifelong learning	E 45, E 110, E 124, ME 105, ME 108, ME 116, ME 117, ME 180, ME 172, ME 190, ME 191	Faculty Evaluations	ME 108, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interviews			

2012 cycle (direct measure): A sample of 56 students in ME 108 (48% of the 2011-12 cohort) were assessed. This represents 1 of the 2 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 90%; Indicator 2 – 90%
A sample of 53 students in ME 191 (44% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 96%; Indicator 2 – 95%
Actions 2012-13: Based on analysis of the results the faculty determined that we need to continue focus effort on ensuring students understand that the BS is the foundation for their life-long learning and without continued efforts their contributions and careers will be limited It was determined that additional materials would be developed and presented in multiple places in the curriculum beginning in the first year.

2015 cycle (preliminary direct measure): A sample of 106 students in ME 108 (52% of the 2014-15 cohort) were assessed. This represents 3 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 90%; Indicator 2 – 92%
sample of 67 students in ME 191 (49% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 95%; Indicator 2 – 95%

Table 4 – 11 Outcome j. ***An ability to identify, formulate, and solve engineering problems***						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance (% students Proficient)**
1.Knowledge of practices in the field, including technologies and engineering techniques	ME 108, ME 126, ME 190, ME 191	Faculty Evaluations	ME 108, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interview			
		Alumni Survey	On line survey			
		Industry	ME 191 presentations			
2.Knowledge of recent engineering disasters, failures, and shortcomings and successes	ME 108, ME 126, ME 190, ME 191	Faculty Evaluations	ME 108, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interview			
		Alumni Survey	On line survey			
		Industry	ME 191 presentations			
3.Recognize the influence of various political/social issues	ME 108, ME 126, ME 190, ME 191	Faculty Evaluations	ME 108, ME 191	3 years	2012, 2015	80%
		Senior Surveys	Exit Interview			
		Alumni Survey	On line survey			
		Industry	ME 191 presentations			

2012 cycle (direct measure): A sample of 56 students in ME 108 (48% of the 2011-12 cohort) were assessed. This represents 1 of the 2 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 88%; Indicator 2 – 82%; Indicator 3 – 75%
A sample of 53 students in ME 191 (44% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 95%; Indicator 2 – 90%; Indicator 3 – 82%
Actions 2012-13: Based on analysis of the results the faculty determined that students were addressing all problems with a narrow view. It was determined that additional materials emphasizing the depth and breadth of engineering practice and responsibility.

2015 cycle (preliminary direct measure): A sample of 106 students in ME 108 (52% of the 2014-15 cohort) were assessed. This represents 3 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 92%; Indicator 2 – 95%; Indicator 3 – 90%
A sample of 67 students in ME 191 (49% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 90%; Indicator 2 – 94%; Indicator 3 – 90%

Table 4 – 12 Outcome k. ***An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.***						
Performance Indicator	**Educational Strategies**	**Methods of Assessment**	**Where Data Collected**	**Length of Assessment Cycle**	**Year/Semester of Data Collection**	**Target for Performance**
1.List various solution techniques	E 6, E 45, E 124, ME 116, ME 105, ME 108, ME 117, ME 138, ME 171, ME 172, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 172, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interviews			
2.Develop skills to apply engineering tools	E 6, E 45, E 124, ME 116, ME 105, ME 108, ME 117, ME 138, ME 171, ME 172, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 172, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interviews			
3.Apply modern engineering tools to solve engineering problems	E 6, E 45, E 124, ME 116, ME 105, ME 108, ME 117, ME 138, ME 171, ME 172, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 172, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interviews			
4.Perform analysis of engineering problems using modern engineering tools	E 6, E 45, E 124, ME 116, ME 105, ME 108, ME 117, ME 138, ME 171, ME 172, ME 126, ME 128, ME 190, ME 191	Faculty Evaluation	ME 172, ME 190	3 years	2012, 2015	80%
		Senior Survey	Exit Interviews			

2012 cycle:(direct measure): A sample of 56 students in ME 172 (35% of the 2011-12 cohort) were assessed. This represents 2 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 88%; Indicator 2 – 90%; Indicator 3 – 90%; Indicator 4 – 98%
A sample of 33 students in ME 190 (49% of 2011-12 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 90%; Indicator 2 – 96%; Indicator 3 – 89%; Indicator 4 – 96%

Actions 2012-13: Based on analysis of the results the faculty determined that that the project based focus of ME 172 is a valuable mechanism for students to learn and practice a wide variety of necessary techniques and problem solving strategies. We must continue to maintain the individual faculty efforts to implement modern tools in the curriculum

2015 cycle (preliminary direct measure): A sample of 106 students in ME 108 (52% of the 2014-15 cohort) were assessed. This represents 3 of the 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows: Indicator 1 – 89%; Indicator 2 – 92%; Indicator 3 – 90%; Indicator 4 – 99%
A sample of 81 students in ME 190 (52% of 2014-15 cohort) were assessed. This represents 2 of 4 sections. The percent of the sample that demonstrated each indicator at the proficient or above level were as follows:
Indicator 1 – 91%; Indicator 2 – 94%; Indicator 3 – 91%; Indicator 4 – 99%

B. Continuous Improvement

Describe how the results of evaluation processes for the student outcomes and any other available information have been systematically used as input in the continuous improvement of the program. Describe the results of any changes (whether or not effective) in those cases where re-assessment of the results has been completed. Indicate any significant future program improvement plans based upon recent evaluations. Provide a brief rationale for each of these planned changes.

The information used for continuous improvement of the program includes results from programmatic assessment, survey results, faculty evaluations, alumni and industry input and other and consultation with the constituencies. Specifically the department seeks input from:

1. **Students –** The department uses exit interviews with the graduating seniors to determine the effectiveness of the program and to identify any areas that need improvement. In addition, the department uses town hall meetings to get feedback from a wider cross section of the student population.
2. **Alumni/Employers –** The department maintains an active Industrial Advisory Committee to advise the department. This committee is composed of industry representatives some of whom are alumni. Members of the IAC interact directly with the students, reviewing senior projects and acting as mentors. IAC members also participate on committees with faculty tasked with specific goals such as strategic planning. Finally, IAC members interact with faculty in regular meetings.
3. **Employers –**The faculty visit local employers every year to evaluate the effectiveness of the program and to identify any emerging technologies that should be incorporated into the curriculum.
4. **4 Local Industry –** the faculty regularly solicit input for specific Senior Projects and work closely with these industry engineers to augment the program.

The faculty reviews are accomplished through a series of regular meetings. After assessment results are tabulated and presented to faculty significant issues are identified. After issues are identified the implications of possible remediation strategies to the curriculum are discussed. Faculty regularly discuss the results of changes to course content, mode and delivery, evaluation strategies, etc. The faculty are active in collaborating on issues such as teaching effectiveness. The department has taken several actions to improve the program since the last review. These include modifications to the course content, addition of new faculty, revisions to the assessment plan, and modifications to the curriculum.

Course Content

Every major course is offered every semester. Most courses have multiple sections to keep class size reasonable and to help students create their schedules. Course content has not been modified significantly except to implement modern topics and tools when available. Faculty have participated in numerous Professional Development opportunities offered at the University to incorporate web-based and on-line support for the lecture and lab materials. Additionally we have added CR/NC “workshops” to support core courses. We have developed and offered a number of new elective courses and updated every elective. We are implementing updated

Mechanical Engineering career development courses in Fall 2015 and we are adding an e-portfolio requirement to the capstone requirement.

New Faculty

The department has added new faculty in necessary to support of specific curricular areas and to respond to the dramatic increase in enrollment in the Mechanical Engineering Program.

1. Troy Topping – Materials Science, 2013
2. Rustin Vogt – Modern Manufacturing, 2014

Revisions to the Assessment Plan

The assessment plan was reviewed in 2010 to move to a programmatic focus. The revised plan is described in CRITERION 3 -A. This plan was implemented for the complete 2012 cycle to evaluate Student Outcomes **a** through **k** that are mapped to the Program Educational Objectives. We are now considering adding e-portfolios as an additional opportunity to assess the Program Educational Objectives at the time of graduation. The students would be required to present work in multiple areas, describe the work and provide reflections on the quality.

Curriculum Revisions

The Mechanical Engineering curriculum underwent a significant modification that was implemented in Fall 2009. These modifications were the direct result of student and alumni feedback, faculty reviews, and alumni survey results. The primary goal of these revisions was to eliminate any duplication in material between courses. The courses needed to be structured such that key material was introduced in one course then re-enforced in latter courses with practice and advanced concepts. The secondary goal of the curriculum revisions was to reduce the number of units in the program. We have found the curriculum to be extremely effective and have seen significant increase in student interest, employer interest, and industry support since the change. We have made only minor modifications including some pre-requisite changes, some course placement changes, and some course content updates.

We continue to modernize our delivery and utilize all possible technological support to provide students with ready access to computer assisted learning devices. We teach in a face-to-face mode with support materials and some evaluation materials available on-line.
Prompted by input from our IAC we have increased the requirements for team-work, communication, ethics and life-long learning. We have begun to use some FE –like exams as a portion of course evaluation strategy. We have also developed many new elective courses and modernized others so that students can study some of the subjects that are more complicated than the standard curriculum allows.

During the 2013-14 year the campus General Education program was modified and the Mechanical Engineering program has developed a GE pattern unique to the program. Additionally during the 2013-14 year a Blended BS/MS Mechanical Engineering program was developed to encourage students to continue their formal education. The process for developing all modifications was to assess the effectiveness of the curriculum for the student learning outcomes and then to develop strategies to for improvement. The faculty discuss curricular issues and opportunities at every department meeting.

C. Additional Information

Copies of any of the assessment instruments or materials referenced in 4.A. and 4.B must be available for review at the time of the visit. Other information such as minutes from meetings where the assessment results were evaluated and where recommendations for action were made could also be included.

Course information, assessment instruments and other materials will be available for review.

CRITERION 5. CURRICULUM

A. Program Curriculum

1. *Complete Table 5-1 that describes the plan of study for students in this program including information on course offerings in the form of a recommended schedule by year and term along with maximum section enrollments for all courses in the program for the last two terms the course was taught. If there is more than one curricular path, Table 5-1 should be provided for each path. State whether you are on quarters or semesters and complete a separate table for each option in the program.*
2. *Describe how the curriculum aligns with the program educational objectives.*
3. *Describe how the curriculum and its associated prerequisite structure support the attainment of the student outcomes.*
4. *Attach a flowchart or worksheet that illustrates the prerequisite structure of the program's required courses.*
5. *Describe how your program meets the requirements in terms of hours and depth of study for each subject area (Math and Basic Sciences, Engineering Topics, and General Education) specifically addressed by either the general criteria or the program criteria.*
6. *Describe the major design experience that prepares students for engineering practice. Describe how this experience is based upon the knowledge and skills acquired in earlier coursework and incorporates appropriate engineering standards and multiple design constraints.*
7. *If your program allows cooperative education to satisfy curricular requirements specifically addressed by either the general or program criteria, describe the academic component of this experience and how it is evaluated by the faculty. (Note this language is harmonized but could be either #6 or #7.)*
8. *Describe the materials (course syllabi, textbooks, sample student work, etc.), that will be available for review during the visit to demonstrate achievement related to this criterion. (See the 2015-2016 APPM Section II.G.6.b.(2) regarding display materials.).*

Consistency of Curriculum with the Program Educational Objectives

The Mechanical Engineering curriculum was developed to prepare students to meet the Program Educational Objectives, student outcomes, Sacramento State Baccalaureate Learning Goals, ABET requirements, the needs and desires of our students and faculty, and to serve the community that will utilize our graduates. Course work spanning a variety of areas is designed to satisfy the broad spectrum of needs of our graduates and their eventual employers in our community and state. Graduates of our program will be thoroughly prepared as they begin their professional careers and will have skills adequate to assure growth and career development regardless of which path their professional lives take.

The program's strength resides in our students developing a thorough knowledge of the fundamentals of Mechanical Engineering, an appreciation of how to effectively use their knowledge, and the ability to build on the foundation throughout their careers. Courses prepare them to do high quality work in whichever general area of Mechanical Engineering their career develops. Our talented faculty includes long tenured senior faculty with highly motivated, well-prepared, new faculty actively engaged in innovative teaching and research.

The Mechanical Engineering lower division curriculum comprises the fundamental knowledge upon which our upper division courses build. The curriculum includes:

Math: Three semesters of Calculus including multi-variant analysis, one semester of Differential Equations, and one unit each of Linear Algebra and Engineering Statistics imbedded in major courses.

Science: One semester of Chemistry, two semesters of Physics, one semester of Computer Programming, and one semester of life science (to fulfill the CSU System General Education requirement)

Engineering Science: One semester of Graphics, one semester of Engineering Materials, two semesters of Analytic Mechanics, one semester of Mechanics of Materials, two semesters of Thermodynamics, one semester of Fluid Mechanics, and one semester of Electric Circuits.

The technical portion of the curriculum builds on this core. Its four areas are:

- Applied Mechanics and Design
- Manufacturing
- Materials Science
- Thermal Sciences

These areas overlap significantly. For instance, there is much design content in the manufacturing, thermal sciences, and materials science courses. Similarly materials, manufacturing, and applied mechanics topics enter are used in design courses.

The Mechanical Engineering curriculum was designed by correlating the student outcomes to the Program Educational Objectives. The student outcomes are addressed in multiple courses and the Program Educational Objectives are achieved through demonstrated success in multiple student outcomes.

The curriculum also requires six units of Mechanical Engineering elective courses selected from an approved list.   The electives include courses from all of the technical areas.

Traditional laboratory experiences are integral components in many courses including the first manufacturing course, both materials science courses, the thermal-fluids system course, the computer applications courses, , and the Senior Project courses. Computers and appropriate software packages are actively used in most courses from the first semester Computer Aided Design course to the Senior Project.

The laboratory portion of the Mechanical Engineering curriculum encompasses four areas:

1. Scientific experiments in the required chemistry and physics courses (Chem. 1E, Phys 11A, and Phys 11C). These laboratory courses educate student in the scientific method, explore

basic scientific experimentation techniques, establish familiarity with instrumentation and equipment and reinforce scientific fundamentals.

2. Basic Engineering Skills are taught in:

   ENGR 6 – Engineering Graphics and Computer-Aided Drafting and Design
   ME 37 – Manufacturing Processes
   ME 105 – Introduction to Technical Problem Solving

   Laboratory experiences reinforce basic skills, safety, and knowledge needed for mechanical engineering practice.

3. Engineering measurement laboratories are included in:

   ENGR 45 – Engineering Materials
   ME 128 – Thermal-Fulid Systems
   ME 180 – Mechanical Properties of Materials

   The curricula in these courses emphasize safety and teach the fundamentals of measurement, experimental techniques, and communication of technical information in engineering.

4. Machinery Design courses form an important part of the curriculum:

   ME 116 – Machinery Design I
   ME 117 – Machinery Design II

   forming the backbone for the culminating design/build project courses,

   ME 190 – Project Engineering I
   ME 191 – Project Engineering II

   in which the previously learned skills support application of design methodology to a particular problem chosen by each student design team. The project is designed in ME 190 and fabricated in ME 191.

In addition to the engineering requirements, the University's General Education (GE) requirement includes 24 units in humanities and social science. These courses address foundational and more complex societal issues. Students are encouraged to take these courses throughout their program in Mechanical Engineering; taking foundational courses early on in the program and building on those foundations later in their course of study. We continually strive to make our graduates aware of the societal and ethical concerns of the engineering profession with special emphasis on energy, the environment, public safety, equal opportunity and professional integrity which are specifically addressed in ME 108 – Professional Topics in Mechanical Engineering and the ME 190/191 capstone sequence.

Credit Hours and Distributions of Study Areas

Table 5-1 shows the evidence that the minimum credit hours and distribution specified in Criterion 5 of the ABET Engineering Accreditation Criteria are satisfied.

Culminating Design Experience

Engineering Design is a significant component in courses throughout the Mechanical Engineering curriculum. Most of the lower division and manufacturing processes courses do not contain complex engineering design but they do instill the fundamental skills needed for design in more advanced courses. Engineering design fundamentals are emphasized throughout the curriculum and the sequence of ME 116 – Machinery Design I, ME 117 – Machinery Design II, ME 190 – Senior Project I, and ME 191 – Senior Project II informs the final two years of the curriculum. As the students are developing their skills in the ME 116 through ME 191 sequence, they are also reinforcing their abilities in courses on computer applications (ME 105 – Professional Topics in Mechanical Engineering and ME 171 – Modeling & Simulation), engineering measurements (ME 128 – Thermal-Fluid Systems), design for manufacturing (ME 138 – Concurrent Product and Process Design, ME 180 – Mechanical Properties of Materials, and ME 172 – Control System Design). Each of these courses include open-ended problems requiring iterative solutions; many require an independent design project.

A major design experience takes place in the capstone senior design sequence ME 190 and ME 191, Project Engineering I and II. Working in small teams, students design and fabricate a complete machine or device. The majority of the projects are sponsored by local industry that adds to the students' experience with a 'real world' problem. In ME 190, students apply design methodology to create a complete design that includes cost estimates, technical calculations, computer analyses, shop drawings, and written reports. In the second semester, ME 191, students fabricate and test the machine or device they designed. The students complete a careful evaluation of the design and make modifications as needed. Throughout both courses students make written and oral presentations. The Mechanical Engineering Department considers this course sequence an absolutely vital component of the curriculum and has worked very hard to maintain high standards. The design problems selected must be real problems that serve a real need. Students are encouraged to secure support and help from industrial sponsors. The end products must be, at minimum, a working engineering prototype. The process mimics a typical industrial design/development procedure. The projects are displayed for IAC and community visitors at the semi-annual Senior Project Showcase.

Materials for Review

Syllabi, textbooks and student work from all required courses will be available for review.

B. Course Syllabi

In Appendix A, include a syllabus for each course used to satisfy the mathematics, science, and discipline-specific requirements required by Criterion 5 or any applicable program criteria.

Table 5-1 Curriculum

Bachelor of Science in Mechanical Engineering

Course (Department, Number, Title) List all courses in the program by term starting with the first term of the first year and ending with the last term of the final year.	Indicate Whether Course is Required, Elective or a Selected Elective by an R, an E or an SE.[1]	*Subject Area (Credit Hours)* Math & Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education	Other	Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Maximum Section Enrollment for the Last Two Terms the Course was Offered[2]
CHEM 1E – General Chemistry for Engineers	**R**	**4**				*Fall 2014/ Spring15*	*126 (lect) 20 (lab)/ 137(lect) 20 (lab)*
MATH 30 – Calculus I	**R**	**4**		*X*		*Fall 2014/ Spring15*	*35/35*
MATH 31 – Calculus II	**R**	**4**				*Fall 2014/ Spring15*	*35/35*
MATH 32 – Calculus III	**R**	**4**				*Fall 2014/ Spring15*	*35/35*
MATH 45 – Differential Equations	**R**	**3**				*Fall 2014/ Spring15*	*35/35*
PHYS 11A – General Physics: Mechanics	**R**	**4**		*X*		*Fall 2014/ Spring15*	*80(lect) 20 (lab)/ 80(lect) 20 (lab)*
PHYS 11C – General Physics: Electricity and Magnetism	**R**	**4**				*Fall 2014/ Spring15*	*82(lect) 20 (lab)/ 70 (lect) 20 (lab)*

ENGR 6 – Engineering Graphics and CADD	**R**		**3** √			*Fall 2014/ Spring15*	*40/35*
ENGR 17 – Circuit Analysis	**R**		**3**			*Fall 2014/ Spring15*	*72/64*
ENGR 30 – Analytic Mechanics: Statics	**R**		**3**			*Fall 2014/ Spring15*	*44/45*
ENGR 45 – Engineering Materials	**R**		**3**			*Fall 2014/ Spring15*	*67 (lect) 20 (lab)/ 88(lect) 16 (lab)*
ENGR 110 – Analytic Mechanics: Dynamics	**R**		**3**			*Fall 2014/ Spring15*	*43/47*
ENGR 112 – Mechanics of Materials	**R**		**3**			*Fall 2014/ Spring15*	*43/45*
ENGR 124 - Thermodynamics	**R**		**3**			*Fall 2014/ Spring15*	*39/54*
ENGR 132 – Fluid Mechanics	**R**		**3**			*Fall 2014/ Spring15*	*72/58*
ME 37 – Manufacturing Processes	**R**		**3**			*Fall 2014/ Spring15*	*62 (lect) 16 (lab)/ 121(lect) 16 (lab)*
ME 105 – Introduction to Technical Problem Solving	**R**	**1**	**2** √			*Fall 2014/ Spring15*	*35/36*
ME 108 – Professional Topics in Mechanical Engineering	**R**	**1**	**1**	*X*		*Fall 2014/ Spring15*	*93/106*
ME 116 – Machinery Design I	**R**		**2** √			*Fall 2014/ Spring15*	*49/55*
ME 117 – Machinery Design II	**R**		**2** √			*Fall 2014/ Spring15*	*36/49*
ME 126 – Heat Transfer	**R**		**3**			*Fall 2014/ Spring15*	*46/41*

ME 128 – Thermal-Fluid Systems	**R**		**3** √			*Fall 2014/ Spring15*	*59 (lect) 20 (lab)/ 73 (lect) 20 (lab)*
ME 138 – Concurrent Product and Process Design	**R**		**3** √			*Fall 2014/ Spring15*	*48/42*
ME 171 – Modeling & Simulation of Mechatronics & Control Syst	**R**		**3** √			*Fall 2014/ Spring15*	*31/35*
ME 172 – Control System Design	**R**		**3** √			*Fall 2014/ Spring15*	*25/29*
ME 180 – Mechanical Properties of Materials	**R**		**3**			*Fall 2014/Spring 2015*	*84 (lect) (20 lab)/ 49 (lect) 20 (lab)*
ME 190 – Project Engineering I	**R**		**3** √	*X*		*Fall 2014/ Spring15*	*67/81*
ME 191 – Project Engineering II	**R**		**2** √	*X*		*Fall 2014/ Spring15*	*46/67*
ME electives (listed below) 6 units required	**R**		**6**				
ME 115 – Dynamics of Machinery and Multi-Body Systems	E		*3*			*Fall 2009*	*5*
ME 121 – Solar Thermal & Energy Storage Systems	E		*2*			*Spring 13/ Spring 15*	*22/25*
ME 122 – Geo-Thermal & Bio-Energy Systems	E		*2*			*Fall 11/ Fall 14*	*11/12*
ME 123 – Wind, Hydro and Ocean Energy	E		*2*			*Spring 12/Spring 13*	*12/17*
ME 136 – Numerical Control Programming	E		*3*			*Spring 13/Fall 14*	*24/17*
ME 137 – Product Design for Manufacturing & Automation	E		*3*			*Fall 13/Fall 14*	*16/13*
ME 140 – Introduction to Motors and Actuators	E		*2*			*Spring 11/ Fall 12*	*19/16*

ME 141 – Introduction to Tolerance Analysis	E		*2*			*Spring 13/ Spring 15*	*13/21*
ME 143 – Vehicle Dynamics and Design	E		*3*			*Fall 12/ Spring 14*	*22/17*
ME 152 – Turbomachinery Design	E		*3*			*Spring 10*	*20*
ME 154 – Alternative Energy Systems	E		*3*			*Fall 09/ Fall 10*	*26/29*
ME 155 – Gas Dynamics	E		*3*			*Spring 10*	*9*
ME 156 – Heating and Air Conditioning Systems	E		*3*			*Fall 13/Fall 14*	*25/25*
ME 159 – High Efficiency HVAC	E		*3*			*Spring 14/ Spring 15*	*13/13*
ME 164 – Introduction to Test Automation	E		*3*			*Fall 10/ Fall 11*	*7/15*
ME 165 – Introduction to Robotics	E		*3*			*Fall 13*	*24*
ME 173 – Applications of Finite Element Analysis	E		*3*			*Fall 13/ Spring 15*	*20/24*
ME 176 – Product Design and Pro/Engineer	E		*3*			*Spring 13/ Fall 14*	*25/22*
ME 177 – Product Design and 3D Parametric Solid Modeling	E		*3*			*Spring 14/ Spring 15*	*42/27*
ME 182 – Introduction to Composite Materials	E		*3*			*Fall 11/ Fall 13*	*22/33*
ME 184 – Corrosion and Wear	E		*3*			*Spring 14/ Spring 15*	*25/15*
ME 186 – Fracture Mechanics in Engineering Design	E		*3*			*Spring 14/ Spring 15*	*23/19*
Add rows as needed to show all courses in the curriculum.							
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		29 + 3 GE life science	63	27			

OVERALL TOTAL CREDIT HOURS FOR COMPLETION OF THE PROGRAM	122						
PERCENT OF TOTAL		26	52	22			
Total must satisfy either credit hours or percentage	Minimum Semester Credit Hours	32 Hours	48 Hours				
	Minimum Percentage	25%	37.5 %				

1. **Required** courses are required of all students in the program, **elective** courses (often referred to as open or free electives) are optional for students, and **selected elective** courses are those for which students must take one or more courses from a specified group.
2. For courses that include multiple elements (lecture, laboratory, recitation, etc.), indicate the maximum enrollment in each element. For selected elective courses, indicate the maximum enrollment for each option.

Instructional materials and student work verifying compliance with ABET criteria for the categories indicated above will be required during the campus visit.

CRITERION 6. FACULTY

A. Faculty Qualifications

Describe the qualifications of the faculty and how they are adequate to cover all the curricular areas of the program and also meet any applicable program criteria. This description should include the composition, size, credentials, and experience of the faculty. Complete Table 6-1. Include faculty resumes in Appendix B.

The Mechanical Engineering faculty have widely varied backgrounds, ranging from mechanical, aeronautical and industrial engineering, to engineering mechanics, manufacturing and materials science.

Many have had significant industrial experience prior to joining our faculty. Most have earned doctorates and some hold professional registration.

Most of the faculty have been active in research programs. Fields of study include:

- Bond graph modeling and spacecraft dynamics – Jose Granda
- Silicon wafer bonding – Susan Holl
- Mechanism design, manufacturing – Akihiko Kumagai
- Computer integrated manufacturing (CIM) – Tien Liu
- CADD modeling, rapid prototyping – Yong Suh
- Biomass conversion, combustion – Timothy Marbach
- Automation, mechatronics – Ken Sprott
- Nanostuctures of aluminum, modern materials – Troy Topping
- Aerospace and aircraft structures – Ilhan Tuzcu
- Particle manufacturing – Rustin Vogt
- Computational fluid mechanics – Dongmei Zhou

The following is a list of full-time faculty, by curriculum areas, with their highest degrees and areas of technical interest.

Applied Mechanics and Design

Eke, Estelle, Ph.D., Aero/Astronautics, Rice University
Controls, optimization, modeling of dynamic systems

Granda, Jose J., Ph.D., Mechanical Engineering, University of California, Davis
System dynamics, finite-element analysis, Bond-graphs

Sprott, Kenneth, Ph.D., Mechanical Engineering, University of California, Davis Dynamics, Mechanical Design, Automation, Robotics, Mechatronics

Suh, Yong, Ph.D., Mechanical Engineering, Renssalaer Polytechnic Institute
Computer-aided design, Rapid Proto-typing

Tuzcu, Ilhan, Ph.D., Mechanical Engineering, Virginia Tech
Aircraft design, controls

Manufacturing

Kumagai, Akihiko, Ph.D., Mechanical Engineering, Univ. of Wisconsin, Milwaukee
Manufacturing, automation, mechanism design, mechatronics, kinematics, robotics

Vogt, Rustin, Ph.D., Materials Science and Engineering, University of California, Davis
Modern manufacturing and sustainability

Materials Science

Holl, Susan L., Ph.D., Material Science and Engineering, Univ. of California, Berkeley
Silicon wafer bonding, semiconductor devices, ceramics

Topping, Troy, Ph. D. Materials Science and Engineering, University of California, Davis
Nanostructures of aluminum

Thermal Sciences

Marbach, Timothy, Ph.D., Oklahoma University
Combustion, biomass conversion

Zhou, Dongmei, Ph.D., University of Texas, Austin
Computational fluid dynamics, fuel cells

Currently, there are two emeritus faculty who teach on a part-time basis in the Faculty Early Retirement Program (FERP): Rabindranath Bandy and Tien-I Liu.

B. Faculty Workload

Complete Table 6-2, Faculty Workload Summary and describe this information in terms of workload expectations or requirements.

All faculty are responsible for a 15 Weighted Teaching Unit (WTU) instructional load per semester. Non-tenure track faculty can be assigned 15 WTU of in-class teaching. Tenured and tenure-track faculty are normally assigned a 12 WTU in-class load with 3 WTU reserved for advising and service to the Department, College and University. Some opportunities for "assigned time" awards are available for faculty to complete specific projects related to their research and/or professional development interests.

C. Faculty Size

Discuss the adequacy of the size of the faculty and describe the extent and quality of faculty involvement in interactions with students, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners including employers of students.

There are twelve (12) full-time faculty members in the Department of Mechanical Engineering divided into four program areas: Applied Mechanics & Design, Manufacturing, Materials Science, and Thermal Sciences. All but one of these has an earned Ph.D. and is tenured or tenure-track. There are two emeritus faculty members participating in the Faculty Early Retirement Program (FERP). Five (5) to seven (7) part-time faculty are employed each semester depending on need. The majority of major courses are covered by full-time faculty. The faculty characteristics are as described in Tables 6-1 and 6-2.

All departmental governance is accomplished by regular faculty. All major curricular advising is done by regular faculty. Each Mechanical Engineering student must see a faculty advisor each semester for curricular advising. The faculty share the load of committee work and advising. The faculty members participate in many committees (department, college, and university level).Additionally, the faculty are involved as advisors to several active student professional groups, among them SAE, ASME, SWE and Tau Beta Pi.

D. Professional Development

Provide detailed descriptions of professional development activities for each faculty member.

Each faculty member is encouraged to develop a plan with clearly defined goals. Probationary faculty and Associate Professors are expected to have their plan articulated in their personnel action file with reflections and modifications of their goals. The personnel action file is examined at regularly scheduled evaluations for the Retention/Tenure/Promotion process. The College of Engineering and Computer Science provides a one course reduction in work load for the first four semesters when a new faculty member is appointed.

There are several opportunities that are available for faculty development that include:

1. Research and Creative Activity (RCA) Grants – This grant is designed to fund faculty as a startup funding for their scholarly activities. The funding could be up to 6 WTUs (two classes), two months summer salary, and $2500 funding (for travel and other expenses).

2. Pedagogy Enhancement Award (PEA) – This award is design to fund improvement of teaching related activities. The funding is 3 WTUs (1 class release time) and $500 (for travel and other expenses).

3. System wide grants Proven Course Re-Design and Promising Course Re-Design – Assigned time and monetary awards are available from the CSU system

4. President's UEI (University Enterprises Inc.) Faculty Grant Program – This grant program funds faculty development and are available to faculty from the President's Office. The funding is competitive and could be up to $2,000 per faculty.

5. Provost Research Incentive Fund – The Provost created a special fund to support summer projects to for faculty research and scholarly activity. Awards provide $5000 in summer salary.

6. New Faculty Development Allocation – The College reduces the teaching load for newly hired faculty by one class (3 WTU) for the first two years. This allows new faculty to develop their teaching and research. In addition, for the past two years new faculty have been awarded New Faculty Development funds.

7. Summer Teaching Institute – This competitive opportunity is available to faculty who want to develop/improve their teaching. The University funds about 40 faculty members every year and provides them with laptop or $800 for use to improve their teaching. Six faculty from Mechanical Engineering have participated in this program over the last three years

8. NSF Grant Proposal Program – This program supports faculty who wish to develop and submit NSF grant proposals.

The Department does not have any development funding other than limited travel funds (as mentioned above). The Department uses its own trust to support faculty development in travel.

The faculty members maintain their currency in the field by a variety of activities, summarized as follows:

- Prof. Eke is active in developing on-line teaching capabilities and adaptable projects for courses in the applied mechanics and design area.

- Prof. Granda is a NASA faculty fellow. He was a NASA spokesperson for several Space Shuttle missions. He works with computer modeling and simulation of dynamic systems.

- Prof. Marbach is involved in research on combustion and biomass conversion. He is the PI for the California Department of Energy Appliance Testing Center.

- Prof. Holl has been involved in research to develop a method of bonding silicon wafers to flexible substrates. She has presented the work in recent International Electrochemical Society conferences.

- Prof. Kumagai is deeply involved in industrial research including modeling and development of advanced spring technology and liquid handling systems. He has been successful in engaging students in his research work.

- Prof. Sprott has been involved in developing the Mechatronics and Automation areas working with students in engine monitoring, data acquisition, and smart irrigation. He is also involved in industrial design consulting developing consumer and industrial products.

- Prof. Suh is involved with reconstructing Polyhedral CAD models from single-view drawings. He publishes in ASME & IEEE conferences on use of computers and information integration.

- Prof. Topping has been active in investigating innovative methods for increasing strength in metals with an emphasis on ultrafine particle reinforced metals. He publishes frequently in materials journals and conferences.

- Prof. Tuzcu works primarily in the area of aircraft vibrations and stability. He supervises many student projects and publishes frequently in ASME, AIAA and SAE journals.

- Prof. Vogt studies modern manufacturing techniques related to product design and development. He is interested in metal processing and sustainability.

- Prof. Zhou utilizes her expertise in computational fluid dynamics to study various systems involving energy production and energy management.

Faculty Name	**Journal Publications**	**Conference Presentations**
Eke		2
Granda	10	5
Holl	5	2
Kumagai	1	3
Liu	15	12
Marbach	1	4
Topping	9	23
Sprott	3	2
Suh	3	1
Tuzcu	5	3
Vogt	5	
Zhou	2	6

Appendix B includes an abbreviated resume for each program faculty member with the rank of instructor or above.

E. Authority and Responsibility of Faculty

Describe the role played by the faculty with respect to course creation, modification, and evaluation, their role in the definition and revision of program educational objectives and student outcomes, and their role in the attainment of the student outcomes. Describe the roles of others on campus, e.g., dean or provost, with respect to these areas.

The Department faculty are responsible for all aspects of governing the department. Faculty members serve on committees at the Department, College, and University level to ensure complete representation of the Department's programs at all levels. The Department's small faculty has serves as a Committee of the Whole for Curriculum, Advising, Graduate Programs, Assessment and Equipment. Hiring and Retention/Tenure/Promotion are governed by specific contract and University Policy and require committees formed of smaller groups of faculty The Department has elected representatives on the College curriculum committee, the Academic Council, and the College RTP committee, the Personnel Board. Additionally, the department has an elected representative on the University Faculty Senate, and has faculty on various other College and University committees.

Department faculty are responsible for maintaining and effectively delivering the curriculum. The faculty established Program Educational Objectives for the program that are evaluated periodically. All courses have well-articulated outcomes that are consistent with the program's student outcomes and Program Educational Objectives. Courses are usually developed and updated by individual faculty with direction and approval from the entire faculty. Each course has a coordinator with primary responsibility for ensuring the outcomes are met. Each faculty member is primarily associated with one area: thermal sciences, applied mechanics and design, manufacturing or materials science. All courses and curriculum modifications, including prerequisite changes, are initiated by the faculty, and approved by the Department. After approval by the Department faculty, course and curricular changes are sent to the College of Engineering and Computer Science Academic Council for evaluation and approval. After College level approval, course and curricular changes are sent to the University Curriculum Committee for evaluation and approval. After University Curriculum Committee approval, all course and curriculum changes are sent to the Faculty Senate for approval. After Senate approval the changes are official and are sent to the Provost's office. The Provost's office maintains the online resources that contain all this information. The schematic below summarizes the process of approval of curriculum related proposals before any proposal is incorporated into the University Catalog (Figure 6-1).

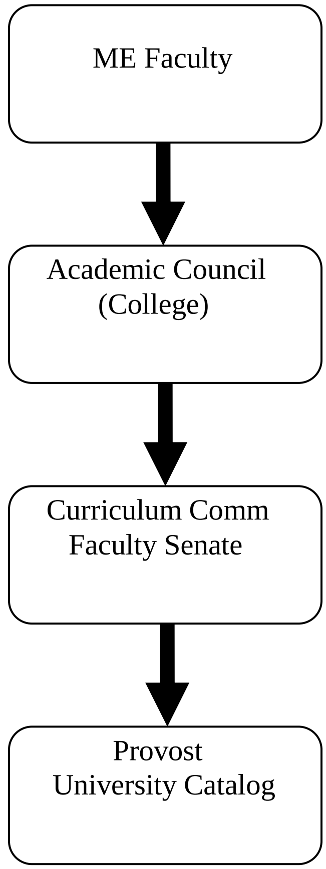

Figure 6-1 Course Approval Process

Consistency and quality are essential for all courses taught in the department. With the increase in student interest we offer multiple sections of courses. To ensure consistency, all instructors meet to discuss topics covered, evaluation techniques, texts selected, and student performance. Most other major courses are taught by several different faculty. The Mechanical Engineering faculty believe that every course is the responsibility of the entire faculty. Each course maps to particular student outcomes; and with our relatively small, involved faculty we have a good sense of how each of the courses is developing and how well it meets the Program Educational Objectives. All Mechanical Engineering faculty are dedicated to ensuring we deliver a high quality curriculum. The senior faculty are engaged in ensuring the newer faculty have opportunities to participate in professional development to ensure continuous improvement.

Table 6-1. Faculty Qualifications

Bachelor of Science in Mechanical Engineering

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment [2] T, TT, NTT	FT or PT [3]	Years of Experience: Govt./Ind. Practice	Years of Experience: Teaching	Years of Experience: This Institution	Professional Registration/ Certification	Level of Activity [4] H, M, or L: Professional Organizations	Level of Activity H, M, or L: Professional Development	Level of Activity H, M, or L: Consulting/summer work in industry
Robin Bandy	Ph.D.	P	T/	PT	7	30	30		L	L	L
Estelle Eke	Ph.D.	P	T	FT	3	26	25		M	M	L
Jose Granda	Ph.D.	P	T	FT	9	32	32		L	M	M
Sue Holl	Ph.D.	P	T	FT	3	35	35		M	M	L
Pat Homen	Ph.D. (expected 2018)	A	NTT	FT	25	14	14		L	L	M
Aki Kumagai	Ph.D.	P	T	FT	6	19	15		M	M	L
Tom Liu	Ph.D.	P	T	PT	3	39	28	Taiwan	M	H	M
Tim Marbach	Ph.D.	P	T	FT	1	10	10		M	M	L
Marcus Romani	M.S.	A	NTT	FT				CA			
Ken Sprott	Ph.D.	P	T	FT	10	12	12		L	M	M
Yong Suh	Ph.D.	ASC	T	FT	8	11	11		L	M	L
Ray Tang	Ph.D.	A	NTT	PT							
Troy Topping	Ph.D.	AST	TT	FT	1	11	11		M	H	M
Ilhan Tuzcu	Ph.D.	ASC	T	FT	2	11	7		L	M	L
Rustin Vogt	Ph.D.	AST	TT	FT	1	9	9		M	H	M
Dongmei Zhou	Ph.D.	ASC	T	FT	0	17	10		M	M	L

Instructions: Complete table for each member of the faculty in the program. Add additional rows or use additional sheets if necessary. Updated information is to be provided at the time of the visit.

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: TT = Tenure Track T = Tenured NTT = Non Tenure Track
3. At the institution
4. The level of activity, high, medium or low, should reflect an average over the year prior to the visit plus the two previous years.

Table 6-2. Faculty Workload Summary

Bachelor of Science in Mechanical Engineering

Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	Research or Scholarship	Other[4]	
Robin Bandy	FERP (PT)	Spring 2015: Engr 110W/1.3; ME 180/2; ME 180/2; ME 184/3; ME 186/3	90		10	100
Estelle Eke	FT	Fall 2014: Engr 110/3; Engr 110/3; ME 105/2; ME 105L/2; ME 172/3 Spring 2014:Engr 110/3; ME 105/2; ME 105L/2; ME 172/3	70	10	20	100
Jose Granda	FT	Fall 2014: ME 171/3; ME 171/3; ME 196A/2; ME 196AL/2; ME 278/3 Spring 2015: ME 171/3; ME 172/3; ME 172/3; ME 241/3	70	10	20	100
Sue Holl	FT				100	100
Pat Homen	FT	Fall 2014: Engr 1A/2;Engr 1AL/2; Engr 45/2; ME 108/2; ME 180/2; ME 180/2 Spring 2015: Engr 45/2; ME 108/2;ME 108/2; ME 180L/2; ME180L/2; ME 180l/2	80		20	100
Aki Kumagai	FT	Fall 2014: ME 37/2; ME 37/2; ME 37L/2; ME 37L/2; ME 136/3 Spring 2015:ME 138/3; ME 138/3; ME 236/3;ME 236/3	70	10	20	100
Tien-I Tom Liu	FERP (PT)	Fall 2014: ME 137/3; ME 138/3; ME 138/3; ME 238/3	90	10		100
Tim Marbach	FT	Fall 2014: Engr 124/3; Engr 124/3; ME 122/2; ME 128/2; ME 128L/2 Spring 2015: Engr 124/3; Engr 124/3; ME 124W/1.3; ME 128/2; ME 128L/2	70	10	20	100

Marcus Romani	FT	Fall 2014: Engr 124/3; Engr 124/3; ME 128L/2; ME 156/3; ME 156/3 Spring 2015: Engr 124/3; Engr 124/3; ME 121/2; ME 128L/2; ME 128L/2; ME 159/3	100			100
Ken Sprott	FT	Fall 2014: ME 116/2; ME 116/2; ME 117/2; ME 117/2; ME 209/2 Spring 2015: ME 116/2; ME 116/2; ME 117/2; ME 117/2; ME 141/2	70	10	20	100
Yong Suh	FT	Fall 2014: Engr 6/2; Engr 6/2; Engr 6L/2; Engr 6L/2; ME 176/3 Spring 2015: Engr 6/2; Engr 6/2; Engr 6L/2; Engr 6L/2; ME 171/3; ME 177/3	70	10	20	100
Ray (Hong-Yue) Tang	PT	Fall 2014: Engr 6/2; Engr 6L/2; ME 172/3; ME 191L/2 Spring 2015: ME 37L/2; ME 37L/2; ME 37L/2; ME 172/3; ME 191L/2; ME 191L/2	100			100
Troy Topping	FT	Fall 2014: Engr 45/2; Engr 45L/2; Engr 45L/2; Engr 45W/1.3; ME 296R/3 Spring 2015: Engr 45/2; Engr 45L/2; Engr 45L/2; Engr 45W/1.3; ME 296R/3	60	20	20	100
Ilhan Tuzcu	FT	Fall 2014: Engr 45/2; Engr 45L/2; ME 180L/2; ME 180L/2; ME 180L/2 Spring 2015: sabbatical	70	10	20	100
Rustin Vogt	FT	Fall 2014: ME 190/2; ME 190L/2; ME 190L/2; ME 191/1; ME 191L/2; ME 191L/2 Spring 2015: ME 37/2; ME 190/2; ME 190L/2; ME 190L/2; ME 191/1	60	20	20	100
Dongmei Zhou	FT	Fall 2014: ME 126/3; ME 126/3; ME 259/3 Spring 2015: ME 126/3; ME 126/3; ME 253/3	70	10	20	100

1. *FT = Full Time Faculty or PT = Part Time Faculty, at the institution*
2. *For the academic year for which the Self-Study Report is being prepared.*
3. *Program activity distribution should be in percent of effort in the program and should total 100%.*
4. *Indicate sabbatical leave, etc., under "Other."*
5. *Out of the total time employed at the institution.*

CRITERION 7. FACILITIES

A. *Offices, Classrooms and Laboratories*

Summarize each of the program's facilities in terms of their ability to support the attainment of the student outcomes and to provide an atmosphere conducive to learning.

1. *Offices (such as administrative, faculty, clerical, and teaching assistants) and any associated equipment that is typically available there.*
2. *Classrooms and associated equipment that are typically available where the program courses are taught.*
3. *Laboratory facilities including those containing computers (describe available hardware and software) and the associated tools and equipment that support instruction. Include those facilities used by students in the program even if they are not dedicated to the program and state the times they are available to students. Complete Appendix C containing a listing of the major pieces of equipment used by the program in support of instruction.*

Offices

The Department of Mechanical Engineering is housed in Riverside Hall and conducts much of its activities in Riverside Hall and the adjacent Santa Clara Hall. All faculty offices are on the fourth and fifth floor of Riverside Hall, close to the fourth floor Department office; proximity is useful and promotes faculty collaboration. Each faculty member has his or her own office. The Department office houses the mailroom, workroom, space for administrative support and the Department Chair's office.

Classrooms

Most classrooms on campus are equipped with projectors and computer connections. Our lecture courses are scheduled wherever we can locate an adequate room on campus. The classrooms vary in size and quality. All lab courses are scheduled in the Mechanical Engineering lab facilities in Santa Clara Hall or Riverside Hall. Courses that have a significant computer component are scheduled into rooms with workstations for each student. These rooms are located in Riverside Hall (RVR), Santa Clara Hall (SCL), and the Academic Information Resource Center (AIRC)

Laboratories

The laboratory facilities that support our instructional program cover four main areas: applied mechanics and design, energy conversion and thermal systems, manufacturing, and materials science (Figure 7-1). These laboratories are housed in Riverside Hall and Santa Clara Hall.

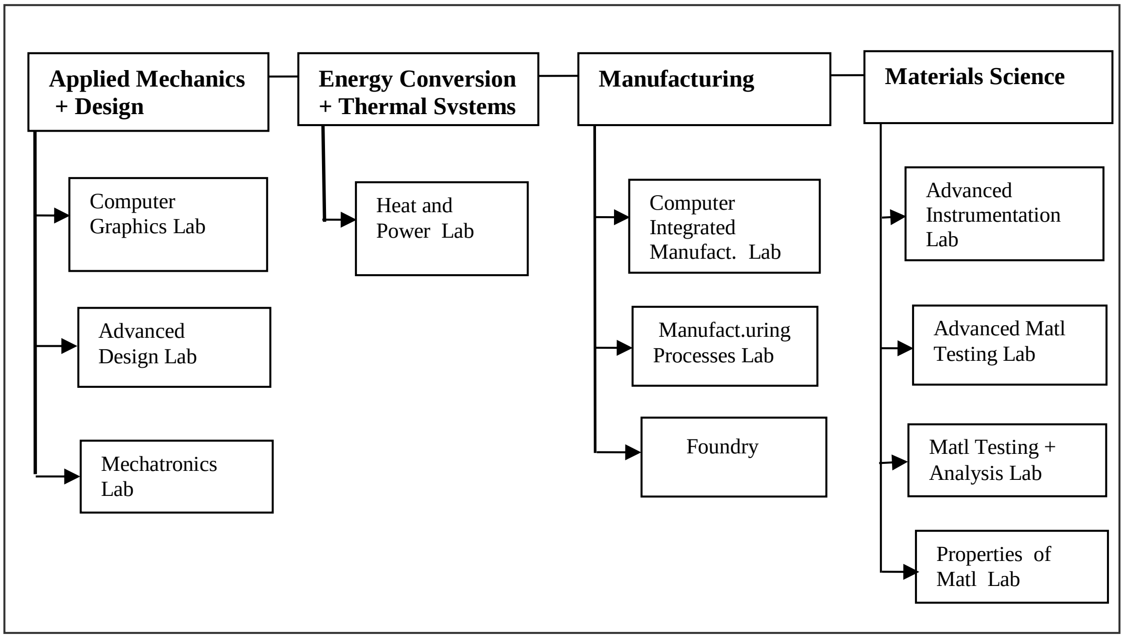

Figure 7-1 Four Main Areas and Labs in Mechanical Engineering

Manufacturing

The advanced manufacturing facility in SCL houses a Sankyo robot, two CNC machines, a Mori Seiki Machining Center and a Mori Seiki Lathe. The Student Machine Shop in SCL 1329 is furnished with standard manufacturing tools and a three axis Knee milling machine. Students learn the fundamentals of manufacturing processes during their first year using these tools. The shop is maintained by the College Mechanical Shop Technicians.

Applied Mechanics and Design

During summer 2015, the workstations in the Advanced Design lab, RVR 4001, were upgraded. The computer graphics lab, SCL 1218, had 40 new workstations installed in 2012. A mechatronics and automation lab was created in SCL 1349B in 2004 and was upgraded in 2009 with new data acquisition equipment.

Thermal Sciences

The Energy lab, SCL 1357, has received over $100K worth equipment donated by alumni and industry. These include a new 24 in by 24 in wind tunnel with variable frequency drive (vfd), lift and drag measurement apparatus, propeller anemometer and National Instruments data acquisition system. The laboratory has also been upgraded with a fluid flow test apparatus which includes a centrifugal pump (vfd), magnetic flow meter, actuated control valve, valve manifold (butterfly, gate and globe valves), flow meter manifold (orifice plate, turbine and votex shedding flow meters) and a National Instruments data acquisition system.

Materials Science

SCL 1349 has two Tinius-Olsen hydraulically controlled Universal Testing Machines. In 2003 one of these was upgraded to use a computer controlled operating system. The SATEC Universal Testing Machine in RVR 1005 has an upgraded computer control and operating system installed in 2007. In 2007, eight computer workstations were added to the Materials Science teaching lab in RVR 1003. The Scanning Electron Microscope imaging system in the Advanced Instrumentation lab in RVR 1007, was upgraded to a computer-based digital capture process. A back-scatter detector will be attached to the SEM in summer 2009.

Functional Laboratory Description

A comprehensive, though not exhaustive list, of our laboratory facilities and capabilities, including software, is presented in Table 7-1.
The departmental plan assigns faculty and labs to the four functional areas: Applied Mechanics and Design, Thermal Sciences, Manufacturing and Materials Science. The faculty are charged with monitoring the status of the laboratory facilities in their area.

Table 7-1 Mechanical Engineering Laboratories

Group	Laboratory	Location
Applied Mechanics and Design	Computer Graphics Lab	**SCL 1218**
	Advanced Design Lab	**RVR 4001**
	Mechatronics Lab	**SCL 1349 B**
Manufacturing	Computer Integrated Manufacturing Lab	**SCL 1327**
	Manufacturing Processes Lab	**SCL 1329**
	Foundry	**SCL 1349**
Materials Science	Advanced Instrumentation Lab	**RVR 1007**
	Material Testing and Analysis Lab	**RVR 1003**
	Advanced Materials Testing Lab	**RVR 1005**
	Properties of Material Lab	**SCL 1349**
Thermal Sciences	Heat and Power Lab	**SCL 1357**

B. Computing Resources

Describe any computing resources (workstations, servers, storage, networks including software) in addition to those described in the laboratories in Part A, which are used by the students in the program. Include a discussion of the accessibility of university-wide computing resources available to all students via various locations such as student housing, library, student union, off-campus, etc. State the hours the various computing facilities are open to students. Assess the adequacy of these facilities to support the scholarly and professional activities of the students and faculty in the program.

All faculty have at least one computer provided by the College. Faculty computers are "re-freshed" every four years. Also, faculty members who participate in the University's Summer Institute receive a laptop or iPad and software to support their use to increase teaching effectiveness. There are two open computer labs, equipped and maintained by the College, available to students and faculty. The equipment and facilities in Riverside

Hall and Santa Clara Hall are maintained and operated by the College. Technical support is available to all faculty and students through the College Computing and Communications staff. There are five full-time staff which are augmented by several student assistants each term.

The Department has two instructional computer labs, RVR 4001 and SCL 1218. RVR 4001 was recently equipped with 36 student workstations and SCL 1218 has 40 student work stations. In addition, the Academic Information Resource Center, has two classrooms with 30 workstations in which the Department schedules classes. Computer labs and computing hardware are maintained by the ECS Computing and Communications Services group, located in Riverside Hall. This group maintains hardware and software and coordinates software resources and upgrades for the department and College. The Computing and Communications Services group is responsible for installing software on servers, laboratory computers, and faculty and staff computers.
The University maintains the wireless network throughout the campus and also maintains open computing labs outside Riverside Hall and Santa Clara Hall. The University's Media Services works in conjunction with our department to ensure that all multi-media equipment is well maintained.

The Mechanical Engineering Department has always devoted a substantial portion of its equipment budget to the acquisition, maintenance and upgrading of software tools. Whenever possible resources are combined with others in the College to maximize the opportunities for software acquisition.

C. Guidance

Describe how students in the program are provided appropriate guidance regarding the use of the tools, equipment, computing resources, and laboratories.

Developing appropriately professional behavior and safety is essential to a working engineer. We ensure our students develop these skills by emphasizing responsibility in all situations. The computer labs are available to students outside of class time after they apply for an electronic key fob which provides access. Food and drink are not allowed in computer labs. The students are mindful that if the lab equipment is damaged there are not funds to replace it.

Safety in practice and design is introduced in the first year ME 37 – Manufacturing Processes course. It is reinforced in the sophomore level Engr 45 – Engineering Materials course. Students must have safety instruction and pass a safety quiz to progress in these courses. Additional safety training is required of all students as they begin the Senior Project sequence. All students working on projects for clubs or other courses must pass a safety course before they are allowed to work in the Student Shop.

D. Maintenance and Upgrading of Facilities

Describe the policies and procedures for maintaining and upgrading the tools, equipment, computing resources, and laboratories used by students and faculty in the program.

Laboratory Equipment: Upgrades, Planning, and Maintenance

Our Department has attempted to follow a continuous improvement program for our laboratory facilities utilizing resources to maintain our equipment and upgrade when possible. The Department has a five year lab improvement plan that is updated annually. During times when University and College resources are not available the Department continues to pursue laboratory improvement through acquisition of donated equipment. The Department's IAC has laboratory upgrades as a goal. Various equipment funding plans are being developed.

Maintenance of lab facilities is routinely conducted by the Mechanical Tech shop personnel. There is one full time technicians assigned to Mechanical Engineering and several student assistants each term. They maintain the operational safety of all equipment and notify the department when repairs are needed.

Physical Facilities/Financial Resources

The laboratory facilities used in the Mechanical Engineering Department instructional program support four subject areas: graphics and design, materials science, manufacturing, and thermal sciences. Appendix C provides the details for each laboratory.

E. Library Services

Describe and evaluate the capability of the library (or libraries) to serve the program including the adequacy of the library's technical collection relative to the needs of the program and the faculty, the adequacy of the process by which faculty may request the library to order books or subscriptions, the library's systems for locating and obtaining electronic information, and any other library services relevant to the needs of the program.

Library, Information Technology, and Computers

The University Library holds over one million volumes, thousands of maps, slides and pamphlets, and several million pieces of microforms and non-print media as well as subscriptions to some 3,000 magazines, technical and scholarly journals, and newspapers. Extensive data bases linked to thousands of additional journals are available electronically. The Library is a depository for California State publications and for selected United States government materials. EUREKA (the Library catalog) and other databases are available via the internet.

Library Media Services, located on the first floor, provides individual listening and viewing facilities for media collections; the Library's slide and microform collections can also be found there, complete with reading and printing capabilities. The second floor houses the reference collection and service points, as well as the Curriculum Collection that contains materials related to elementary and secondary school instruction. Periodicals are located on the third floor.

The Department of Special Collections and University Archives collects materials from California State University, Sacramento as well as items documenting the social, cultural, economic and political history of the Sacramento region. High-use materials are kept on reserve or offered electronically. Other special Library facilities and services include a map area, group study rooms, a Graduate Studies Reading Area, and a computer lab for student use. Self-service copiers are available on each floor.

Library orientation tours are conducted at regular intervals during the initial weeks of each semester. The reference librarians also offer subject-oriented sessions and other forms of library instruction. Hands-on sessions on database searching and searching the internet, and an array of subject-based classes are scheduled in the Library Instruction Labs.

Journal articles, books, conference proceedings and standards not owned or currently subscribed to by the Library can be acquired by the CSUS scholarly community through interlibrary loan, usually provided without fee to students, faculty and staff.

Three Librarians have in-depth knowledge and experience with engineering research. One Librarian is dedicated to the Mechanical Engineering department; a second Librarian supports Civil and Electrical Engineering; while a third Librarian focuses on Computer Science and Engineering. The Reference Desk is located on the 2nd floor and is serviced by professional librarians as well as staff and students for 72.5 hours per week.

The Library has one smart classroom dedicated to Research Instruction with 30 computers as well as a Computer Lab open to CSUS Students. Currently, there are 88 computers in the Library at large dedicated to serving the CSUS scholarly community (stations with Saclink login required) along with 21 public computers. The Library also has 70 laptops that can be checked out for use on campus, as well as 20 tablets (10 iPads and 10 Surface Pros).

A new, very popular service the Library began offering this past year is an online reservation system for group study rooms. The Library has 14 group study rooms, which can be used by individuals if groups do not have a demand. The study rooms seat 4-8 people and have Wi-Fi access. Select rooms have dry erase boards and flat screens for laptop display.

Mechanical Engineering Collection

To support CSUS's Mechanical Engineering department, the library has a substantial collection of books (some of which are available in electronic format) as well as journals, databases, and reference materials. The primary database for engineering research is Engineering Village. Indexing extends from 1970 to the present and includes peer-reviewed journal articles, conference proceedings, trade publications, and some dissertations.

- In 2012, 2,955 searches were conducted in Engineering Village in 1,229 individual sessions.
- In 2013, 3,538 searches were conducted in Engineering Village in 1,339 individual sessions.
- In 2014, 2857 searches were conducted in 904 individual sessions. (Statistics were reported somewhat differently by the vendor in 2014, however, so it is not certain that the number of searches or sessions actually declined).

The databases IEEE Xplore and Science Direct are also used by engineering students and faculty, including those in the Mechanical Engineering department. The Library's subscription to IEEE XPLORE provides the CSUS scholarly community with full text access to transactions, journals, standards, and magazines published by the IEEE from 1998 to the present. It also provides full text access to IEEE-Wiley books from 1974-2011 and indexing to the IEL from 1872 to the present.

- In 2012, 3401 full text journal articles were accessed through IEEE XPLORE.
- In 2013, the number of full text articles accessed was 3286.
- In 2014, the number increased to 5152.

CSUS students can now access digital dissertations, theses, and Master's projects published after 2010 through ScholarWorks – an institutional repository. Many CSUS dissertations, theses, and projects published before 2010 can be found in print in the Library.

The LibGuide for Mechanical Engineering Research, tailored for CSUS students, has some of the highest usages of all the CSUS LibGuides.

- In 2012, the LibGuide was accessed 917 times.
- In 2013, it was accessed 1, 228 times.
- In 2014, it was accessed 790 times.

Other LibGuides have been created with focuses on research in Electrical and Electronics Engineering, Civil Engineering, Energy Systems, and Alternative Energy sources, which also benefits Mechanical Engineering students.

F. Overall Comments on Facilities

Describe how the program ensures the facilities, tools, and equipment used in the program are safe for their intended purposes (See the 2015-2016 APPM II.G.6.b.(1)).

The laboratory facilities used in the Mechanical Engineering Department instructional program support four subject areas: graphics and computer-aided design, materials science, manufacturing, and thermal-fluid systems. Appendix C provides the details for each laboratory.

In general, the funding provided by the University for maintenance and updating of the laboratory facilities falls far short of what is needed. This is a particularly serious concern because the department must maintain both experimental and computer laboratories.

CRITERION 8. INSTITUTIONAL SUPPORT

A. Leadership

Describe the leadership of the program and discuss its adequacy to ensure the quality and continuity of the program and how the leadership is involved in decisions that affect the program.

The program is housed in the Mechanical Engineering Department, which is one of 5 academic departments in the College of Engineering and Computer Science. The Department has the following administrative structure: a department chair, an associate chair, and a graduate coordinator.

The University Manual describes the role and responsibilities of the department chair as follows:

> An academic department chair is a teaching faculty member of that department, and as such has all the rights and responsibilities of a faculty member. In addition, the primary function of the chair is to carry out the business of his/her academic department. He/she is responsible for communicating the department's needs to the college or University administration. He/she is also responsible for communicating University and college policies and administrative procedures to the department faculty and staff.
>
> The academic department chair is responsible for discharging the following duties in accordance with the established policies and procedures of the department, college, University and the CSU System.
>
> - Supervise the recruiting of faculty and staff in accordance with the department's programmatic needs and in keeping with the mandate of Affirmative Action.
> - Supervise the evaluation of department faculty and staff as required by departmental personnel procedures.
> - Foster an environment in which faculty development is encouraged and supported within the goals and objectives of the department, college and University.
> - Encourage currency and improvement in the quality of the department's curriculum.
> - Coordinate departmental student advising efforts.
> - Coordinate the departmental workload assignment of faculty and staff.
> - Prepare and present the department's budget to college authorities as appropriate. The chair is responsible for administration of departmental resources.
> - Ensure that the instructional schedules of the department are submitted as required and modified as needed.
> - Coordinate the work of departmental committees and serve on college or University committees.
> - Ensure that a department process for dealing with student grievances is implemented in accordance with general University and system procedures.
> - Facilitate the instructional support operations of the department to ensure effective use of clerical service, proper space allocations, adequate supplies, etc.
> - Perform other duties as specified by the dean and/or other University administrators and carry out assigned duties in accordance with University policy.

In addition to the above responsibilities as outlined by the University, the Chair of the Department of Mechanical Engineering leads in efforts to:

- Connect the Department to the professional community by attending professional meetings, community events, and participating in committees.
- Coordinating the efforts of the Industrial Action Committee to ensure maximum benefit for the Department..
- Serving on Department level committees: 1) search committee, 2) retention, tenure, and promotion (RTP), and 3) curriculum committee.
- Managing all personnel matter within the department.
- Serving on the Executive College Committee (Department chairs, Dean, and Associated Dean).
- Raising funds for scholarships and other activities for the Department.

The Department Chair is described by the University Policy Manual as:

An academic department chair is a teaching faculty member of that department, and as such has all the rights and responsibilities of a faculty member. In addition, the primary function of the chair is to carry out the business of his/her academic department. He/she is responsible for communicating the department's needs to the school or University administration. He/she is also responsible for communicating University and school policies and administrative procedures to the department faculty and staff.

The department chair's responsibilities are numerous as a first level administrator within an academic unit. However, because the chair is still classified as a faculty (part of a bargaining unit), s/he has very limited authority.

The department chair consults with the department faculty in making administrative decisions regarding such matters as workload, scheduling, curriculum, and budget. The department chair consults periodically with department faculty, other department chairs with whom he/she interacts, and the school dean regarding pertinent aspects of departmental administration. After careful consideration of faculty concerns and thoughts on these administrative matters, and consultation as needed, the department chair has the authority to make timely decisions to accomplish the administration of the department. Faculty have the right to appeal or request review of any administrative decisions affecting them.

Only full-time probationary or tenured faculty are eligible to serve as department chairs. Department chairs are recommended to the Dean by the faculty who forwards the recommendation to the Provost and President. The Department recommendation is determined by secret ballot by a majority vote in an election in which all tenured and probationary faculty members of the department, including those on the Faculty Early Retirement Program, and those on leave, are eligible to vote. The term for the Mechanical Engineering Department chair is three years.

The chair reports to the Dean of the College, Dr. Lorenzo Smith. The chair is the principle leader of the department and makes all curricular, scheduling, expenditure decisions in consultation with the department faculty and the Dean. The department chair is a member of the college executive committee that consists of the chairs of the five departments in the college, the Dean, and the Associate Dean. This committee meets regularly to discuss issues and planning related to the administration of the various programs. This organization has served the department and its programs well and has ensured stability and continuity.

B. Program Budget and Financial Support

B-1. Budget process

Describe the process used to establish the program's budget and provide evidence of continuity of institutional support for the program. Include the sources of financial support including both permanent (recurring) and temporary (one-time) funds.

At the university level, the annual general fund or baseline budget for the College of Engineering and Computer Science is determined each year by the Provost based on the budget of the previous year. Additions or deletions associated with incremental increases or decreases are based on estimates of needs and costs by Academic Affairs. The General Fund budget categories are faculty, department chairs, management and staff, operating expense, and equipment. In addition, the college and each department have a general trust fund which are funded by gifts and donations and are used to support needs of the programs supplemental to the general fund budget.

Each year the college budget is primarily divided across the departments on the basis of the cost for faculty and staff salaries with funds for operations to programs based on an incremental number across programs with additional funds for one time operation costs

B-2. Support of Teaching

Describe how teaching is supported by the institution in terms of graders, teaching assistants, teaching workshops, etc.

The college allocates funds for student graders and tutors for each program. Tutors are also provided through the university Faculty Student Mentor Program. In addition, the university offers teaching improvement support services for faculty through the Center for Teaching and Learning.

B-3. Infrastructure, Facilities, and Equipment Funding

To the extent not described above, describe how resources are provided to acquire, maintain, and upgrade the infrastructures, facilities, and equipment used in the program.

The college equipment money has traditionally been allocated annually by the Provost using end-of-the-year money. This past year (AY2013-2014) the college equipment funds were reduced from an average of $370,000 per year for the previous 3 years to $137,000 (see table 8.1). For 2014-2015, the college has only been allocated $21,000 to date for new or replacement equipment.

Table 8-1 Five Year College and Department Equipment Funding

Academic Year	College Allocation	Department Allocation
2009-2010	$416,972	$70,000
2010-2011	$399,080	$80,000
2011-2012	$397,069	$79,000
2012-2013	$321,991	$41,000
2013-2014	$137,277	$8,200
2014-2015	$164,011	$34,000
Average	**$306,067**	**$52,033**

The College of Engineering and Computer Science maintains an IT support staff (Computing and Communications Services) and a tech shop in support of facilities and equipment within the overall baseline budget allocation. The Computing and Communications Services personnel maintain all shared college computer facilities, all departmental faculty computers and laboratory equipment and provides software support to the department. In the past, the strong support provided by the university and the college has allowed the department to maintain state-of-the art equipment for faculty and student labs. However, if the level of equipment support since the AY 2013-2014 is continues the ability to maintain the current high quality of instruction would become problematic.

At the campus level, the Informational Resources and Technology division provides central support for campus level laboratories and IT needs.

B-4. Adequacy of Resources to Attain Student Outcomes

Assess the adequacy of the resources described in this section with respect to the students in the program being able to attain the student outcomes.

As stated previously, the majority of the program budget is derived from the allocation from the College of Engineering and Computer Science, which receives its budget from the university and which in turn receives funding from the state. The current level of support has allowed the department to maintain high quality programs. Since the state budget is closely tied to the economic health of the state and recent comments by the governor portray a growing economy one may hope that it bodes well of the future. However, areas of particular concern are lack of response to request to hire tenure-track faculty and the recent drastic cut in equipment funding from the university as indicated in Table 8-1. If this current level of support does not improve the ability of the department to maintain the high quality of its programs may be jeopardized.

C. Staffing

Describe the adequacy of the staff (administrative, instructional, and technical) and institutional services provided to the program. Discuss methods used to retain and train staff.

The Mechanical Engineering undergraduate and graduate programs are supported by one administrative support coordinator who is responsible for departmental activities including answering phones and drop in inquiries; student questions and student files; entering schedules into the registration system; travel and purchase requests; hiring student assistants; and departmental correspondence. In addition, the Mechanical Engineering department currently employs one full-time administrative support assistant shared with the Civil Engineering Department. In addition the department also hires a part-time student assistant to assist with office tasks.

The College of Engineering and Computer Science maintains an IT support staff (Computing and Communications Services) in support of facilities and equipment. The Computing and Communications Services personnel maintain all departments and college computers and software as well as all computer labs. The support provided has been sufficient to date.

D. Faculty Hiring and Retention

D-1. Process for Faculty Hiring

Describe the process for hiring of new faculty.

Departments submit an annual hiring plan to the dean and these are compiled and submitted to the Provost for approval. Once the positions have been approved the department starts the recruitment process. All vacancy announcements, selection criteria, reference-check questions and interview questions are reviewed and approved by the department, the ECS Dean and the campus human resources administrator. A faculty search is initiated, advertisements are posted and the applicant pool is reviewed by the Dean to determine its adequacy. Subsequently, a list of candidates for reference-check is submitted to the Dean for approval. Finalists are then identified by the committee and invited to campus for interviews. Once the interviews for a position have been completed the committee establishes a list of candidates to be submitted to the department at large. The department faculty members who have attended the interviews for all the candidates for a given faculty position then vote on a ranking of the candidates to be offered the position. Details of the process are described in Table 8-1.

D-2. Strategies for Faculty Retention

Describe strategies used to retain current qualified faculty.

The department has a long history of being a place where faculty members spend most of their career. Many recent retirees have served over thirty years and many current senior faculty were hired in the eighties. There are a number of factors that contribute to the attractiveness and stability of the program:

- A department atmosphere, which has always been collegial. Although there might be occasional differences of opinions the faculty has always been able to come to some agreement when making important decisions.

- Sabbaticals and difference-in-pay leave programs which makes leaves available every six years. Since spring 2009, three of all eligible full-time faculty members have taken sabbatical leaves and two more have been approved for the coming academic year.
- Benefit packages that are competitive. The Public Employees Retirement System, Cal PERS, is viewed by many as one of the best pension system in the country.
- Recognition of scholarly activities at all levels, departmental, college, and university.
- A desirable geographical location with a variety of professional opportunities in the community.
- Opportunities to collaborate with state departments and agencies (e.g., California DoE, DMV, Department of Water Resources, Caltrans, Air Resources Board, etc.) primarily located in the state capital.
- Ability to interact with many industry leaders: Intel, HP, Northrop Grumman, Lawrence Livermore National Lab, VSP, Aerojet/Rocketdyne, DMG-Mori, Siemens, and many others.

E. Support of Faculty Professional Development

Describe the adequacy of support for faculty professional development, how such activities such as sabbaticals, travel, workshops, seminars, etc., are planned and supported.

Professional development funds have been limited in recent years as has university allocated travel funding for the Department. Recognizing the importance of professional development, the department and the college have supplemented the university allocation with additional funding using non-state resources. In particular the new dean has instituted two programs for faculty development:

- Matching funds for the President UEI Faculty Grant Program (see below).
- Federal Grant Proposal Awards – 3 units of release time or equivalent seed money to develop a research grant proposal.

Opportunities for funding of faculty development at the university and system levels include:

- *Research and Creative Activity Grants* – These grants are designed as a startup funding for faculty scholarly activities. The funding could be up to 6 WTUs (two classes), two months summer salary, and $2500 (for travel and other expenses).
- *Pedagogy Enhancement Award* – This award is design to fund improvement of teaching related activities. The funding is 3 WTUs (1 class release time) and $500 (for travel and other expenses).
- *President's UEI (University Enterprises Inc.) Faculty Grant Program* – This grant program funds faculty development and is available to faculty from the President's Office. The funding is competitive and could be up to $2,000 per faculty.
- *University Incentive Travel Fund* **-** The University Faculty Travel program has been revised and an increased allocation of funds has been distributed directly to the colleges in support of faculty travel and scholarly development. This travel fund is generated from the research incentive funds.
- *Probationary Faculty Development Grant Award* – This program reduces the teaching load for newly hired faculty by one class (3 WTU) for the first two years and $500. This allows new faculty to develop their teaching and research.
- *Provost Faculty Summer Research Incentive Program* – This program provides $5000 for faculty to develop a research grant proposal or write a conference paper.

- *New faculty Research Startup Funding* – This recent program provides all newly hired assistant professors with $10,000 to establish their research.
- *CSUPERB faculty travel grant* – This program from the CSU system Chancellor's office provides up to $1500 for travel expenses.

Table 8-1 Flow Process for Recruitment and Appointment of Full-Time Faculty

I.	***Authorization***	*College process for requesting approval of full-time positions*	*Meeting with College Dean to discuss recruitment strategies*	*Department forwards recruitment package to Dean for review and approval*	*Dean's office sends electronic copy of vacancy announcement to HR for placement on website*	*Department places journal ads*	
II.	***Recruitment***	*College-wide meeting to discuss recruitment process*	*Department conducts recruitment activities (networking, conferences, etc…)*	*Department mails acknowledgement letters and applicant flow questionnaires*	*Department develops selection criteria, interview questions, and reference check questions*	*Sent to Director of EO/AA for review*	*Dean determines the adequacy of applicant pool and whether to proceed, extend or cancel search*
III.	***Screening***	*Paper screening to recommend candidates for reference checking*	*Dean determines the adequacy of the pool and whether to proceed, extend or cancel search*	*Committee checks references of selected applicants*			
IV.	***Interviewing***	*Selection of interviewees*	*Dean determines the adequacy of the interview pool, and whether to proceed, extend or cancel search*	*Interviews conducted*			
V.	***Offer***	*Select and recommend candidate for appointment and prepare Process Summary*	*Forward appointment package with recommendation to Dean*	*Decision by Dean to proceed with the recommendation*	*Appointment package reviewed by HR, including Director of EO/AA*	*Appointment package, recommendation and letter reviewed and approved by Provost and Vice President for Academic Affairs*	

PROGRAM CRITERIA

Describe how the program satisfies any applicable program criteria. If already covered elsewhere in the self-study report, provide appropriate references.

The ABET program criteria for Mechanical Engineering are Curriculum and Faculty.

A. Curriculum

The Mechanical Engineering objectives and learning outcomes are designed to ensure that our graduates demonstrate the abilities described. The objectives are discussed in CRITERION 2 and the learning outcomes are discussed in CRITERION 3. The relationship between the outcomes and the curriculum is also discussed in CRITERION 3. A complete description of the components of the curriculum is presented in CRITERION 5.

B. Faculty

The core competencies of the Mechanical Engineering Faculty are documented in CRITERION 6. The professional development activities of the faculty are also documented in CRITERION 6. The support for future faculty development activities is documented in CRITERION 8.

Appendix A – Course Syllabi

Please use the following format for the course syllabi (2 pages maximum in Times New Roman 12 point font)

1. *Course number and name*

2. *Credits and contact hours*

3. *Instructor's or course coordinator's name*

4. *Text book, title, author, and year*
   a. *other supplemental materials*

5. *Specific course information*
   a. *brief description of the content of the course (catalog description)*
   b. *prerequisites or co-requisites*
   c. *indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program*

6. *Specific goals for the course*
   a. *specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.*
   b. *explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.*

7. *Brief list of topics to be covered*

1. Course number and name: **Chem 1E – General Chemistry for Engineers**

2. Credits and contact hours: 4 units (180 min/week lecture, 180 min/week laboratory)

3. Instructor's or course coordinator's name: Dr. Susan Crawford

4. Textbook, title, author, and year: Mannering, F., and S. Washburn (2013). *Principles of Highway Engineering and Traffic Analysis, Fifth Edition,* John Wiley & Sons.
   Other supplemental materials: None.

5. Specific course information
   a. Course Description (Catalog Description) – A one-semester chemistry course for engineering students covering the fundamental principles and concepts of chemistry important to engineering applications. Lecture topics include atomic and molecular structure, solution chemistry, equilibrium, oxidation-reduction, thermochemistry; intermolecular forces; electrochemistry; radiochemistry; polymers; metallic bonding and alloys; chemical diffusion and kinetics.
   b. Prerequisites or Co-requisites - High school chemistry; MATH 30 or eligibility to take MATH 30 as evidenced by the calculus readiness diagnostic exam; passing score on a standardized Chemistry diagnostic exam given prior to each semester, or minimum grade of "C" in CHEM 4.
   c. Course Designation - Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Specific Course Learning Outcomes:
1. Molecular and chemical nomenclature
2. Identification and writing of basic chemical reactions
3. Dimensional Analysis and Significant figure calculations
4. Atomic and molecular structure
5. Chemical calculations involving quantitative measures
6. Behavior of gasses, liquids, and solids
7. Energetic and kinetic properties of chemical systems
8. Equilibrium and phase changes
9. Electrochemistry and corrosion
10. Basis of a selection of chemical analytical techniques

7. Brief List of Topics to be Covered
    a. Problem solving, units, models, numbers, density (1 class)
    b. Atoms and Molecules: atoms, isotopes, ions, compounds, bonding, nomenclature, moles (2 classes)
    c. Chemical equations (2 class)
    d. Stoichiometry, limiting reactants, Solubility rules and types of reactions in solution: net ionic equations (1 class)
    e. Solution Reactions Gas Laws & the Ideal Gas Law (1 class)
    f. Mixtures of gasses, gas stoichiometry & kinetic molecular theory (1 class)
    g. Atomic structure, electron configuration, the periodic table, ionization energy, electron affinity, bonding and molecules, electronegativity, polarity, Lewis structures, Molecules, materials, intermolecular forces, phase diagrams, bonding in solids (1 class)
    h. Intermolecular Forces and Thermochemistry (2 classes)
    i. Entropy and the second law, spontaneity and Gibb's free energy Kinetics (1 class)
    j. Kinetics and Equilibrium (3 classes)
    k. Electrochemistry (2 classes)

1. Course number and name: **MATH 30 – Calculus I**

2. Credits and contact hours: 4 units (200 min/week lecture)

3. Instructor's or course coordinator's name: David Zeigler

4. Textbook, title, author, and year: *Calculus - Early Transcendental (7th ed)* by James Stewart
   Other supplemental materials: None.

5. Specific course information
   a. Course Description (Catalog Description) - Functions and their graphs; limits; the derivative and some of its applications; trigonometric and hyperbolic functions and their inverses; the integral; the fundamental theorem; some applications of the integral.
   b. Prerequisites or Co-requisites - MATH 29 (Pre-Calculus) or four years of high school mathematics which includes two years of algebra, one year of geometry, and one year of mathematical analysis; completion of ELM requirement and Pre-Calculus Diagnostic Test.
   c. Course Designation - Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Specific Course Learning Outcomes:

1. Understand the definition of the derivative; use the definition to find the derivative of simple functions, and interpret the definition geometrically and in a variety of applied contexts including instantaneous velocity.
2. Know the fundamental rules of differentiation including the chain rule and use these rules to compute the derivatives of polynomials, rational functions, exponential, logarithmic, and trigonometric functions.
3. Use the limits and the derivative to identify asymptotes, relative extrema, and inflection points of curves and apply these techniques to curve sketching.
4. Know the Mean Value Theorem and the Extreme Value Theorem and use these theorems to locate and find zeros of functions and to solve optimization problems.

7. Brief List of Topics to be Covered
   a. Concept of tangent line and limit (2 weeks)
   b. Differentiation (4 weeks)
   c. Transcendental functions (2 1/2 weeks)
   d. Mean value theorem and curve sketching (2 1/2 weeks)
   e. Integration (3 weeks)

1. Course number and name: **MATH 31 – Calculus II**

2. Credits and contact hours: 4 units (200 min/week lecture)

3. Instructor's or course coordinator's name: Lisa Taylor

4. Textbook, title, author, and year: *Calculus - Early Transcendental (7th ed)* by James Stewart
   Other supplemental materials: None.

5. Specific course information
   a. Course Description (Catalog Description) - MATH 30 (Calculus I) continuation. Methods of integration; improper integrals; analytic geometry; infinite sequences and series.
   b. Prerequisites or Co-requisites - MATH 30 (Calculus I) or appropriate high school based AP credit.
   c. Course Designation - Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Specific Course Learning Outcomes:
1. Understand the indefinite integral as the inverse of differentiation, know the basic rules and techniques of integration (including the method of substitution, integration by parts, and trigonometric substitutions), and use these rules to evaluate antiderivatives.
2. Extend the Riemann integral to improper integrals with unbounded functions and domains of integration.
3. Know the definition, graphs, derivatives and antiderivatives of the inverse trigonometric functions, hyperbolic functions and the inverse hyperbolic functions.
4. Know the definition for convergence and divergence of infinite sequences and series and apply these definitions to elementary sequences and to geometric and harmonic series.
5. Know the integral test, comparison test, ratio test, and alternating series test for convergence of infinite series and apply these tests to standard series.
6. Find the power series of a function, determine the radius of convergence and the interval of convergence (including end point convergence) of a power series, and determine the error term for a function and its power series.

7. Brief List of Topics to be Covered
   a. Applications of Integration (2½ weeks)
   b. Techniques of Integration (3½ weeks)
   c. Further Applications of Integration (1 week)
   d. Infinite Sequences and Series (6½ weeks)
   e. Parametric Equations and Polar Coordinates (1½ weeks)

1. Course number and name: **MATH 32 – Calculus III**

2. Credits and contact hours: 4 units (200 min/week lecture)

3. Instructor's or course coordinator's name: David Zeigler

4. Textbook, title, author, and year: *Calculus - Early Transcendental (7th ed)* by James Stewart
   Other supplemental materials: None.

5. Specific course information
   a. Course Description (Catalog Description) - Continuation of Math 31 (Calculus II). Algebra and calculus of vectors; functions of several variables; partial differentiation; multiple integration; vector analysis.
   b. Prerequisites or Co-requisites - MATH 31
   c. Course Designation - Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Specific Course Learning Outcomes:</u>

1. Understand and identify vectors in the plane and in three dimensional space.
2. Understand the dot product of two vectors including the cross product of two vectors, surfaces, and cylindrical and spherical coordinates in space.
3. Understand the concept of vector-valued function, differentiation and integration of vector-valued functions.
4. Understand functions of several variables, limits, continuity, partial derivatives, differentials, chain rules, directional derivatives gradients, tangent planes, normal lines and extrema of functions of two variables.
5. Calculate and understand iterated integrals, double integrals, triple integrals, triple integrals in cylindrical and spherical coordinates, and change of variables in multiple integrals.
6. Understand vector analysis, vector fields, line integrals, and Greens theorem. Conservative vector fields and independence path. Surface integrals, divergence theorem and Stokess theorem.
7. Solve application problems.

7. Brief List of Topics to be Covered
   a. Three-Dimensional Analytic Geometry & Vectors (3½ weeks)
   b. Differentiation of Functions of Several Variables (4 weeks)
   c. Multiple Integrals (3½ weeks)
   d. Vector Analysis (3 weeks)

1. Course number and name: **MATH 45 – Differential Equations**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Andras Domokos

4. Textbook, title, author, and year: A First Course in Differential Equations with Modeling Applications**,** Ninth Edition, by Dennis G. Zill
   Other supplemental materials: None.

5. Specific course information
   a. Course Description (Catalog Description) - First order differential equations, second order differential equations with constant coefficients. Laplace transforms, small systems of linear differential equations, numerical methods, introduction to second order differential equations with variable coefficients.
   b. Prerequisites or Co-requisites - MATH 30 (Calculus I).
   c. Course Designation - Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Specific Course Learning Outcomes:

1. ***Solve problems by thinking logically, making conjectures, and constructing valid mathematical arguments.***
2. Make valid inferences from numerical, graphical and symbolic information.
3. ***Apply mathematical reasoning to both abstract and applied problems, and to both scientific and non-scientific problems.***

7. Brief List of Topics to be Covered
   a. Introduction (1 week)
   b. First order differential equations (3 weeks)
   c. Higher order differential equations (3 weeks)
   d. Laplace transforms (3 weeks)
   e. Systems of differential equations (1 week)
   f. Applications (3 weeks)

1. Course number and name: **PHYS 11A – General Physics: Mechanics**

2. Credits and contact hours: 4 units (120 min/week lecture, 50 min/week discussion, 180 min/week laboratory)

3. Instructor's or course coordinator's name: Vera Margoniner

4. Textbook, title, author, and year: Physics for Scientists and Engineers: A Strategic Approach, Vol. 1 (Chs 1-15) (3rd Edition) by Randall Knight.
   Other supplemental materials: Subscription to pearsonmylabandmastering.com

5. Specific course information
   a. Course Description (Catalog Description) - PHYS 11A, 11B, 11C sequence is a three semester course in introductory physics requiring elementary calculus. This sequence satisfies the lower division physics requirement for a major in physics, physical science, chemistry, geology, or engineering.
   b. Prerequisites or Co-requisites - MATH 30 (Calculus I), MATH 31 (Calculus II); or equivalent certificated high school courses. MATH 31 (Calculus II) may be taken concurrently.
   c. Course Designation - Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Specific Course Learning Outcomes:

1. Analyze and predict the motion of simple objects *(motion in 1- and 2-dimensions; circular and rotational motion)*
2. Explain why objects change their motion *(forces)*
3. Analyze interactions between objects *(energy, work, momentum, and conservation laws)*
4. Recognize that our description of nature is connected to careful observation and reasoning *(lab work)*
5. Explain and apply core ideas and models concerning physical systems and mechanisms, citing critical observations, underlying assumptions and limitations.
6. Describe how scientists create explanations of natural phenomena based on systematic collection of empirical evidence subjected to rigorous testing and/or experimentation.
7. Access and evaluate scientific information, including interpreting tables, graphs, and equations.
8. Recognize evidence-based conclusions and form reasoned opinions about science related matters of personal, public and ethical concern.

7. Brief List of Topics to be Covered
   a. Concepts of Motion (2 classes)
   b. Kinematics in One Dimension (3 classes)
   c. Vectors and Coordinate Systems (3 classes)
   d. Kinematics in Two Dimensions (3 classes)
   e. Force and Motion (2 classes)
   f. Dynamics I: Motion Along a Line (3 classes)

g. Newton's Third Law (3 classes)
h. Dynamics II: Motion in a Plane (3 classes)
i. Impulse and Momentum (3 classes)
j. Energy (4 classes)
k. Work (2 classes)
l. Rotation of a Rigid Body (4 classes)
m. Newton’s Theory of Gravity (2 classes)
n. Oscillations (3 classes)

1. Course number and name: **PHYS 11C – General Physics: Electricity and Magnetism**

2. Credits and contact hours: 4 units (120 min/week lecture, 50 min/week discussion, 180 min/week laboratory)

3. Instructor's or course coordinator's name: Jérôme Bürki

4. Textbook, title, author, and year: R. D. Knight, *Physics for Scientists and Engineers, Volume 4,* published by Pearson, 3th Edition (2013)
   Other supplemental materials: Subscription to pearsonmylabandmastering.com

5. Specific course information
   a. Course Description (Catalog Description) - PHYS 11A, 11B, 11C sequence is a three semester course in introductory physics requiring elementary calculus. This sequence satisfies the lower division physics requirement for a major in physics, physical science, chemistry, geology, or engineering.
   b. Prerequisites or Co-requisites - MATH 31 (Calculus II), PHYS 11A (General Physics: Mechanics).
   c. Course Designation - Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Specific Course Learning Outcomes:
1. Acquire, through hands-on experience and interactive demonstrations, familiarity with the basic phenomena of electricity and magnetism
2. Develop and use a mental model of charges
3. Understand what fields and potentials are and how they are used
4. Analyze simple electric circuits including batteries, resistors, capacitors, or inductors
5. Explain magnetic inductance and some of its applications
6. Recognize that our description of nature is connected to careful observation and reasoning (lab work)

7. Brief List of Topics to be Covered
   a. The Electric Field (2 classes)
   b. Gauss's Law (3 classes)
   c. The Electric Potential (3 classes)
   d. Potential and Field (3 classes)
   e. Current and Resistance (3 classes)
   f. Fundamentals of Circuits (4 classes)
   g. The Magnetic Field (5 classes)
   h. Electromagnetic Induction (4 classes)
   i. Electromagnetic Fields and Waves (3 classes)
   j. AC Circuits (4 classes)

1. Course number and name: **ENGR 6 – Engineering Graphics and CADD**

2. Credits and contact hours: 3 Units (100 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Yong Suh

4. Texbook, ttile, author, and year: *Visualization and Engineering Design Graphics with Augmented Reality*, Second Edition, Alcaniz, Dorribo Camba, Contero, Otey, 2014
   Other supplemental mateirials: None

5. Specific course information
   a. Course description (Catalog Description): In depth graphical analysis and solution of typical three-dimensional space problems by applying the principles of orthogonal projection. Fundamentals of interactive computer aided design and drafting. Preparation of engineering drawings utilizing the CAD system.
   b. Prerequisites or Co-requisites: None
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Course Learning Outcomes</u>
The student will be able to:
1. Understand and use the principles of orthogonal projection (descriptive geometry) to solve spatial three-dimensional problems.
2. Extract the different views (6 views) of any simple mechanical object,
3. Extract sectional and auxiliary views of mechanical objects,
4. Dimension the mechanical drawing appropriately and with different formats,
5. Create, modify, print and save engineering drawing utilizing a CAD system,
6. Use SolidWorks for basic construction techniques, basic Editing, and dimensioning
7. Understand and apply manually and using CAD tool to manipulate the mechanical related objects include creating and generating the planes, edge views, true length and true shape, revolution, skew lines, and piercing points, calculate slope, clearance, and dihedral angles,
8. Design and complete the drawing for a simple mechanical project,
9. Practice teamwork to accomplish a group project.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ENGR 6**
a	Ability to apply knowledge of mathematics, science, and engineering	I
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	I
d	Ability to function on multidisciplinary teams	I
e	Ability to identify, formulate, and solve engineering problems	I
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	I
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	I

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. *Brief List of Topics Covered*
   a. Introduction, Geometric Construction
   b. Isometric Sketch
   c. Multiview Projection
   d. Dimensioning
   e. Tolerancing
   f. Intro to SolidWorks, SolidWorks Sketch
   g. SolidWorks Sketch, SolidWorks Parts
   h. SolidWorks Parts
   i. SolidWorks Assemblies
   j. SolidWorks Drawings
   k. Sections, Auxiliar Views) - using SolidWorks
   l. BOM, Assembly Drawing
   m. Design Table, HoleWizard, PhotoWorks, Analysis

1. Course number and name: **Engineering 17 – Introductory Circuit Analysis**

2. Credits and contact hours**:** 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Thomas W. Matthews

4. Textbook, title, author, and year: *Electric Circuits,* 10th Ed., Nilsson and Riedel, 2015
Other supplemental materials: None

5. Specific course information
    a. Description of the content of the course (catalog Desription): Writing of mesh and node equations. DC and transient circuit analysis by linear differential equation techniques. Application of laws and theorems of Kirchoff, Ohm, Thevenin, Norton and maximum power transfer. Sinusoidal analysis using phasors, average power.
    b. Prerequisites or co-requisites: PHYS 11C (General Physics: Electricity and Magnetism), MATH 45 (Differential Equations); either the math or physics may be taken concurrently, but not both.
    c. Course Designation - Required Course

6. Specific goals for the course
    a. Specific Outcomes of Instruction

Course Learning Outcomes

student will be able to:

a. Recognize the symbols for and explain the terminal characteristics of voltage and current sources, controlled sources, resistors (Ohm's law), capacitors, and inductors.
b. Apply Kirchoff's laws to write node and mesh equations for DC conditions and correctly carry out analysis to find voltages, currents, and powers.
c. Use circuit analysis techniques including voltage and current division, superposition, and equivalent circuits (Thevenin and Norton) as needed to obtain specific results.
d. Demonstrate Outcomes 1-3 for AC sinusoidal steady-state analysis using phasors and including real and apparent power.
e. Analyze circuits containing capacitors and inductors using differential equations, and calculate voltages and currents as functions of time.
f. Analyze circuits containing ideal operational amplifiers.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ENGR 17**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	
d	Ability to function on multidisciplinary teams	
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief list of topics to be covered
   a. Terminal characteristics of circuit elements
   b. Nodal and mesh analyses for DC circuits.
   c. Voltage and current division.
   d. Superposition principle
   e. Source transformations.
   f. Maximum power transfer.
   g. Thevenin and Norton models for DC circuits.
   h. Ideal Operational Amplifiers
   i. First-order RL and RC circuits – Source-free and step responses.
   j. Second-order RLC circuits – Source-free and step responses.
   k. Sinusoidal analysis – Phasor / frequency-domain analysis.
   l. Complex power.

1. Course number and name: **ENGR 30: Analytic Mechanics: Statics**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Eric Matsumoto

4. Textbook, title, author, and year: Beer, F. P., Johnston, E. R., and Mazurek, D, *Vector Mechanics for Engineers, Statics*, 10th Ed., McGraw-Hill Science/Engineering/Math, New York, 2012.
   Other supplemental materials: Packet of "partial" lecture notes for use in class made available through SacCT 9.1.

5. Specific course information
   a. Course Description - This course introduces the principles of statics, including the following topics: statics of particles, equivalent systems of forces, equilibrium of rigid bodies, centroids, centers of gravity and forces on submerged surfaces, analysis of trusses, including the use of computer software, analysis of frames and machines, forces in beams including shear and bending moment diagrams, friction, and moments of inertia.
   b. Prerequisites or Co-requisites - MATH 31 (Calculus II), PHYS 11A (General Physics: Mechanics), and one of the following courses: ENGR 4, ENGR 6 or CE 4 (Engineering Graphics), with grades of C- or better.
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

9. *Lecture* – Based on lectures and homework, students should be able to do the following:
   a. Convert units within and between SI or US customary systems.
   b. Calculate quantities with appropriate numerical accuracy.
   c. Explain the six fundamental principles of elementary mechanics.
   d. Solve problems using fundamental principles in a logical and systematic way.
   e. Idealize problems using mathematical models.
   f. Draw free body diagrams.
   g. Solve force vector problems using force triangles and trigonometric identities.
   h. Apply equilibrium equations to solve 2D and 3D particle and rigid body problems for forces.
   i. Determine support reactions and internal forces in 2D and 3D structures.
   j. Determine properties of area, volume, and mass (center of gravity and centroid).
   k. Analyze statically determinate trusses.
   l. Calculate internal forces and moments in statically determinate frames and machines.
   m. Construct shear and bending moment diagrams for statically determinate beams.
   n. Calculate moment of inertia of individual and composite areas.
   o. Solve problems involving Coulomb friction.
10. *Course Project* – Based on the team project, students should be able to do the following:
   a. Combine and build upon principles of statics to design, analyzing, building, and test a 3-D scale model truss, including material testing.
   b. Satisfying project guidelines that address efficiency of strength, accuracy of pretest

predictions, and aesthetics.
c. Formally present project results through an oral team presentation and written summary.
d. Work effectively in a team to conduct project.

b. Student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	Student Outcomes	ENGR 30
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	-
c	Ability to design a system, component, or process to meet desired needs	-
d	Ability to function on multidisciplinary teams	D
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	-
g	Ability to communicate effectively	D
h	Understanding impacts of engineering solutions in the global, economic, and societal context	-
i	Recognition of need for, and ability to engage in lifelong learning	I
j	Knowledge of contemporary issues	-
k	Ability to use techniques, skills and modern engineering tools	D

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
   a. Vectors and Forces (1 class)
   b. Statics of 2D and 3D particle equilibrium (5 classes)
   c. Equivalent systems of forces and equilibrium of 2D and 3D rigid bodies (5 classes)
   d. Centroids and centers of gravity (3 classes)
   e. Analysis of trusses, frames, and machines (3 classes)
   f. Forces in beams and frames (4 classes)
   g. Moment of inertia (2 classes)
   h. Project and other topics (5 classes)

1. Course number and name: **ENGR 45 – Engineering Materials**

2. Credits and contact hours: 3 units (100 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Troy Topping

4. Textbook title, author, and year: *Introduction to Materials Science for Engineers*, 8h Edition, Shackelford, 2015
   E 45 Engineering Materials Lab Manual, Holl & Washburn, 2015
   Other supplemental materials: Mastering Engineering.

5. Specific course information
   a. Course Description (Catalog Description): Basic principles of mechanical, electrical and chemical behavior of metals, polymers and ceramics in engineering applications; topics include bonding, crystalline structure and imperfections, phase diagrams, corrosion, and electrical properties. Laboratory experiments demonstrate actual behavior of materials; topics include metallography, mechanical properties of metals and heat treatment.
   b. Prerequisites or Co-requisites: CHEM 1E (General Chemistry for Engineers), MATH 30 (Calculus I)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes:

1. Explain relationships between crystal structures and microstructures
2. Explain relationships between microscopic behavior and macroscopic physical properties
3. Utilize data from binary equilibrium phase diagrams and fundamental metallurgical processing in material selection
4. Utilize data from environmental and physical degradation for appropriate materials selection
5. Conduct standard materials tests, analyze the data generated and present results orally and in lab report form.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ENGR 45**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	D
c	Ability to design a system, component, or process to meet desired needs	
d	Ability to function on multidisciplinary teams	I
e	Ability to identify, formulate, and solve engineering problems	I
f	Understanding of professional and ethical responsibility	I
g	Ability to communicate effectively	I
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	I
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	I

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
    a. Materials classifications
    b. Atomic structure and interatomic bonding
    c. Structure of crystalline solids
    d. Microstructures
    e. Mechanical properties
    f. Imperfections in solids
    g. Strengthening mechanisms
    h. Binary equilibrium phase diagrams
    i. Diffusion mechanisms and effects
    j. Phase transformations
    k. Structure and properties of ceramics
    l. Structure and properties of polymers
    m. Structure and properties of composite materials
    n. Electrochemical corrosion
    o. Electrical properties of materials
    p. Environmental implications

1. Course number and name: **ENGR 110 – Engineering Mechanics - Dynamics**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Ilhan Tuzcu

4. Textbook title, author, and year: *Engineering Mechanics - Dynamics*, Seventh Ed., J. L. Meriam and L. G. Kraige, 2013
   Other supplemental materials: WileyPlus.

5. Specific course information
   a. Course Description – Fundamental principles of kinematics and kinetics, study of motion and force analysis of particles and rigid bodies, application to idealized structures and physical systems, introduction to free and forced vibrations.
   b. Prerequisites – ENGR 30 (Statics), MATH 45 (Diff. Eqns.), and MATH 32 (Calculus III) or MATH 35 (Int. Lin. Alg.) or MATH 100 (Applied Lin. Alg.).
   c. Course Designation – Required Course.

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Course Learning Outcomes</u>

The student will be able to:

1. Understand how to determine relations among positions, velocities and accelerations of particles and rigid bodies in the plane
2. Use first principle methods to relate forces to the motion of particles in the plane.
3. Determine the rotational inertia of a rigid body.
4. Use first principle methods to relate forces and moments to the motion of rigid bodies in the plane.
5. Use energy methods to determine the motion of particles and rigid bodies in the plane.
6. Determine the behavior of a mass-damper-spring system under both free and forced vibration.
7. Understand how to determine the parameters required to minimize vibrations in a mechanical system
8. Understand how to determine relations among positions, velocities and accelerations of particles and rigid bodies in the plane
9. Use first principle methods to relate forces to the motion of particles in the plane.
10. Determine the rotational inertia of a rigid body.
11. Use first principle methods to relate forces and moments to the motion of rigid bodies in the plane.
12. Use energy methods to determine the motion of particles and rigid bodies in the plane.
13. Determine the behavior of a mass-damper-spring system under both free and forced vibration.
14. Understand how to determine the parameters required to minimize vibrations in a mechanical system

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ENGR 110**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	I
c	Ability to design a system, component, or process to meet desired needs	
d	Ability to function on multidisciplinary teams	I
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	I
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	I
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	I

I = Introduced, D = Developed and Practiced with feedback,
G = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
    a. Basic Concepts: Units, Vectors, Newton's Law of Gravitation (1 class)
    b. Kinematics of Particles: Rectilinear Motion, Plane Curvilinear Motion, Rectangular, Intrinsic, and Polar Coordinates, Relative Motion, Constrained Motion (7 classes)
    c. Kinetics of Particles: Newton's Laws; Equations of Motion (3 classes)
    d. Plane Kinematics of Rigid Bodies: Translation, Rotation, and General Plane Motion; Angular Velocity, Instantaneous Center of zero velocity, Angular Acceleration, General Equations of Motion (7 classes)
    e. Work and Energy: Work and Kinetic Energy, Power, Potential Energy (4 classes)
    f. Impulse and Momentum: Principles, Conservation of Linear and Angular Momentum (2 classes)
    g. Vibration and Time Response: Free Vibration of Particles; Forced Vibration of Particles (4 classes)

1. Course number and name: **ENGR 112 – Mechanics of Materials**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Kimberly Scott-Hallet

4. Textbook, title, author, and year: Wright, J., and J. MacGregor (2012). *Reinforced Concrete Mechanics & Design, of Highway Engineering and Traffic Analysis, Sixth Edition*, Pearson. Other supplemental materials: None.

5. Specific course information
    a. Course Description (Catalog Description) - Stresses, strains and deformations in elastic behavior of axial force, torsion and bending members, and design applications. Statically indeterminate problems. Strain energy. Column stability.
    b. Prerequisites or Co-requisites - ENGR 30 (Analytic Mechanics: Statics), ENGR 45 (Engineering Materials), and MATH 45 (Differential Equations for Science and Engineering) with a grade of C- or better
    c. Course Designation: Required

6. Specific goals for the course
    a. Specific Outcomes of Instruction, ex. The student will be able to explain the significance of current research about a particular topic.

<u>Specific Course Learning Outcomes:</u>

1. *Tension, Compression, and Shear & Axially Loaded Members* –Analyze and design simply axial members, which allows for study of more complex structural members.

2. *Torsion* – Analyze stress in torsional members.

3. *Shear Forces, Bending Moments, and Beams* –Analyze the stresses, stress resultants, and deformations of an arbitrarily loaded beam.

4. *Analysis of Stress and Strain* - Calculate the stress state on an arbitrary material plane.

5. *Applications of Plane Stress* – Solve simple pressure vessel problems and analyze the stresses in members subjected to arbitrary loadings.

6. *Additional Topics in Beam Theory* – Analyze the deflections of a beam subjected to arbitrary loadings. Student should be prepared for future courses on the structural analysis of frames.

7. *Columns* - Analyze the behavior of a column subject to elastic buckling. Student should also be able to determine when elastic buckling theory is applicable.

b. Explicitly Indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	Student Outcomes	ENGR 112
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	-
c	Ability to design a system, component, or process to meet desired needs	I
d	Ability to function on multidisciplinary teams	-
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	I
g	Ability to communicate effectively	D
h	Understanding impacts of engineering solutions in the global, economic, and societal context	-
i	Recognition of need for, and ability to engage in lifelong learning	D
j	Knowledge of contemporary issues	D
k	Ability to use techniques, skills and modern engineering tools	D

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
    a. Axially Loaded Members
    b. Torsion Analysis of Members
    c. Shear forces and bending moments for beams
    d. Bending Stresses on beams
    e. Shear stresses on beams
    f. Plan stress and strain
    g. Column Analysis

1. Course number and name: **ENGR 124 – Thermodynamics**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Timothy Marbach

4. Textbook, title, author, and year: *Thermodynamics An Engineering Approach, 8*^{h} Edition, Cengle and Boles, 2014
   Other supplemental materials: None.

5. Specific course information
   a. Course Description (Catalog Description): Study of thermodynamic principles and their applications to engineering problems. Includes a study of the first and second laws, the properties of pure substances and ideal gas, gas/vapor mixtures, and an introduction to thermodynamic cycles.
   b. Prerequisites or Co-requisites: CHEM 1E (General Chemistry for Engineers), PHYS 11A (General Physics: Mechanics), Math 32 (Calculus III)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes

The student will be able to:

1. Explain important concepts related to energy, energy transformation processes, and the First and Second Laws of thermodynamics
2. Formulate thermodynamics problems with a methodological, systematic approach.
3. Determine properties of water, common refrigerants and ideal gases
4. Solve conservation of energy problems for closed and open systems.
5. Solve problems using the second law of thermodynamics
6. Solve problems related to at least one common thermodynamic cycle.

b. Explicitly Indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ENGR 124**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	D
d	Ability to function on multidisciplinary teams	
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	D
g	Ability to communicate effectively	
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	D
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	D

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
    a. Basic Concepts: Systems, Properties, Processes and Cycles
    b. Properties of a Pure Substance, Saturation, Quality
    c. Tables of Thermodynamic Properties
    d. Ideal Gas Equation of State
    e. Conservation of Mass; Work and Energy
    f. First Law for Closed and Open Systems
    g. Second Law of Thermodynamics; Carnot Cycle
    h. Entropy: Pure Substance and Ideal Gases
    i. Refrigeration and Air Conditioning Systems

1. Course number and name: **ENGR 132 – Introduction to Fluid Mechanics**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: August Smarkel

4. Textbook, title, author, and year: *Fundamentals of Fluid Mechanics*, 7^h Edition Munson, Okiishi, Huebsch, Rothmayer
   Other supplemental materials: None.

5. Specific course information
   a. Course Description (Catalog Description): Lectures and problems in the fundamental principles of incompressible and compressible fluid flow
   b. Prerequisites or Co-requisites: ENGR 110 (Dynamics for Engineers)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Specific Course Learning Outcomes:

1. *Introduction* – This portion of the course provides general background information on fluid mechanics and prerequisites. This information is intended to give students a basic knowledge of some of the fundamental properties of fluid; compressibility, viscosity, density and unit weight; and surface tension, and how they relate to the molecular structure of the material. This section also covers where fluids fit into the broader view of material phases and how fluids differ from solids. This section also introduces the continuum assumption and how it relates to non-rigid-body mechanics.
2. *Hydro Statics*– Hydrostatics reviews static force equilibrium, with an emphasis on non-uniform distributed loads. Student learn how fluids inability to hold shear forces in a static state create pressure increases with depth and various methods to calculate pressure increases with depth in compressible and non-compressible fluids. Students learn how to use pressure acting on surface to form distributes loads and find forces due to pressure forces acting on plates, curved surfaces and three dimensional bodies. Students will be able to prove force equilibrium on statics fluids and be able to find forces that must be applied to the fluid and the forces the fluid must apply to objects to maintain force equlibirum.
3. *Accelerations of particles(Bernoulli's equation)* – This section focuses on fluid packets that are not in static equilibrium. Students learn Eularian and Lagrangian approaches for tracking fluid packet movements. This section focuses on fluid interaction with no work exchanges with the environment (energy conservation in a fluid). Acceleration tangent to and normal to a streamline are covered. Students will be able to model non-viscous fluid behavior in dynamic applications.
4. *Reynolds Transport Theorem (RTT)*-Students will be able to define a system and control volume. Students will be able to use RTT to model draw down time of a liquid filled tank and learn when steady state assumptions can be made. Students will also have a brief introduction to Navier Stokes Equation and show that assumptions must be made

for there to be a solution to that equation.

5. *Energy Equation and Dimensionless Models*– Student will understand the significance of each term in the energy equation and that it models energy in a fluid and how that energy is exchanged with the environment through thermal and mechanical work. Through the application of dimensionless numbers and model similitude, students will be able to model steady state systems with pumps, turbines and complex head loss in pipe networks. Student will be able to design systems using the Moody diagram to approximate head loss. Students are also introduced to open channel flow.
6. *Momentum Drag Forces*– Student are able to solve for the force interaction between fluids and solid objects in dynamic problems using a control volume. Students are able to solve problems in both a stationary and non-stationary velocity reference frame. Students are expected to find solutions to steady and non-steady state second order differential equations. Topics covered include forces due to fluid jets, rocket thrust and drag forces through Reynolds number approximation, and water hammer effects.

b. Explicitly Indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ENGR 132**
a	Ability to apply knowledge of mathematics, science, and engineering	M
b	Ability to design and conduct experiments and to analyze and interpret data	D
c	Ability to design a system, component, or process to meet desired needs	D
d	Ability to function on multidisciplinary teams	-
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	I
g	Ability to communicate effectively	D
h	Understanding impacts of engineering solutions in the global, economic, and societal context	-
i	Recognition of need for, and ability to engage in lifelong learning	D
j	Knowledge of contemporary issues	I
k	Ability to use techniques, skills and modern engineering tools	M

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7. Brief List of Topics to be Covered
    a. Fluid Properties (2 classes)
    b. Hydrostatics (5 classes)
    c. Acceleration of fluids (5 classes)
    d. Reynolds Transport Theorem (3 classes)
    e. Energy Equation and Dimensionless numbers (8 classes)
    f. Momentum and Drag Forces (6 classes)

1. Course number and name: **ME 37 – Manufacturing Processes**

2. Credits and contact hours: 3 units (100 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Akihiko Kumagai

4. Textbook, title, author, and year: *DeGarmo's Materials and Processes in Manufacturing*, 11h Edition, Black and Kohser, 2012
   Other supplemental materials: None.

5. Specific course information
   a. Course Description (Catalog Description): Principles of manufacturing processes in the area of metal removal, forming, joining and casting and fundamentals of numerical control. Study includes applications of equipment, e. g. lathe milling machine, drill press, saw grinder, welder, molding equipment and core makers. Emphasis on safety during hands-on operations.
   b. Prerequisites or Co-requisites: None
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Course Learning Outcomes</u>
The student will be able to:
1. Explain and describe basic. manufacturing methods including Casting, green sand casting, die casting, and investment casting, Cold and hot working of metals, Welding and cutting, Forging, Press work, Machining including CNC, Threading, Grinding, and plastic injection molding
2. Compare the advantages and disadvantages of different processes, Identify parts made by specific processes
3. Identify and explain the use of basic measuring tools
4. Identify commonly used cutting tools and do simple feed and speed calculations
5. Correctly select tap drill size and depth from drawings and charts
6. Perform simple tuning and drilling operations on the lathe, Measure parts using a micrometer and scale
7. Understand simple engineering drawings and tolerances, Operate a drill press and drill holes using drill jigs, Perform simple milling operations
8. Read and correctly adjust cross feed on the lathe and mill
9. Name the major parts of the lathe and mill and explain their operation
10. Make a simple green sand mold, Perform edge and corner welds using OAW, Perform fillet welding using GMAW
11. Identify basic machine tools and explain their operation
12. Successfully complete two lab projects using these skills

b. Explicitly Indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 37**
a	Ability to apply knowledge of mathematics, science, and engineering	I
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	I
d	Ability to function on multidisciplinary teams	I
e	Ability to identify, formulate, and solve engineering problems	
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
   a. Foundry methods
   b. Die casting
   c. Hot Working of Metals
   d. Cold Working of Metals
   e. Press work and tooling
   f. Metal cutting
   g. Turning, drilling, and boring
   h. Milling, sawing and broaching
   i. Machining cutters
   j. Production machines

1. Course number and name: **ME 105 – Introduction to Technical Problem Solving**

2. Credits and contact hours: 3 units (100 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Estelle Eke

4. Textbook, title, author, and year: *Learning to Program with Matlab: Building GUI Tools*, Craig, 2013
   ME 105 Laboratory Manual, Eke, 2015
   Other supplemental materials: None

5. Specific course information
   a. Course Description (Catalog Description): Introduction to the use of computers for engineering, science and mathematical computations. Introduction to linear algebra and matrix applications. Introduction to concepts of programming and visualization using MATLAB and PBasic. Practical applications involving design using a microcontroller. Applications will be drawn from a variety of science and engineering areas.
   b. Prerequisites or Co-requisites: ENGR 17 (Circuit Analysis), ENGR 30 (Analytic Mechanics: Statics)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes

The student will be able to:

1. Use matrix operations and linear algebra techniques to solve problems.
2. Structure a well-defined set of steps that can be carried out on a computer.
3. Write programs in Matlab that involve loops, conditional statements, logical and rela operators, and data files.
4. Demonstrate how actions defined by code can be linked to a user interface object by crea Graphical User Interface.
5. Visualize data by generating plots in 2D and 3D.
6. Demonstrate a basic level of confidence in programming by completing a group proje employs a microcontroller.
7. Locate sources of information and effectively document how a project was accomplished.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 105**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	I
d	Ability to function on multidisciplinary teams	I
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	I
g	Ability to communicate effectively	I
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	I
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	D

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
   a. Introduction to the Computing Environment (SacCT, UNIX, Voyager, MATLAB)
   b. Introduction to Technical Problem Solving
   c. Introduction to Linear Algebra (Array and Matrix Operations)
   d. Solving Systems of Equations: Cramer's Method; Gauss' Method
   e. Introduction to m-files
   f. Polynomials
   g. MATLAB Programming
   h. Technical Writing
   i. Microcontroller Basics
   j. Constructing digital circuits; PWM; EEPROM

1. Course number and name: **ME 108 – Professional Topics in Mechanical Engineering**

2. Credits and contact hours: 2 units (100 min/week lecture)

3. Instructor's or course coordinator's name: Patrick Homen

4. Textbook, title, author, and year: *The Drunkard's Walk, How Randomness Rules Our Lives,* Mlodinow, 2008
   Other supplemental materials: *FE Fundamentals of Engineering Supplied Reference Handbook*, 8th edition, 2nd revision. (NCEES, 2011)
   Working toward Sustainability, Ethical Decision Making in a Technological World, Kibert, Monroe, Peterson, Plate, Thiele, 2012

5. Specific course information
   a. Course Description (Catalog Description): Introduction to statistical methods applied to analysis of engineering systems. Topics include data collection, distribution characteristics, probability, uses of regression analysis, and decision-making under uncertainty. Introduction to economic analysis applied to engineering designs. Topics include marginal or incremental economic analysis using multiple standard methods while addressing organizational constraints and money market factors.
   b. Prerequisites or Co-requisites: MATH 31 (Calculus II)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes

The student will be able to:

1. Explain to a colleague the fundamentals of engineering statistical analysis
2. Explain to a colleague the use of typical statistical data representations
3. Explain to a colleague the fundamentals of probability including hypothesis testing
4. Explain to a colleague the fundamentals of engineering economics
5. Explain to a colleague the fundamentals of various standard economic analysis techniques, including but not limited to present worth, future worth, cost-benefit and replacement analysis

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	Student Outcomes	ME 108
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	
d	Ability to function on multidisciplinary teams	
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	D
g	Ability to communicate effectively	D
h	Understanding impacts of engineering solutions in the global, economic, and societal context	D
i	Recognition of need for, and ability to engage in lifelong learning	D
j	Knowledge of contemporary issues	D
k	Ability to use techniques, skills and modern engineering tools	D

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
   a. Defining populations and samples, sampling methods
   b. Pictorial and tabular methods: frequency distributions, bar charts, stem-and-leaf displays, dotplots
   c. Measures of central tendency: mean, median, mode, quartiles, percentiles
   d. Measures of dispersion: range, standard deviation, variance,
   e. Probability: counting techniques, conditional probability
   f. Probability distributions: uniform distribution, binomial probability distribution, normal distribution
   g. Confidence intervals, Linear regression
   h. Introduction to hypothesis testing
   i. Breakeven analysis: fixed costs, variable costs, revenue, profit
   j. Interest and Equivalence: simple interest, compound interest, equivalence, continuous compounding, inflation effects
   k. Present worth analysis, Annual cash flow analysis
   l. Rate of return analysis and incremental rate of return analysis
   m. Future worth analysis
   n. Benefit-cost analysis
   o. Payback period analysis
   p. Depreciation
   q. Replacement Analysis

1. Course number and name: **ME 116 – Machinery Design I**

2. Credits and contact hours: 2 units (100 min/week lecture)

3. Instructor's or course coordinator's name: Kenneth Sprott

4. Textbook, title, author, and year: *Machine Design An Integrated Approach,* 5^{th} Ed. Norton, 2008
   Other supplemental materials:

5. Specific course information
   a. Course Description (Catalog Description): Introduction to basic design methodology for mechanical systems and devices. Detail design of machine components; application of analytical methods in the design of complex machines. Failure mode analysis, theories of failure, yield, fracture, deflection, and fatigue analysis of machine elements. Design of common machine elements such as bearings and shafts.
   b. Prerequisites or Co-requisites: ENGR 6 (Engineering Graphics and CADD), ME 37 (Manufacturing Processes), Co-requisite: ENGR 112 (Mechanics of Materials)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes

The student will be able to:

6. Understand the basic steps of the mechanical design process.
7. Calculate the allowable loads and stresses based on applied forces and a factor of safety.
8. Calculate stress in machine components and pressure vessels given the applied loads.
9. Calculate the deflection of machine components under an applied load.
10. Predict failure in machine components using both static failure theories and fatigue analysis.

c. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 116**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	I
d	Ability to function on multidisciplinary teams	D
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	D
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	D
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	D

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
   a. Design Process
   b. Relationship between stress and strain
   c. Stress in Machine Elements
   d. Deflection of Machine Elements
   e. Static Failure Theory
   f. Fatigue

1. Course number and name: **ME 117 – Machinery Design II**

2. Credits and contact hours: 2 units (100 min/week lecture)

3. Instructor's or course coordinator's name: Kenneth Sprott

4. Textbook, title, author, and year: *Machine Design An Integrated Approach,* Norton, 5th Ed. 2008
   Other supplemental materials: None

5. Specific course information
   a. Course Description (Catalog Description): Introduction to design of machine components; application of analytical methods in the design of complex machines. Design of common machine elements such as threaded fasteners, springs, flexible drive components, gears, and friction devices. Introduction to stress and deflection analysis using finite element software.
   b. Prerequisites or Co-requisites: ME 116 (Machinery Design I)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Course Learning Outcomes</u>
The student will be able to:
1. Design and size threads used in power screws and in threaded fasteners. Design and size machine components which use threaded fasteners.
2. Design and size gears and gear boxes for use in machine components.
3. Design and select flexible drive components used in machine applications.
4. Design and select springs used in machine applications.
5. Design and select friction devices such as brakes and clutches.
6. Use finite element software to determine loads in a machine component.
7. Work on a team to design a mechanical system.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 117**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	D
d	Ability to function on multidisciplinary teams	D
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	D
g	Ability to communicate effectively	D
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	D
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	D

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
   a. Belts and Chain Drives
   b. Gears
   c. Springs
   d. Bolted joints
   e. Clutches and brakes.
   f. Finite element analysis

1. Course number and name: **ME 126 – Heat Transfer**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Dongmei Zhou

4. Textbook, title, author, and year: *Introduction to Heat Transfer*, Bergman, Lavine, Incropera, DeWitt, 2011
   Other supplemental materials: None

5. Specific course information
   a. Course Description (Catalog Description): Basic principles of heat transfer, including processes of conduction, convection, radiation, evaporation and condensation.
   b. Prerequisites or Co-requisites: ENGR 124 (Thermodynamics), ENGR 132 (Fluid Mechanics)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes

The student will be able to:

1. Define and identify different modes of heat transfer

2. Calculate steady and unsteady heat conduction in one dimension.

3. Understand the fundamentals of convective heat transfer process

4. Calculate the heat transfer coefficient in different convection environments.

4. Calculate the radiant heat transfer between solid bodies, black or gray.

5. Apply heat transfer principles (conduction, convection and radiation) in solving engineering problems that are related to heat transfer.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 126**
a	Ability to apply knowledge of mathematics, science, and engineering	M
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	
d	Ability to function on multidisciplinary teams	M
e	Ability to identify, formulate, and solve engineering problems	M
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	D/M
h	Understanding impacts of engineering solutions in the global, economic, and societal context	D
i	Recognition of need for, and ability to engage in lifelong learning	
j	Knowledge of contemporary issues	M
k	Ability to use techniques, skills and modern engineering tools	M

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
   a. Basic Modes of Heat Transfer
   b. Steady ID Conduction
   c. Unsteady ID Conduction
   d. Analysis of Convection Heat Transfer
   e. Forced Convection
   f. Heat Exchangers
   g. Heat Transfer by Radiation

1. Course number and name: **ME 128 – Thermal-Fluid Systems**

2. Credits and contact hours: 3 units (100 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Timothy Marbach

4. Textbook, title, author, and year: *Thermodynamics An Engineering Approach*, 7th Ed., Cengel and Boles, 2010
   Other supplemental materials: None

5. Specific course information
   a. Course Description (Catalog Description): Fundamentals of the Otto, Diesel, Brayton and Rankine power cycles, vapor-compression refrigeration, psychrometric processes and chemical reactions. Theory and application of temperature, pressure, flow, and velocity instruments, introduction to experiment design, errors, uncertainty and data acquisition, analysis and presentation.
   b. Prerequisites or Co-requisites: ENGR 124 (Thermodynamics)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Course Learning Outcomes</u>
The student will be able to:
1. Explain to a colleague the fundamentals of the Otto, Diesel, Brayton and Rankine power cycles, refrigeration cycles, psychrometric processes and chemical reactions.
2. Explain to a colleague the theory and application of fluid and thermal measurement instruments.
3. Formulate and solve real-world problems related to power and refrigeration cycles, psycrometric processes and chemical reactions.
4. Plan and conduct experiments, analyze data, clearly present results and draw justified conclusions.
5. Evaluate and explain the environmental, economic and social impacts of energy systems.
6. Locate and utilize sources of thermal-fluid information and thermodynamic properties.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 128**
a	Ability to apply knowledge of mathematics, science, and engineering	M
b	Ability to design and conduct experiments and to analyze and interpret data	M
c	Ability to design a system, component, or process to meet desired needs	
d	Ability to function on multidisciplinary teams	M
e	Ability to identify, formulate, and solve engineering problems	M
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	M
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	M

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
    a. Otto and Diesel Cycles
    b. Brayton Cycle
    c. Rankine Cycle
    d. Vapor-Compression Refrigeration
    e. Adsorption Refrigeration
    f. Psychrometrics
    g. Combustion and Chemical Reactions
    h. Advanced Topics and Project

1. Course number and name: **ME 138 – Concurrent Product and Process Design**

2. Credits and contact hours: 3 units (100 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Akihiko Kumagai

4. Textbook, title, author, and year: *Collaborative Product Design,* Tien-I Liu, CSUS, 2007
   Optional: *Product Development and Design for Manufacturing,* John W. Priest and Jose M. Sanchez, Marcel Dekker, NY, 2001

   Other supplemental materials: None

5. Specific course information
   a. Course Description (Catalog Description): Manufacturing considerations in product design including: design for assembly (DFA), design for productibility (DFP), design to cost (DTC), design to life cycle cost (DTLCC), design for quality and reliability (DFQR); introduction to concurrent engineering
   b. Prerequisites or Co-requisites: ME 37 (Manufacturing Processes), ME 116 (Machinery Design I)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes

The student will be able to:

1. Understand the basic steps of the mechanical design process.
2. Calculate the allowable loads and stresses based on applied forces and a factor of safety.
3. Calculate stress in machine components and pressure vessels given the applied loads.
4. Calculate the deflection of machine components under an applied load.
5. Predict failure in machine components using both static failure theories and fatigue analysis.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 138**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	
d	Ability to function on multidisciplinary teams	
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	D
g	Ability to communicate effectively	
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	D

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M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
   - ***a.*** Concurrent Engineering, Collaborative Product Design, QFD, and Case Studies
   - ***b.*** Product Development Process and Organizations
   - ***c.*** DFMA and Case Studies
   - ***d.*** Design to Cost and Case Studies
   - ***e.*** Trade-Off Analyses
   - ***f.*** Design to Life Cycle Cost and Case Studies
   - ***g.*** Design for Quality and Reliability and Case Studies
   - ***h.*** Derating, FTA, FMEA, Cause and Effect Diagram and Case Studies
   - ***i.*** Kaizen (Continuous Improvement) and Case Studies
   - ***j.*** Design for Serviceability (Maintainability and Repairability)
   - ***k.*** Design for Performance
   - ***l.*** Manufacturing: JIT manufacturing, Computer-Aided Process Planning (CAPP), Process Capability Analysis, Statistical Process Control (SPC), Supply Chain Management, and Safety

1. Course number and name: **ME 171 – Modeling & Simulation of Mechatronics & Control Systems**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Jose Granda

4. Textbook, title, author, and year: *System Dynamics A Unified Approach,* Karnopp and Rosenberg, 2006
   E 171 Software and Hardware Manual, J. Granda
   Advanced Continuous Simulation Language (ACSL) Reference and User's Manual, Mitchell and Gauthier Associates, 1986
   Other supplemental materials: None

5. Specific course information
   a. Course Description (Catalog Description): Computer modeling and mathematical representation of mechanical, fluid, thermal, and electrical systems. Development of system design criteria and solutions using computer simulation. Use of Bond Graphs and Bond Diagram modeling techniques. Study of natural frequencies, eigen vectors, solution of differential equations of dynamic response of computer models. Introduction to start variable feedback control systems.
   b. Prerequisites or Co-requisites: ENGR 110 (Analytic Mechanics: Dynamics), ME 105 (Introduction to Technical Problem Solving)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes

The student will be able to:

1. Create a linear mathematical model of a system.
2. Solve a differential equation of a system using Laplace Transform.
3. Represent a system using a transfer function and block diagram.
4. Represent a system using a state space representation.
5. Model a mechanical, an electrical, and a thermal/fluid system.
6. Characterize the frequency response of a system.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 171**
a	Ability to apply knowledge of mathematics, science, and engineering	D
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	D
d	Ability to function on multidisciplinary teams	D
e	Ability to identify, formulate, and solve engineering problems	D
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	D
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	D

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7. Brief List of Topics to be Covered
   - ***a.*** ***Linear Models***
   - ***b.*** ***Differential Equations, Matrices, Complex Analysis***
   - c. ***Laplace Transform, Transfer Functions***
   - ***d.*** Modeling transducers. System Differential equations. Derivations using models.
   - ***e.*** Computer Generation of Physical Handout System Models.
   - ***f.*** Extended formulation methods Output equations. Computer Solution Techniques
   - ***g.*** Free and forced response Introduction to feedback control
   - ***h.*** Transfer functions. Frequency response.
   - ***i.*** Multiport fields and junction structures.
   - ***j.*** Modeling, transducers, Amplifiers and instruments.

1. Course number and name: **ME 172 – Control System Design**

2. Credits and contact hours: 3 units (150 min/week lecture)

3. Instructor's or course coordinator's name: Estelle Eke

4. Textbook, title, author, and year: *Control Systems Engineering, Seventh Edition,* Norman, 2015
   Other supplemental materials: *Student Version of MATLAB/Simulink, 2014 or later,* MathWorks.com

5. Specific course information
   a. Course Description (Catalog Description): Use of mathematical models for the generation of equations of motion for mechanical and electrical systems. Evaluation of single and multiple degrees of freedom systems in the time and frequency domain. Topics include feedback control systems, Laplace transform, state space representation, transfer functions, error analysis, stability of control systems and system response. Automatic control system design using root locus and frequency response methods. Design of compensating controls using state of the art software and automation tools. Introduction to digital control.
   b. Prerequisites or Co-requisites: ME 171 (Modeling & Simulation of Mechatronics & Control Systems)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Course Learning Outcomes</u>
The student will be able to:

7. Apply the concepts of open and closed loop performance when analyzing a control system.
8. Determine the stability of a system.
9. Use time and frequency domain analysis tools.
10. Use software to accomplish optimized designs.
11. Understand real devices that require modeling and control.
12. Work in a team to analyze and design real physical feedback control systems to meet performance specifications.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 172**
a	Ability to apply knowledge of mathematics, science, and engineering	D/M
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	D/M
d	Ability to function on multidisciplinary teams	
e	Ability to identify, formulate, and solve engineering problems	D/M
f	Understanding of professional and ethical responsibility	
g	Ability to communicate effectively	D/M
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	D/M
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	D/M

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7. Brief List of Topics to be Covered
   a. Mathematical modeling of systems in the time domain
   b. Mathematical modeling of systems in the frequency domain.
   c. Laplace transforms, transfer functions.
   d. First-, second- and higher-order systems
   e. State Variable representation of systems.
   f. Computational methods using software for generating transfer functions and performing simulations.
   g. Feedback control system characteristics and performance.
   h. Stability of linear feedback systems; Routh-Hurwitz criterion
   i. Root Locus Techniques
   j. Frequency Response Techniques
   k. Control System Design via Root Locus techniques
   l. Control System Design via Frequency Response
   m. Design of Feedback Control Systems. Compensation.
   n. Design of Proportional, Derivative, Integral and PID controllers.
   o. Introduction to Digital Control.
   p. Feedback Control System Design of real physical systems.

1. Course number and name: **ME 180 – Mechanical Properties of Materials**

2. Credits and contact hours: 3 units (100 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Patrick Homen

4. Textbook, title, author, and year: *Mechanical Behavior of Materials,* 4th Ed., Dowling, 2013
   Other supplemental materials: None

5. Specific course information
   a. Course Description (Catalog Description): Principles of mechanical properties of metals and polymers, including strength under combined loads, fatigue, and fracture mechanics. Laboratory includes study of strengthening mechanisms, and principles of experimental stress analysis.
   b. Prerequisites or Co-requisites: ENGR 112 (Mechanics of Materials)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Course Learning Outcomes</u>

The student will be able to:

1. understand microstructural relationships to macroscopic properties;
2. understand the effects and limitations of alloying;
3. understand the processes and effects of standard heat treatments;
4. conduct and interpret the results from standard mechanical tests;
5. understand the stress-strain relationships for simple and complex loading situations;
6. understand yielding and fracture;
7. use analytical methods to predict material behavior;
8. use models for evaluating deformation behavior;
9. use stress-based and strain-based approaches to fatigue;
10. use experimental data to evaluate stress and strain in complex loading situations;

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 180**
a	Ability to apply knowledge of mathematics, science, and engineering	D/M
b	Ability to design and conduct experiments and to analyze and interpret data	D/M
c	Ability to design a system, component, or process to meet desired needs	
d	Ability to function on multidisciplinary teams	D/M
e	Ability to identify, formulate, and solve engineering problems	D/M
f	Understanding of professional and ethical responsibility	D/M
g	Ability to communicate effectively	D/M
h	Understanding impacts of engineering solutions in the global, economic, and societal context	
i	Recognition of need for, and ability to engage in lifelong learning	D/M
j	Knowledge of contemporary issues	
k	Ability to use techniques, skills and modern engineering tools	D/M

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M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
    a. Bonding and crystal structures
    b. Structure and deformation in materials
    c. Elastic and inelastic deformation
    d. Alloying and processing; irons and steels, non-ferrous metals
    e. Polymers, ceramics, composites
    f. Mechanical testing; tensile and other basic tests
    g. Stress-strain relationships
    h. Complex and principal states of stress and strain
    i. Yielding and fracture under combined stresses
    j. Fracture of cracked members
    k. Fatigue; testing, stress-based approach, fatigue life, crack growth
    l. Plastic deformation behavior and models
    m. Cyclic loading behavior of real materials
    n. Stress-strain analysis of plastically deforming members
    o. Residual stresses and strains for bending
    p. Strain-based approach to fatigue
    q. Strain gage use in experimentation

1. Course number and name: **ME 190 – Project Engineering I**

2. Credits and contact hours: 3 units (100 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Rustin Vogt

4. Textbook, title, author, and year: None

Other supplemental materials: *Solid Works Tutorials*
https://www.solidworks.com/sw/resources/solidworks-tutorials.htm

5. Specific course information
   a. Course Description (Catalog Description): Beginning of a two semester project; design of a product, device, or apparatus that will be fabricated in ME 191. Students work in small groups, interacting with product users, vendors, technicians, and faculty advisors.
   b. Prerequisites or Co-requisites: ME 117 (Machinery Design II)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

Course Learning Outcomes

The student will be able to:

1. Propose a project of appropriate size, scope and complexity within the stated and budgetary constraints.
2. Transform a "general" project concept into an explicit set of functions, constraints, and objectives.
3. Use a systematic process to create, analyze and evaluate design alternatives.
4. Clearly justify and document engineering decisions.
5. Present technical details of the design with drawings, a report, testing plan, and a presentation.
6. Practice teamwork to accomplish a group project.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 190**
a	Ability to apply knowledge of mathematics, science, and engineering	M
b	Ability to design and conduct experiments and to analyze and interpret data	
c	Ability to design a system, component, or process to meet desired needs	D/M
d	Ability to function on multidisciplinary teams	D/M
e	Ability to identify, formulate, and solve engineering problems	M
f	Understanding of professional and ethical responsibility	D
g	Ability to communicate effectively	D
h	Understanding impacts of engineering solutions in the global, economic, and societal context	D
i	Recognition of need for, and ability to engage in lifelong learning	D
j	Knowledge of contemporary issues	D/M
k	Ability to use techniques, skills and modern engineering tools	M

I = Introduced, D = Developed and Practiced with feedback,
M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
    a. Problem Definition and Scoping
    b. Technical Writing
    c. Dimensioning
    d. Tolerances
    e. SolidWorks Drawings
    f. Assembly Drawing
    g. Bill of materials
    h. Analysis and Cost Evaluation
    i. Project Management/Scheduling
    j. Patents
    k. Engineering Ethics and Professional Behavior
    l. Presentation Skills

1. Course number and name: **ME 191 – Project Engineering II**

2. Credits and contact hours: 2 units (50 min/week lecture, 165 min/week laboratory)

3. Instructor's or course coordinator's name: Rustin Vogt

4. Textbook, title, author, and year: None
   Other supplemental materials: *Solid Works Tutorials*
   https://www.solidworks.com/sw/resources/solidworks-tutorials.htm

5. Specific course information
   a. Course Description (Catalog Description): Continuation of the project begun in ME 190. Part II consists of fabrication and assembly of equipment, testing, evaluation, and reporting..
   b. Prerequisites or Co-requisites: ME 190 (Project Engineering I)
   c. Course Designation: Required Course

6. Specific goals for the course
   a. Specific Outcomes of Instruction

<u>Course Learning Outcomes</u>

The student will be able to:

1. Manufacture and test a project from ME 190 with the same scope and complexity within the stated time and budgetary constraints.
2. Transform a "general" project concept into an actual prototype satisfying constraints, and objectives.
3. Negotiate effectively with suppliers
4. Use a systematic process to test, analyze and evaluate theoretical calculations with experimental data
5. Clearly justify and document engineering decisions.
6. Present technical details of final design modifications with drawings, a report and a presentation.
7. Practice teamwork to accomplish a group project.
8. Projects are deemed successful if comparison of experimental data with expected calculated theoretical data is technically justified.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

ABET a-k	**Student Outcomes**	**ME 191**
a	Ability to apply knowledge of mathematics, science, and engineering	M
b	Ability to design and conduct experiments and to analyze and interpret data	M
c	Ability to design a system, component, or process to meet desired needs	M
d	Ability to function on multidisciplinary teams	M
e	Ability to identify, formulate, and solve engineering problems	M
f	Understanding of professional and ethical responsibility	D
g	Ability to communicate effectively	M
h	Understanding impacts of engineering solutions in the global, economic, and societal context	M
i	Recognition of need for, and ability to engage in lifelong learning	D
j	Knowledge of contemporary issues	M
k	Ability to use techniques, skills and modern engineering tools	M

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M = Demonstrated as Mastery level appropriate for graduation

7. Brief List of Topics to be Covered
    a. Manufacturing
    b. Testing Methods
    c. Analysis
    d. Project Management/Scheduling
    e. Presentation Skills

Appendix B – Faculty Vitae

Please use the following format for the faculty vitae (2 pages maximum in Times New Roman 12 point type)

1. *Name*

2. *Education – degree, discipline, institution, year*

3. *Academic experience – institution, rank, title (chair, coordinator, etc. if appropriate), when (ex. 1990-1995), full time or part time*

4. *Non-academic experience – company or entity, title, brief description of position, when (ex. 1993-1999), full time or part time*

5. *Certifications or professional registrations*

6. *Current membership in professional organizations*

7. *Honors and awards*

8. *Service activities (within and outside of the institution)*

9. *Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation*

10. *Briefly list the most recent professional development activities*

1. **Robin Bandy**

2. Education
   1976 Ph.D. Metallurgical Science, University of Manitoba, Canada
   1972 M.S. Materials Science, University of Hawaii
   1965 B. Tech. Mechanical Engineering, I.I.T., India
   1961 B.Sc. Honors in Physics, University of Calcutta, India

3. Academic Experience:
   Professor (1988-present) Total years of service CSUS: 30
   Department Chair (2005-2008)
   Associate Professor (1985-88)

4. Non-Academic Experience:
   Metallurgist, Brookhaven National Laboratory, Upton,New York (1980-85
   Research Engineer, Whiteshell Research Laboratory,Atomic Energy of Canada, Pinawa, Manitoba (1978-80)
   Summer Research Fellow at Lawrence Livermore National Laboratory, Livermore, CA
   Summer Research Fellow at Naval Air Development Center, Warminster, PA

5. Professional Registration: none

6. Professional Memberships:
   Member, National Association of Corrosion Engineers
   American Society of Metals

7. Honors and Awards:
   Research grant of $10,000 per year for 1999, 2000, 2001 from Lockheed Martin Corp. to develop Design and Testing guidelines for Titanium strut hinges.

8. Service:
   Department: Chair (2005-2208), Curriculum, RTP, Graduate, Equipment, Hiring, Scholarship Committees
   College: Administrative Council

9. Publications: none

10. Professional Development:
    Research in the areas of design and testing guidelines for titanium strut hinges used in devices for deployment in Space.

1. **Estelle M. Eke**

2. Education
   1985 Ph.D. Aeronautical and Astronautical Engineering, Rice University
   1981 M.S. Mechanical Engineering and Materials Science, Rice University
   1978 B.S. Aeronautical and Astronautical Engineering, Purdue University

3. Academic Experience:
   Professor (1995 - Present) Total years of service CSUS: 25
   Associate Professor (1990 - 1995)
   Graduate Coordinator (1999 – 2002)
   Department Chair (2002 - 2005)
   Tuskegee University, Assistant Professor, Department of Aerospace Science Engineering, January 1988 - July 1990
   Rice University Research/Teaching Assistant, Mechanical Engineering and Materials Science, May 1980 - August 1984

4. Non-Academic Experience:
   Member Technical Staff, Navigation Systems Section, Jet Propulsion Laboratory, Pasadena, CA, August, 1984 - December, 1987

5. Professional Registration: None

6. Professional Memberships:
   AIAA
   ASME
   ASEE
   Phi Kappa Phi

7. Honors and Awards:
   Outstanding Teacher Award, College of Engineering and Computer Science, 2000-2001
   Faculty Award for Service and Support, Sigma Gamma Rho Sorority, CSUS, 1994
   Professor of the year, School of Engineering, Tuskegee University, 1989-1990
   Teacher of the year in Aerospace Engineering, Tuskegee University, 1988 and 1989
   Selected as one of American's Top 100 Black Business and Professional Women, Dollar & Sense Magazine, 1986
   Black Women of Achievement Award; NAACP Legal Defense and Education Fund, 1986
   Amelia Earhart Award, 1983-84

8. Service:
   Department (i) Member, Curriculum Committee; (ii) Member, Equipment Committee; (iii)Member, Hiring Committee; (iv) Member, RTP Primary Committee.

University (i) Proposal Reviewer: Provost's Research Incentive Fund (2014-15); (ii)Juror: Student Research Symposium (2013); (iii) Advisor: First Year Academic Program (2012 - 2014); (iv) Reader: Writing Placement for Juniors (WPJ) examination (2007 – present). **Community** (i) Reviewer: Engineering Mechanics Dynamics 6E, Meriam & Kraige, John Wiley & Sons, Inc. (2010). (ii) Reviewer: Automatic Controls System, Golnaraghi/Kuo Chapters 5 & 6, John Wiley & Sons, Inc. (2012); (iii) Robotics Competition Judge: Elementary MESA Day (2011-12); (iv) Robot Design Judge: FIRST Robotics Competition, University of California, Davis, CA (2007 – Present).

9. Publications:
   - **Eke, Estelle M.** (2015). *Introduction to Technical Problem Solving using MATLAB and LEGO MINDSTORMS NXT*. Proceedings of the American Society for Engineering Education Pacific Southwest Regional Conference. San Diego. 2015.
   - **Eke, Estelle M.** (2015)*Using Simulink, Matlab, and LEGO Mindstorms to teach a Project-Based Control Systems Design Course*. Proceedings of the American Society for Engineering Education Annual Conference. Seattle, Washington. 2015.

10. Professional Development:
    NSF/ASEE Funded Faculty Development Virtual Community Practice Grant (2013-14).
    CSU, Proven ENGR 110 Course Redesign Grant (2015-16). $14,148.

1. **Jose J. Granda**

2. Education
   1982 Ph.D. Mechanical Engineering, University of California, Davis
   1976 M.E., Mechanical Engineering, University of California, Berkeley
   1974 B.S. & M.S., Mechanical Engineering, National Polytechnic School, Quito, Ecuador

3. Academic Experience:
   Professor (1987-present) Total years of Service CSUS: 32 years
   Associate Professor (1983-87)
   Graduate Coordinator, 1996-1999
   Visiting Professor Institute for Dynamic Systems and Control, ETH (Swiss Federal Institute of Technology) Zurich, Switzerland, 2010.
   University of Applied Sciences, Darmstadt, Germany. Joint Master's Program Professor and coordinator. 2007- present.
   University of Applied Sciences Bonn-Rhein-Sieg, Germany. Visiting Professor, 1999-2000

4. Non-Academic Experience:
   NASA-ESMD Fellowship 2007 Senior Projects/Internships
   NASA Faculty Fellowship 2005 Space Station Centrifuge Module
   NASA Faculty Fellowship 2004 Morphing Project, Space Shuttle

5. Professional Registration: none

6. Professional Memberships:
   Editorial Board of the International Journal of Control Engineering 2006-present
   AIAA, American Institute of Astronautics and Aeronautics
   Technical Committee Activity Chair. Society for Computer Simulation, 1983-present.
   General Chair of International Conf. on Bond Graph Modeling and Simulation, ICBGM 2003, 2005

7. Honors and Awards:
   Honoris Causa Professor Wilhelm Büchner University of Applied Science, Darmstadt, Germany, 2010
   University Service Award, 2009

8. Service:
   Department: RTP, Curriculum, Equipment, Graduate Studies committees
   College: Member, College of ECS Personnel Board,

9. Publications:
   BOOKS:

   - **J. J. Granda** and D. C. Karnopp, eds. "Proceedings of ICBGM'2014. 11th International Conference on Bond Graph Modeling and Simulation" Simulation Series, Vol 46 Nr 8, SCS Publishing, ISBN: 978-1-63266-700-7 Summer 2014.

- **J. J. Granda** and F. E. Cellier, eds. "Proceedings of ICBGM'2012. 10th International Conference on Bond Graph Modeling and Simulation" Simulation Series, Vol 44 Nr 13, SCS Publishing, ISBN: 978-1-61839-985-4 Summer 2012.
- W. Borutzky, (Ed.)/ **J.J. Granda** "Bond Graph Modelling of Engineering Systems: Automating the Process for Modeling and Simulation of Mechatronics Systems" Chapter11 www.springer.com/978-1-4419-9367-0 ISBN 978-1-4419-9367-0 July, 2011.
- F. E. Cellier, and **J. J. Granda** eds. "Proceedings of ICBGM'2010. 9th International Conference on Bond Graph Modeling and Simulation" Simulation Series, Vol 42 Nr 2 2010, SCS Publishing, ISBN: 9-78161738-209-3 April 2010.

RESEARCH PAPERS:

- **Granda J.J**., "CAMPG in Control System Design Computer Generated Transfer Functions and State Space Models" 11th International Conference on Bond Graph Modeling and Simulation (ICBGM'2014) Monterey, California, July 2014.
- **Granda J.J**., Nguyen L., Touey B. "The Bond Graph Method for Dynamic Analysis of the Autonomous Morpheus Planetary Lander" 10th International Conference on Bond Graph Modeling and Simula- tion (ICBGM'2012) Genoa University, Genoa, Italy, July 2012.
- **Granda J.J.** Nguyen L., Hundal S. "Modeling The Space Station A Three Dimensional Rigid-Flexible Dynamic Model To Predict Modes Of Vibration And Stress Analysis" Guidance and Control Con- ference AIAA, Toronto, Canada August 2010
- Tuzcu I., Tuan D. A. Le, **Granda J.J.** "A Feasibility Study of Using Piezoelectric Actuators in Control of UAVs . The 12th Mechatronics Forum Biennial International Conference". Swiss Federal Institute of Technology, ETH Zurich, Switzerland. June 2010.
- Gibbons L., **Granda J.J** "Modeling Considerations For Nano-Systems Using Bond Graph Techniques" Proceedings of the 2010 International Conference on Bond Graph Modeling and Simulation. Or- lando, Fla. April 2010.
- **Granda J.J.** Teaching Virtual Product Design Using Dynamic Models at the Undergraduate and Graduate Levels . Virtual Product Development Conference. Phoenix, Arizona, April 2009

10. Professional Development:

Research in the areas of computer modeling and simulation of dynamic systems, mechatronics, space vehicles, control systems and finite element modeling Development of new software library for implementation in courses
ME 170, ME 171, ME 173, ME 270, ME241, ME272. Attended conferences to improve, FORTRAN, BASIC, C , Computer Graphics, CAD/CAM and modeling techniques.
Implement engineering applications on several operating systems such as: IBM/CMS 3000- 4000 (CMS), (MVS); CYBER 170/30; SUN (UNIX); Hewlett Packard (HPUX), IBM (DOS), WINDOWS, WINDOWS NT.

Susan L. Holl

1. Education
   1981 Ph.D Materials Science & Engineering, University of California, Berkeley
   1978 M.S. Materials Science & Engineering, University of California, Davis
   1976 B.S. Electrical Engineering and Materials Science & Engineering (double major), University of California, Davis

2. Academic Experience:
   Department Chair (2008- present) Total years of service CSUS: 35
   Professor, Department of Mechanical Engineering (1985-present)
   Associate Professor, (1980-1985)
   Teaching Assistant, Department of Materials Science and Engineering, University of California, Berkeley (1979-80), part-time
   Research Associate, Lawrence Berkeley Laboratory, Berkeley, CA (1979-80), part-time

3. Non-Academic Experience:
   Consultant, Materials joining processes, Vacuum Process Engineering, Sacramento, CA (1985-2006)
   Consultant in Materials Science, DMEA, Sacramento, CA (2001-2003)
   Consultant in Materials Science, Nimbus, Inc., Sacramento, CA (1981-1984),
   Sandia Laboratories, Member of Technical Staff (1976-1979)

4. Professional Registration: none

5. Professional Memberships:
   International Electrochemical Society
   American Society of Engineering Education
   Sigma Xi
   Tau Beta Pi

6. Honors and Awards:
   University Livingston Lecture Award, 2013; University Outstanding Service Award, 2006; Engineering and Computer Science Department of Mechanical Engineering Outstanding Service Award, 2002; Tau Beta Pi Outstanding Teaching Award for Mechanical Engineering, 2005

7. Service:
   Department: Chair (2008 – present), Primary RTP, Industry Advisory Committee, IAC Senior Project Sub-Committee, Equipment Committee, Curriculum Committee, Assessment Committee, Materials Science Curriculum Sub-Committee; Major Academic Advisor, New Student Orientation, authored Department Advising Manual; organized department events: preview day, Homecoming, Evening with Industry; thesis advisor
   College: write Instructionally Related Activities proposal (awarded annually between $39,000 and $60,000);Faculty advisor to the E&CS Student Joint Council, Tau Beta Pi, Competitive Robotics, Society of Women Engineers, Order of the Engineer; in conjunction

with University Career Center developed a “From Undergrad to Professional” seminar series; College Executive Committee; Commencement Coordinator; Coordinator for EOP retention programs (PERSIST and DEGREES)
University: Senate Executive Committee (2013-2015), Faculty Policies Committee Chair (2013-15), Faculty Policies Committee (2011-present); General Education Committee (2008 – present); Graduation Initiative Committee (2011- 2015); Intercollegiate Athletics Advisory Committee (2014 – present)
Professional: Tau Beta Pi: Secretary/Treasurer, Sacramento Alumnus Chapter, National Fellowship and Scholarship Board (1992 – 2014), Executive Council member, (2014-present)

8. Publications:
   - Nick Bennett, Isabelle Pauline Ferain, Patrick McNally, **Susan Holl**, Cindy Colinge, “Strain Characterization of Directly Bonded Germanium-to-Silicon Substrates Bonded Interface Properties”,*Electrochemical Society Trans.* 2013 50(7): 77-83
   - Ki Yeol Byun, Isabelle Ferain, Brenda Long, **Susan Holl,** Cindy Colinge, "Comprehensive investigation of Ge-Si bonded interfaces using surface activation", TMS Electronic Materials Conference, June, (2011)
   - **Susan Hol**l, Srinivasulu Korrapati, and C. Colinge ,"Optimization of Silicon-Silicon Adhesive Wafer Bonding", has been published in "ECS Transactions", Electrochemical Society Transactions 33 (4), 297-306 (2010)
   - **Susan L Hol**l, Srinivasulu Korrapati, Cynthia Colinge, “Optimization of Adhesive Wafer Bonding for Silicon,” TMS Electronic Materials Conference, June 2010
   - K. Y. Byun, S. Song, **S. Holl**, C. Colinge, I. Ferain, K. Hobart, and F. Kub, "Formation of Thin Film Strained Silicon on Flexible Polymer Substrates", ***Korean MEMS Society 11th Annual Conference***, (2009)

9. Professional Development:
   Created web-based self paced tutorial on binary equilibrium phase diagrams Creating “virtual tours” of Department of Mechanical Engineering labs
   NSF reviewer for the REU program
   Textbook reviewer for MATLAB and Materials Science textbooks for Wiley and Prentice-Hall.

1. **Patrick D. Homen**

2. Education
   2015- present Ph.D. program, Mechanical Engineering University of California, Davis
   1979 B.S. Biological Science, University of California, Davis

3. Academic Experience:
   Lecturer (2000 - present) Total years of service CSUS: 19
   Biomedical Engineering MS program, 1981 -1984,
   Lab Instructor, Department of Mechanical Engineering (1982 – 1985)

4. Non-Academic Experience:
   Industry Expert, California State Contractor's Board, 2001 – 2007
   Self Employed: Consultant, General Building Contractor, 2002 - 2006
   California C-8, construction contractor, Sacramento, CA, 1984 - 2003

5. Professional Registration: none

6. Professional Memberships:
   Tau Beta Pi

7. Honors and Awards:
   Outstanding Teaching Award, CSUS, 2012
   National Outstanding Chapter Advisor, Tau Beta Pi, 2010

8. Service:
   Department: Faculty advisor to Formula SAE, Academic Advisor
   College: Faculty advisor to CA Upsilon Tau Beta Pi, University Advising Center, EOP Introduction to Engineering course

9. Publications: none

10. Professional Development:
    Research in the areas of composite materials and mechanical properties of materials.

1. **Akihiko Kumagai**

2. Education:
   1993 Ph.D. Mechanical Engineering, University of Wisconsin-Milwaukee
   1985 M.S. Mechanical Engineering, University of Florida
   1983 B.S. Mechanical Engineering, University of Florida

3. Academic Experience:
   Professor (2011 – present) Total years of service CSUS: 15
   Associate Professor (2004-2011)
   Assistant Professor (2000-2004)
   Graduate Coordinator (2008 – present)
   Assistant Professor, Engineering Technology, Wayne State University, Detroit, MI (1996-2000)

4. Non-Academic Experience:
   United States Patent 7606690, "Method and Apparatus for Modeling Coil Spring Using a Force Field Generator," October 20, 2009
   NASA Kennedy Space Center (KSC), FL: Exploration Systems Mission Directorate (ESMD) faculty project for generating senior design projects, June 4 – August 10, 2007
   NASA Marshall Space Flight Center (MSFC), Huntsville, AL: Developed a closed-form forward kinematic analysis software package for the 6-DOF Stewart platform type docking simulator, May 30 – August 4, 2006
   Reflect Scientific Inc.: Automated filling station for micro titer plates, 2001 – 2006
   NHK International Co. (1998 – 2005): Spring force line generator for damper friction test of McPherson type automobile suspension system, 1998 – 2005
   Manufacturing Engineer, United Technologies, Automotive, Huntington, IN (1993-1996)
   Manufacturing Engineer, Motorola, Semiconductor Division, Sendai, Japan (1985-1988)

5. Professional Registration: None

6. Professional memberships:
   ASME (American Society of Mechanical Engineers)
   SAE (Society of Automotive Engineers)
   Society of Manufacturing Engineers (SME)
   Tau Beta Pi (Engineering Honor Society)

7. Honors and Awards:
   SME Distinguished Faculty Advisor Award, March 2014

8. Service:
   Administrative: Graduate Program Coordinator, Dept. of Mechanical Engineering, August 2011 – Present

Department level: Chair, Hiring Committee, Spring 2014; Chair, Appointment, Retention, Tenure, and Promotion (ARTP) Committee, August 2005 – May 2011; Faculty advisor: Formula SAE, Faculty advisor: SAE Mini Baja, Faculty advisor: SME
College level: Department representative for Personnel Board; Chair, Outstanding Award Committee, August 2010 – May 2011
University level: Chair, Peer Review Committee, February 2015 – Present; CSUS/Yokohama National University (Japan) Student Exchange Program Student Selection Committee, March 2001 – Present

9. Publications:
    - Mojica, J., **Kumagai, A.**, and Marsh, S., "Vibration Suppression Drafting Arm for Tremor Patients," Proceedings of the ASME International Mechanical Engineering Congress and Exhibition, San Diego, CA, November 15-21, 2013, Paper No. IMECE2013-65217.
    - Liu, T.I., **Kumagai, A.**, Wang, Y.C., Song, S.D., Fu, Z., and Lee, J., "On-Line Monitoring of Boring Tools for Control of Boring Operations," International Journal of Robotics and Computer-Integrated Manufacturing, Vol. 26, No. 3 June 2010, pp. 230-239.
    - **Kumagai, A.**, Liu, T-I, Sul, D., "Radio Frequency Fuel Gauging with Neuro-Fuzzy Inference Engine for Future Spacecrafts," Proceedings of the 10th International Association of Science and Technology for Development (IASTED) Conference on Artificial Intelligence and Applications (AIA), Innsbruck, Austria, February 15-17, 2010, Paper No. 674-020.
    - **Kumagai, A.**, Suh, Y., Tracy, T., Naritomi, K., and Pierson, K., "Developing a Pen for Tremor Patients," Proceedings of the 29th IASTED Conference on Modeling Identification and Control (MIC), Innsbruck, Austria, February 15-17, 2010, Paper No. 675-019.

10. Professional Development:
    Development of Quality Control courses with American Society of Quality (ASQ) and College of Continuing Education (CCE) at CSUS, November 2014 – Present
    NSF/CSU Faculty-lead I-CORPs Team project for developing a mechanical assisting device for tremor patients handwriting, March 2015 – Present

1. **Tien-I Liu**

2. Education
   1987, Ph.D., Mechanical Engineering, University of Wisconsin-Madison,
   1973, M.S., Mechanical Engineering, University of Wisconsin-Madison,.
   1968, B.S., Mechanical Engineering, National Taiwan University,.

3. Academic Experience:
   Professor, FERP (2010 – present)   Total years of service CSUS: 28
   Professor (1992 – 2010)
   Associate Professor (1987 – 1992)
   Professor, Associate Professor, Department of Mechanical Engineering, National Central University, Taiwan, 1979-1984. Full time.
   Associate Professor, Lecturer, Department of Mechanical Engineering, Tamkang University, Taiwan, 1974-1979. Full time.
   Instructor, Air Force Technical Academy, Taiwan, 1968-1969. Full time.

4. Non-academic Experience:
   - Manufacturing Engineer, Cummins Engine Co., Indiana, 1973-1974. Full time.
   - Gage Engineer, Timex Watches Co., Taiwan, 1970-1971. Full time.
   - Mechanical Engineer, General Instruments Co., Taiwan, 1969-1970. Full time.
   - "Optimum Face Milling Cutter", Patent No. 24331 of Taiwan

5. Professional Registrations:
   Registered Professional Engineer, Taiwan.

6. Professional Organizations:
   Fellow, American Society of Mechanical Engineers (ASME)
   Permanent Member, Chinese Institute Engineers/U.S.A. (CIE/USA)
   Permanent Member, Chinese Institute of Engineers/Taiwan (CIE/Taiwan)
   Permanent Member, Chinese Society of Mechanical Engineers/Taiwan (CSME/Taiwan)

7. Honors and Awards:
   Invited Speaker, International Symposium on Precision Engineering Measurement and Instrumentation, Guiang, China, 2013.
   Invited Speaker, International Symposium on Precision Engineering Measurement and Instrumentation, Lijiang, China, 2011.
   Fellow, American Society of Mechanical Engineers (ASME), 2006.
   CSUS Outstanding Teaching Award, 2006.
   Best Paper Award of IEA and JOSE, 2006.

8. Service Activities (within and outside of the institution from the past five years)
   Department: Member of Curriculum Committee, Graduate Studies Committee
   College: Personnel Board (secondary RTP)
   Professional: Consultant, Industrial Safety and Health Association, Taiwan, 2014 – present.
   Consultant, Institute of Occupational Safety and Health, Taiwan, 1994-1995.

Session Chairman at numerous the International Symposia on Precision Engineering Measurement and Instrumentation

9. Publications and Presentations (partial list)
    - “On-line Detection and Measurements of Tool Wear for Precision Boring of Titanium Components,” Journal of Engineering Manufacture, DOI: 10.1177/0954405415587671, 2015
    - “Tool Condition Monitoring (TCM) Using Neural Networks," International Journal of Advanced Manufacturing Technology, Vol. 78, Issue 9, pp. 1999-2007, 2015
    - “Intelligent Measurements for Monitoring and Control of Glass Production Furnace for Green and Efficient Manufacturing,” International Journal of Advanced Manufacturing Technology, Vol. 75, Issue 1, pp. 339 – 349, 2014
    - “Real-time Recognition of Ball Bearing States for the Enhancement of Precision, Quality, Efficiency, Safety, and Automation of Manufacturing,” International Journal of Advanced Manufacturing Technology, Vol. 71, Issue 5, pp. 809-816, March, 2014
    - “On-Line Detection and Measurements of Drill Wear for the Drilling of Stainless Steel Parts,” International Journal of Advanced Manufacturing Technology, Vol. 68, Issue 5, pp. 1015-1022, September, 2013
    - “On-Line Monitoring and Measurements of Tool Wear for Precision Turning of Stainless Steel Parts,” International Journal of Advanced Manufacturing Technology, Volume 65, Issue 9, pp. 1397-1407, April, 2013
    - “Monitoring and Diagnosis of Tapping Process for Product Quality and Automated Manufacturing,” International Journal of Advanced Manufacturing Technology, Vol. 64, Issue 5, pp. 1169-1175, February, 2013
    - “The Effect of Shift Distribution on the Design and Performance of the X and CUSUM Charts in Monitoring Process Mean and Variability,” European Journal of Industrial Engineering, Vol. 7, No. 2, pp. 224-247, 2013
    - “A Control Scheme Integrating the T Chart and TCUSUM Chart,” Quality and Reliability Engineering International, Volume 27, pp. 529-539, 2011
    - “A Knowledge-based System of High Speed Machining for the Manufacturing of Products,” International Journal of Knowledge-based and Intelligent Engineering Systems, Vol. 14, No. 4, 2010
    - "On-Line Monitoring of Boring Tools for Control of Boring Operations," International Journal of Robotics and Computer Integrated Manufacturing, Volume 26, Issue 3, pp. 230-339, June, 2010
    - “Radio Frequency Fuel Gauging with Neuro-Fuzzy Inference Engine for Future Spacecrafts,” the 10th International Association of Science and Technology for Development (IASTED) Conference on Artificial Intelligence and Applications (AIA), Innsbruck, Austria, Paper No. 674-020, 2010

10. Briefly list the most recent professional development activities:
    Many industrially sponsored projects such as:
    Lockheed Martin Space Corporation, conducted a research project entitled “Tool Condition Monitoring (TCM) Using Neural Networks”, 2010-2015.

1. **Tim Marbach**

2. Education:
   2005 Ph.D. Mechanical Engineering, University of Oklahoma, Norman, OK
   2001 B.S. Engineering Science, St. Mary's University, San Antonio, TX

3. Academic Experience:
   Associate Professor (2010-Present) Total years of service CSUS: 10
   Assistant Professor (2005-2010)
   Process Technology Instructor, UC Davis Master Brewer Program (2009-Present)

4. Non-Academic Experience:
   US Dept of Energy Gas Turbine Industrial Fellowship, Siemens-Westinghouse, 2003
   US Army Fuels and Lubricants Research Facility, Southwest Research Inst., 1997-2001

5. Professional Registration: None

6. Professional Memberships:
   - ASME
   - Tau Beta Pi
   - ASEE

7. Honors and Awards:
   Outstanding Teaching Award, College of Engineering and Computer Science, 2010
   CSUS Tau Beta Pi Outstanding Instructor Award, 2007

8. Service:
   University: Vice-Chair, Faculty Senate, 2012-2013; Chair, Instructional Program Priorities (IPP) Taskforce, 2012-2013; Chair, Academic Resource Allocation Decision Making Task Force, 2014-Present; Chair, University Elections Committee, 2012-2013; Senator, Faculty Senate, 2008-2014; Member, Provost Search Committee, 2013; Member, University Elections Committee, 2011-2013; Chief Marshall, Commencement, Fall 2012, Fall 2013, Spring 2014
   College: Member, Engineering and Computer Science Dean Search Committee, 2014; Member, College of Engineering and Computer Science, Outstanding Awards Committee, 2010-14; Faculty Advisor, Tau Beta Pi, 2010-Present
   Department: Faculty Advisor, ASME, 2010-Present; Chair, Mechanical Engineering Hiring Committee, 2011-12 and 2012-13; Member, RTP Committee, 2010-2011; Advisor, Masters Thesis, Yuk Cheung, 2010; Advisor, Masters Thesis, Chandon Sohi, 2010; Advisor, Masters Thesis, Jorge Chavero, 2012; Advisor, Masters Thesis, Pradeep Garlapati, 2012; Advisor, Masters Thesis, Duff Harrold, 2013; Advisor, Masters Thesis, Adnan Bedri, 2013; Advisor, Masters Thesis, Betty Bui, 2013; Advisor, Masters Thesis, Manual Verduzco, 2014; Advisor, Masters Thesis, Levi Bowers, 2014

9. Publications:
   - **Marbach, T.L**., "Significant Learning in Renewable Energy," Proceedings of the 121st ASEE Annual Conference and Exhibition, Paper No. 8622, 2014.
   - Dent, T.J., **Marbach, T.L**. and Agrawal, A.K., "Computational Study of a Mesoscale Combustor with Annular Heat Recirculation and Porous Inert Media," Numerical Heat Transfer, Vol. 61, No. 12, pp. 873-890, 2012.
   - Chavero, J., Harrold, D., and **Marbach, T.L**., "Equilibrium and Kinetics Analysis of NOx reduction from Biogas Combustion," Proceedings of ASME Power 2011, ASME Paper No. POWER2011-55313, 2011.
   - Proceedings of the 41st Heat Transfer and Fluid Mechanics Institute, Edited by **T.L. Marbach**, 2010.
   - Sohi, C. and **Marbach, T**. "A Review of Microalgae-Based Aviation Fuels," Proceedings of the 41st Heat Transfer and Fluid Mechanics Institute, 2010.

10. Professional Development:
    Author and Subject Matter Expert, McGraw-Hill Higher Education, 2013-Present.
    Appliance Energy Efficiency Testing, California Energy Commission, June 2014-June 2015, $200,000.
    Project Sprinter, Marchon Eyewear, June-December 2014, $12,895.

1. **Marcus Romani**

2. Education
   2005, M.S. Mechanical Engineering, CSU Sacramento
   2002, M.S. Mechanical Engineering, CSU Sacramento
   1990 Teaching Credential, Mathematics, U.C. Davis
   1985 A.B, Philosophy of Science, Princeton University

3. Academic Experience
   Lecturer (2009 – present)   Total years of service CSUS: 6
   High School and Junior High Teacher, Sacramento Country Day School (1989-2001)
   High School Teacher, St. Paul's School for Boys, Brooklandville, MD (1985-1987)

4. Non-Academic Experience
   Senior Mechanical Engineer, Meline Engineering, Sacramento, CA (2003-2014)
   Mechanical Design Engineer, Mazzetti & Associates (2002 – 2003)

5. Professional Registration: Mechanical Engineering, California

6. Professional Memberships: None

7. Honors and Awards:
   Francie Tidey Award for Educational Excellence, Sacramento Country Day School, 2012

8. Service: None

9. Publications: None

10. Professional Development
    For the last five years, have done mechanical engineering consulting work at Meline Engineering Corporation (www.meline.com), designing mechanical, plumbing, and solar systems for a variety of building applications. Currently consulting as a sole practitioner.

1. **Kenneth S. Sprott**

2. Education
   2000 Ph.D. Mechanical Engineering, University of California, Davis
   1992 M.S. Mechanical Engineering, University of California, Irvine
   1992 B.S. Mechanical Engineering, University of California, Berkeley

3. Academic Experience:
   Associate Professor (2008 – present) Total years of service CSUS: 12
   Assistant Professor (2003 – 2008)
   Graduate Coordinator, 2004 - 2008
   Research Engineer, Department of Mechanical Engineering, University of California, Davis (2001-2003)
   Instructor, Department of Mechanical Engineering, University of California, Davis, 1997, 2003
   Instructor, California Maritime Academy, Vallejo, CA, 1993

4. Non-Academic Experience:
   Consulting Engineer, Independent Contractor, 2003 – present
   Alstom Automation Schilling Robotics, Davis, CA, 1997 – 2001
   Advanced Highway Maintenance and Construction Technology Center, Davis, CA, 1992 – 1997
   McDonnel Douglas Space Systems Co, Huntington Beach, CA, 1986 - 1992

5. Professional Registration: none

6. Professional Memberships:
   ASME

7. Honors and Awards: None

8. Service:
   Department: Assessment Coordinator, Curriculum Committee, Graduate Committee, Equipment Committee, Hiring Committee
   University: Graduate Studies Policies Committee (2010-Present)

9. Publications:
   - **K. Sprott**, Surface Normal Interpolation for Five Axis CNC Milling, submitted to *International Journal of Advanced Manufacturing Technology*, January 2015
   - **K. Sprott** and B. Ravani, Cylindrical milling of ruled surfaces, *International Journal of Advanced Manufacturing Technology*, September 2008, Volume 38, Nos. 7/8 Pages 649-656

10. Professional Development:
    Developed BS/MS Blended program; eAcademy; thesis advisor

1. **Yong S. Suh**

2. Education
   1995 Ph.D. Mechanical Engineering, Rensselaer Polytechnic Institute, Troy, NY
   1989 M.S. Mechanical Design & Production Engineering, Seoul National University, Seoul, Republic of Korea
   1987 B.S. Mechanical Design & Production Engineering, Seoul National University, Seoul, Republic of Korea

3. Academic Experience:
   Associate Professor (2011 – present) Total years of service CSUS: 11
   Assistant Professor (2004 – 2011)

4. Non-Academic Experience:
   1998- 2003 Senior Software Engineer, SolidWorks Corporation, Concord, MA
   1995-1998 Software Engineer, Structural Dynamics Research Corporation, Milford, OH

5. Professional Registration: None

6. Professional Memberships:
   American Society of Mechanical Engineers (ASME)
   American Society for Engineering Education (ASEE)

7. Honors and Awards:
   Certificate of SolidWorks Associate
   Research and Creative Activity Awards 2008-2009
   Research and Creative Activity Awards 2007-2008

8. Service:
   Department: Chair, Equipment Committee, Curriculum Committee, Graduate Committee, Hiring Committee, Faculty Senate
   College: Academic Council (2004-2006, 2008-present)
   University: University Academic Information Technology Council (2004 – 2006)
   Reviewer for Research and Creative Activity Awards (2005-2007)

9. Publications:
   - **Yong S. Suh**, "Development of a Computer Software using Human Computer Interaction", 9th North-West US-Korea Conference on BNCIT (Bio-Nano, Communications-Information, Transportation) Systems Technology, Portland State University, Portland, OR, October 4-5, 2014
   - **Yong S. Suh,** "Development of Educational Software for Beam Loading Analysis using Pen-Based User Interfaces", Journal of Computational Design and Engineering, January 2014, Vol 1(1):67-77
   - Chunhyun Paik, **Yong S. Suh**, "Generalized Queueing Method for Call Blocking Probability and Resources Utilization in OFDM Wireless Networks, IEEE Communications Letters, 15(7):767-769, June 2011

- **Yong S. Suh**, “Development of an Educational Software Tool for Interpretations of Multiview Engineering Drawings”, Computer-Aided Design and Applications, 219-229, 2009

10. Professional Development:
    CSU Promising Course Redesign Award for ENGR 6, 2015-2016
    UEI Provost’s Research Incentive Award, 2014
    eAcademy, June 2014

1. Ray Tang

2. Education
   2009 Ph.D. Mechanical and Aeronautical Engineering, University of California, Davis
   2004 M.S. Mechanical Engineering, University of Wisconsin, Madison

3. Academic Experience:
   Lecturer (2014 - present) Total years of service CSUS: 1
   Post-Doctoral Researcher (2013 -2014), Department of Mechanical Engineering, University of California, Davis
   Graduate Student Researcher (2004 -2009), Department of Mechanical Engineering, University of California, Davis
   Graduate Research Assistant (2002 -2004), Department of Mechanical Engineering, University of Wisconsin, Madison

4. Non-Academic Experience:
   SiGNa Chemistry, Inc, Davis, CA, 1984 – 2003
   Senior Mechanical Engineer – hydrogen and fuel cell generators

5. Professional Registration: none

6. Professional Memberships:
   Tau Beta Pi

7. Honors and Awards:
   Outstanding Teaching Award, CSUS, 2013
   National Outstanding Chapter Advisor, Tau Beta Pi, 2010

8. Service:
   Department: Faculty advisor to Formula SAE
   College: Faculty advisor to CA Upsilon Tau Beta Pi

9. Publications:
   - **H.-Y. Tang**, J. Greenwood, P. Erickson, "Modeling of a Fixed-bed Copper-based Catalyst for Reforming Methanol: Steam and Autothermal Reformation," *International Journal of Hydrogen Energy*, Volume 40, Issue 25, May 2015
   - D. Santamaria, **H.-Y. Tang**, J. Park, T.-H. Yang, Y.-J. Sohn, "3D Neutron Tomography of a Polymer Electrolyte Membrane Fuel Cell under Sub-Zero Conditions," *International Journal of Hydrogen Energy*, Volume 37, Issue 14, Pages 10836-10843, July 2012
   - **H.-Y. Tang**, C. Winkelmann, W. Lestari, V. La Saponara, "Composite Structural Health Monitoring Through Use of Embedded PZT Sensors," *Journal of Intelligent Material Systems and Structures*, vol. 22, pp. 739-755, 2011
   - **H.-Y. Tang**, C. Winkelmann, V. La Saponara, W. Lestari, *Embedded sensors for composite structural health monitoring*, Proceedings of the SAMPE 2008 International Symposium and Exhibition, May 2008, Long Beach, CA

- Winkelmann, **H.-Y. Tang**, V. La Saponara, *Influence of Embedded Structural Health Monitoring Sensors on the Mechanical Performance of Glass/Epoxy Composites*, Proceedings of the SAMPE 2008, International Symposium and Exhibition, May 2008, Long Beach, CA

10. Professional Development:
    Developing sponsored projects for the Senior Project capstone sequence.

1. **Troy David Topping**

2. Education
   Ph.D. Materials Science and Engineering, University of California, Davis, 2012
   B.S. Mechanical Engineering, California State University, Sacramento, 2004

3. Academic experience
   Assistant Professor (2013 – Present) Total years of service CSUS:10
   UC Davis, Assistant Adjunct Professor, 2013 – Present, part time
   UC Davis, Postdoctoral Scholar, 2012 – 2013, full time
   CSUS, Lecturer, 2005 – 2012, part time

4. Non-academic experience
   Aerojet,Materials Science Engineering Internship, 2005, full time
   Spectramerica, Inc., Operations Manager, 1999-2000, full time

5. Certifications or professional registrations
   EIT Spring 2003 – California certificate number 117571
   EDM certified by Mitsubishi World/ MC Machinery Systems – Spring 2006
   Chemical-terrorism Vulnerability Information Authorized User - CVI-20120222-1078397
   Industrial Hygiene Safety Training via UC Davis Extension – Course # 123HSD511

6. Current membership in professional organizations
   TMS, Tau Beta Pi, ASM

7. Honors and awards
   Light Metals Magnesium Best Poster Award – 2nd Author (TMS 2012)
   Bronze award for Ultrafine-Grained Materials: 6th International Symposium: Poster Session (TMS 2010)
   National Physical Science Consortium (NPSC) fellowship, 2-year award from Sandia National Labs (May 2008)
   Silver award for Ultrafine-Grained Materials: 5th International Symposium: Poster Session (TMS 2008)
   Chancellor's Doctoral Incentive Program (CDIP) forgivable loan program, three year award (Fall 2007)

8. Service activities
   Department: Hiring Committee, Equipment Commitment
   College: Academic Council, Advisor for student organizations (ASME and TBP)
   University: General Education Course Review Subcommittee
   Community: Co-Organizer for Symposium at MS&T 2015, Peer Reviewer for Materials Science & Engineering A, Metallurgical Material Transactions A, Acta Metallurgica Sinica (English Letters), Journal of Composite Materials, Adjunct teaching at UC Davis

9. Select Publications and Presentations:
   Publications:
   - Hu, T., Ma, K., **Topping, T.D**., Saller, B., Yousefiani, A., Schoenung, J.M., and Lavernia, E.J., "Improving the tensile ductility and uniform elongation of high-strength ultrafine-grained Al alloys by lowering the grain boundary misorientation angle," *Scripta Materialia*, 78–79, 25–28, (2014).
   - Yang, H., **Topping, T.D**., Wehage, K., Jiang, L., Lavernia, E.J., and Schoenung, J.M., "Tensile behavior and strengthening Mechanisms in a Submicron B_4C-Reinforced Al Trimodal Composite," *Mater. Sci. Eng. A.*, 616, 35-43, (2014).
   - Zhang, Y., **Topping, T.D**., Lavernia, E.J., and Nutt, S.R., "Dynamic Micro-Strain Analysis of Ultrafine-Grained Aluminum Magnesium Alloy Using Digital Image Correlation," *Metall. Mater. Trans. A*, 45, 47–54, (2014).
   - Hu, T., Ma, K., **Topping, T.D**., Schoenung, J.M., & Lavernia, E.J., Precipitation phenomena in an ultrafine-grained Al alloy. *Acta Materialia*, 61, 2163-2178, (2013).
   - **Topping, T.D**., Ahn, B., Nutt. S.R., and Lavernia, E.J., "Influence of hot isostatic pressing on microstructure and mechanical behaviour of nanostructured Al alloy," *Powder Metall.*, 56, 276–287, (2013).
   - **Topping, T.D**., Hu, T., Manigandan, K., Srivatsan, T.S., & Lavernia, E.J., Quasi-static deformation and final fracture behaviour of aluminium alloy 5083: influence of cryomilling. *Philosophical Magazine*, 93(8), 899-921, (2012).
   - **Topping, T.D**., Ahn, B., Li, Y., Nutt, S.R., and Lavernia, E.J., "Influence of process parameters on the mechanical behavior of an ultrafine-grained Al alloy," *Metall. Mater. Trans. A,* 43, 505–519, (2012).
   - Zhang, Z. H., **Topping, T.D**., Li, Y., Vogt, R., Zhou, Y.Z., Haines, C., et al.,"Mechanical behavior of ultrafine-grained Al composites reinforced with B_4C nanoparticles," *Scripta Materialia,* vol. 65, pp. 652-655, (2011).

   Presentations:
   - UKC 2014 – August 6-9, 2014 – San Francisco, CA, *High Strength Aluminum Alloys Produced via Cryomilling* – Invited
   - TMS – Spring 2014 – San Diego, CA**,** *Engineering Nanostructured Materials for Extreme Applications* – Invited**;** *Influence of Sc and Zr Additions on the Microstructure and Mechanical Properties of Powder Metallurgy Al Mg Alloys*
   - TMS – Spring 2013 – San Antonio, TX, *A Comparative Investigation of UFG and CG AA 2139 Microstructures and Mechanical Behavior Prepared by Cryomilling and Conventional Routes*
   - MS&T – Fall 2012 – Pittsburgh, PA, *Microstructural Evolution of a Strain-Hardened, Ultra-Fine Grained Al-Mg Alloy* – Oral
   - PowderMet – June 2012 – Nashville, TN, *Consolidation of Nanostructured Al and Ti via Spark Plasma Sintering and Quasi-Isostatic Forging* –Invited; Session Chair – HIP Processing Session 28

10. Professional Development:
    CSU, Promising Course Redesign ENGR 45 (2015-16), $15,971, STEM Student Success Faculty Learning Community (2014-15), $600, Writing Across the Curriculum Faculty Learning Community (2014-15), $400, NSF Grant Writing Workshops (2015)

1. **Ilhan Tuzcu**

2. Education
   2001 Ph.D. Mechanical Engineering, Virginia Tech University
   1996 M.S. Mechanical Engineering, University of Connecticut
   1990 B.S. Mechanical Engineering, Dokuz Eylul University, Turkey

3. Academic Experience:
   Associate Professor (2012 - Present)   Total years of service CSUS: 7
   Assistant Professor (2008 - 2012)
   Assistant Professor, Department of Aerospace Engineering and Mechanics, University of Alabama, Tuscaloosa, AL. (2004 – 2008)
   Research Associate, Department of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA. (2002 – 2004)

4. Non-Academic Experience:
   Research Fellow, NASA Ames Research Center, Moffett Field, CA.
   (summer 2009, 2010, 2012)

5. Professional Registration: None

6. Professional Memberships:
   AIAA
   ASME

7. Honors and Awards:
   Research Grant of $1,000, UEI Faculty Grants Program, 2014
   Research Grant of $5,000, Provost's Research Incentive Fund, 2014
   Recipient of Turkish Council of Higher Education Scholarship, 1994-1998.

8. Service:
   Department: Hiring Committee, Curriculum Committee, ME Chair Selection Committee
   College: Awards Committee, Academic Council
   University: Research and Creative Activity Subcommittee
   Faculty Advisor for the AIAA Sacramento Student Branch
   Member of the Society of Automotive Engineers (SAE) Unmanned Aerial Systems Committee.
   Session organizer of flight sciences at the SAE 2011 AeroTech Congress & Exhibition, October 18-21, 2011, Centre de Congres Pierre Baudis & Toulouse Expo Toulouse, France.
   Reviewer of many journal and conference papers.

9. Publications:
    - **Tuzcu, I.** and Nguyen, N, “Flutter of Maneuvering Aircraft,” *ASCE Journal of Aerospace Engineering*, in press.
    - Moua, J. K. and **Tuzcu, I**., “Thermal Damping of Vibration of a Cantilever Beam,” *AIAA Region VI Student Conference*, March 1-2, Sacramento, CA, 2014.
    - **Tuzcu, I.** and Gonzalez-Rocha, J., “Modeling and Control of a Thermoelastic Beam,” *Proceedings of the ASME 2013 Dynamic Systems and Control Conference*, October 21-23, Palo Alto, CA, 2013.
    - **Tuzcu, I**., Awni, K, and Gonzalez-Rocha, J., “Stability Prediction of a UAV,” *SAE International Journal of Aerospace*, Vol. 4, No 2, Nov. 2011, 1441-1448.
    - **Tuzcu, I.**, and Nguyen, N., “Unsteady Aeroelasticity of Generic Transport Model,” *AIAA Atmospheric Flight Mechanics Conference*, Portland, Oregon, Aug. 8-11, 2011. AIAA-2011-6319.
    - Nguyen, N., **Tuzcu, I**., Yucelen, T., and Calise, A., “Longitudinal Dynamics and Adaptive Control Application for an Aeroelastic Generic Transport Model,” *AIAA Atmospheric Flight Mechanics Conference*, Portland, Oregon, Aug. 8-11, 2011. AIAA-2011-6291.
    - **Tuzcu, I.**, and Nguyen, N., “Aeroelastic Modeling and Adaptive Control of GTM,” *AIAA Atmospheric Flight Mechanics Conference*, Toronto, Canada, 2 - 5 Aug. 2010.
    - **Tuzcu, I.**, Le, T. D. A, and Granda, J. J., A Feasibility Study of Using Piezoelectric Actuators in Control of UAVs, *Mechatronics 2010*, June 28 - 30, Swiss Federal Institute of Technology ETH, Zurich Switzerland.
    - **Tuzcu, I**., and Nguyen, N., “Adaptive Control of Flexible Aircraft,” *51th AIAA/ASME/ASCE/ AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Orlando, FL, 12 - 15 Apr 2010.
    - **Tuzcu, I**., “A Computational Approach to Robust Stability of Linear Time-Invariant Systems with Single Time-Delay,” *Int. Journal of Robust and Nonlinear Control*, 20 (2010), 1981-1992.

10. Professional Development:
    AIAA Region VI Student Conference, March 1-2, Sacramento, CA, 2014.
    ASME 2013 Dynamic Systems and Control Conference, October 21-23, Palo Alto, CA, 2013.
    AIAA Atmospheric Flight Mechanics Conference, Portland, Oregon, Aug. 8-11, 2011.
    Teaching Institute, Center for Teaching and Learning, California State Univ., Sacramento, 2010.
    51th AIAA/ASME/ASCE/ AHS/ASC Structures, Structural Dynamics, and Materials Conference, Orlando, FL, 12 - 15 Apr 2010.

1. **Rustin G. Vogt**

2. Education
   2010 Ph.D. Materials Science, University of California, Davis
   2004 B.S. Mechanical Engineering, California State University Sacramento

3. Academic Experience:
   Assistant Professor (2014 – present) Total years of service CSUS: 8
   Full-time Lecturer, Mechanical Engineering (2010-2014)
   Part-time Lecturer, Mechanical Engineering (2008-2010)
   Adjunct Faculty, Engineering, American River College (2010-2011)
   Teaching Assistant, Chemical and Materials Science, University of California, Davis (2007-2008)

4. Non-Academic Experience:
   Building Systems Management and Engineering, Energy Consultant, Sacramento, CA (2004-2005)

5. Professional Registration: none

6. Professional Memberships:
   ASME
   SAE
   MRS
   Tau Beta Pi

7. Honors and Awards: none

8. Service:
   Department: Academic Advising (2014-Present)
   University: Academic Policies Committee (2014-Present)
   University: Academic Standards Subcommittee (2014-Present)

9. Publications:
   - Zhang. Z, Li, Y, **Vogt. R**, Zhou, Y., Schoenung, J. Lavernia, E.,"Critical grain size for nanocrystallin-to-amorphous phase transition in Al solid solution" Philosophical Magazine Letters. 92(5), 235-244 (2012).
   - M. Navarro, **R. Vogt**, Stress-assisted corrosion of aluminum 6061 in basic solution. McNairScholars Journal.*12 94-104.* (2011).
   - Y. Li, Z. Zhang, **R. Vogt**., *et. al*.. Boundaries and interfaces in ultrafine-grain composites. Acta Materialia. *59*(19) 7206-7218. (2011).
   - Zhang, Z. Topping, T., Li, Y., **Vogt, R**., Zhou Yizhang., Haines, C., Paras, J., Kapoor, D., Schoenung, J. Lavernia., E. "Mechanical behavior of ultrafine-grain aluminum composites reinforced with B_4C" Scripta Materialia (65) 652-655. (2011).

- Zhang, Z. ; Dallek, S., **Vogt, R**., Li, Y., Topping, T., Zhou, Y., Schoenung, J., Lavernia, E., "Degassing Behavior of Nanostructured Al and Its Composites" Metallurgical and Materials Transactions A, Vol.41(2), pp.532-541 (2010).

10. Professional Development:
FUNDED CONTRACTS: "Sacramento Municipal Utility District, SMUD, Tiny House Competition to Deliver a Net-Zero Home under 400 square feet", Sacramento, CA, 2014, $5,000.
"Seated Rehabilitation Stepper in Collaboration with the Physical Therapy Department at CSUS", Sacramento, CA, 2013, $1,279.
THESIS/PROJECT ADVISOR
Braden, David, "Integrating a Night Sky Radiator into a Ground Source Heat Pump System", Spring, 2015.
Lara, Danielle, "Thermal and Mechanical Behavior of Fiber Reinforced Epoxy", McNair Scholars Program, Spring 2015
Navarro, Marcos, "Stress-Assisted Corrosion of 6061 in Basic Solution", McNair Scholars Program, Spring 2011

1. **Dongmei Zhou**

2. Education
   Ph.D. Mechanical Engineering, University of Texas at Austin, 2005
   M.E. Mechanical Engineering, University of Shanghai for Science and Technology, 1990.
   B.E. Mechanical Engineering, University of Shanghai for Science and Technology, 1987.

3. Academic Experience:
   Associate Professor (2011– present) Total years of service CSUS: 10
   Assistant Professor (2005 – 2011)

4. Non-academic Experience: None

5. Professional Registrations: None

6. Current Membership in Professional Organizations
   American Institute of Aeronautics and Astronautics (AIAA), 2006-2008
   American Physical Society (APS), Division of Fluid Dynamics, 2004-present
   American Society of Mechanical Engineers (ASME), 1998-present
   Society of Women Engineers (SWE), 2008-present

7. Honors and Awards: None
   .
8. Service:
   University: Member, Planning Committee for 2013 Expanding Your Horizons (EYH) Conference, Sacramento, CA, May 2013 – October 2013; Senator, California State University, Sacramento, 2014-present; Faculty Adviser, Society of Women Engineers, Sacramento Valley Section, Sacramento, CA, 2007-2012
   Department: Chair, Elections Committee, 2013.

9. Publications:
   - Christopher Tremblay and **Dongmei Zhou**, "A Study of Efficient Drying Parameters For Bed Dryers," Proceedings of the 2nd International Conference on Fluid Flow, Heat and Mass Transfer, Ottawa, Ontario, Canada, May 2015, Paper No. 179.
   - Dagoberto Calamateo and **Dongmei Zhou**, ","Proceedings of the 2nd International Conference on Fluid Flow, Heat and Mass Transfer, Ottawa, Ontario, Canada, May 2015, Paper No. 180.
   - **Dongmei Zhou** and Jennifer A. Eden, "Optimal Design of the Pelamis Wave Energy Converter," International Journal of Offshore and Polar Engineering, Submitted Sept. 8, 2014.
   - **Dongmei Zhou** and Brian Barrie, "Computer Room Air Handler (CRAH) Subfloor Airflow Analysis For Datacenters," IMECE2014-36269, Proc. of 2014 ASME International Mechanical Engineering Congress and Exposition November 14-20, 2014, Montreal, Quebec, Canada.

- **Dongmei Zhou** and Sung Hong Park, “Simulation-Assisted Management And Control Over Building Energy Efficiency – A Case Study”, 2011 2nd International Conference on Advances in Energy Engineering (ICAEE2011), December 26-28, Bangkok, Thailand, 2011.
- **Dongmei Zhou** and Jeremy W. Dabel, “Modeling and Optimization of a Proton Exchange Membrane Fuel Cell Based on Self-Hydrating Coupled Cathode Design”, International Review of Mechanical Engineering, v4, n5, July 2010.
- Feysal A. Adem, **Dongmei Zhou** and Pramod Krishnani, “CFD Analysis of Drag Reduction Using External Devices on Pickup Trucks”, IMECE2010-39732, Proceedings of the 2010 ASME International Mechanical Engineering Congress and Exposition, Nov. 12-18, 2010, Vancouver, British Columbia, Canada.
- Pramod Krishnani and **Dongmei Zhou**, Adem Feysal, “A Numerical Study of Foot Step Effects on Drag for A Generic SUV”, Proceedings of the 40th Heat Transfer and Fluid Mechanics Institute, June 14, 2010, Sacramento, California, USA.

10. Professional Development:
Dongmei Zhou, “2015-16 Proven Course Redesign, Adopting Faculty proposal – ME126 Heat Transfer,” Course Redesign with Technology – Strategies for Student and Faculty Success, CSU, The California State University, Funded $8,523, Spring 2015.
Dongmei Zhou, “Modeling and Optimization of Hydrokinetic Wave Energy Conversion System”, National Science Foundation (NSF), EPCN Program, October 1 – November 2, 2014.
Dongmei Zhou, Workshop at Center for Teaching and Learning, May 26 - 30 2014.

Appendix C – Equipment

Please list the major pieces of equipment used by the program in support of instruction.

Laboratory	Equipment	
	Hardware	**Software**
Computer Graphics Lab (SCL 1218)	• 40 Windows Workstations	• ANSYS • AutoCad • Mechanical Desktop • CAMP-G • MATLAB ▪ Simulink ▪ Controls Toolbox ▪ Symbolic Toolbox • Microsoft Office • Microsoft Project • NASTRAN 4D • Pro Engineer • P Basic • SolidWorks • Working Model 4D
Advanced Design Lab (RVR 4001)	▪ 36 Windows Workstations	Same as Computer Graphics Lab
Mechatronics Lab (SCL 1349B)	• 4 Windows Workstations • 4 National Instruments multi-function data acquisition systems	• Labview • MATLAB ▪ Simulink ▪ Controls Toolbox ▪ Symbolic Toolbox • Microsoft Office Suite • Parallax Basic

Energy Systems Lab (SCL 1357)	• General Electric adjustable-blade, multistage axial-flow fan • Subsonic wind tunnel (12 in x 12 in cross-sectional test area) • Ingersol-Rand two-stage, double-acting, reciprocating piston compressor • Mazda 4-cylinder, 2.0 L spark-ignition engine with exhaust emissions analyzers • Cogeneration facility with 79 kW gas turbine generator, waste heat boiler, and absorption chiller • Five PC data acquisition computers with installed A/D boards • Fluid flow visualization (smoke tracer) apparatus • Psychrometrics test stand • Fluid flow/pressure loss testing apparatus • Industrial HVAC System • Combustion research apparatus	• Labtech Notebook Pro data acquisition • MATLAB
Computer-Aided Manufacturing Lab (SCL 1327)	• Sankyo SCARA robot • Bridgeport CNC machine • Mori-Seiki ACUMILL 4000 Machining Center • Mori-Seki CL-203B CNC Lathe • Allen-Bradley PLC system • Force monitoring system • Shape memory alloy actuator system • Semi-automated liquid handling system	
Manufacturing Processes Lab (SCL 1329)	• Lathes • Mills • Drill presses • Bandsaw • Grinders	
Foundry Lab (SCL 1349)	• Equipment for sand casting including a gas furnace	
Welding Lab (SCL 1329)	• MIG welding machines • Oxy-acetylene gas welding torches • Spot welding machine	
Advanced Materials Test Lab (RVR 1005)	• SATEC testing machine • Instron Fatigue tester • Strain gages • Data acquisition unit • PC workstations	• SATEC software • Instron software

Materials Testing and Analysis Lab (SCL 1349)	• Two Tinius-Olsen hydraulic universal testing machines • Impact test machines • Heat treatment ovens • Rockwell hardness testers • Fatigue tester • Creep Frame	• Tinius-Olsen UTMs software
Properties of Materials Lab (RVR 1003)	• Electronic balance • Metallographic Microscopes • soldering workstations • Ovens • Fume hood • 9 PC workstations • Beuhler AutoMet 250 Polisher	• Microsoft Office
Advanced Instrumentation (RVR 1007)	• Scanning Electron Microscope • Specimen prep	• PC data imaging system

Appendix D – Institutional Summary

Programs are requested to provide the following information.

1. The Institution

a. Name and Address of the Institution

California State University, Sacramento
6000 J Street, Sacramento, California 95819

b. *Name and Title of the Chief Executive Officer of the Institution*

Dr. Alexander Gonzalez, Outgoing President
Dr. Robert Nelson, Incoming President
California State University, Sacramento

c. Name and title of person submitting the self-report study

Dr. Susan L. Holl, Chair
Department of Mechanical Engineering
California State University, Sacramento

d. *Name the organizations by which the institution is now accredited and the dates of the initial and most recent accreditation evaluation.*

Western Association of Schools and Colleges (WASC)
Initial accreditation: 1975
Most recent accreditation: 2007

2. Type of Control

Description of the type of managerial control of the institution, e.g., private-non-profit, private other, denominational, state, federal, public-other, etc.

California State University, Sacramento is State-supported and is one of the twenty-three campuses of the California State University System. The general control of the system is vested in the Office of the Chancellor, which is located in Long Beach, California.

3. Educational Unit

Describe the educational unit in which the program is located including the administrative chain of responsibility from the individual responsible for the program to the chief executive officer of the institution. Include names and titles. An organization chart may be included.

The organizational chart showing the position of the engineering unit within the institution is shown in Figure D - 1

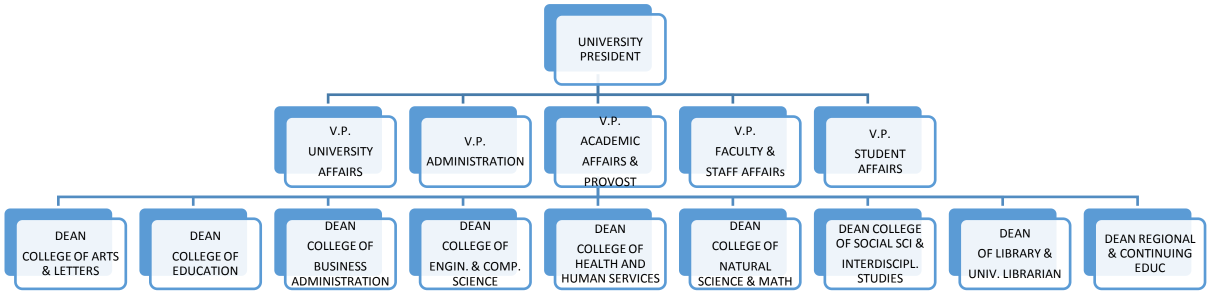


Figure D-1 University Administrative Organizational Chart

The organizational chart showing the position of the department within the college is shown in Figure D – 2.

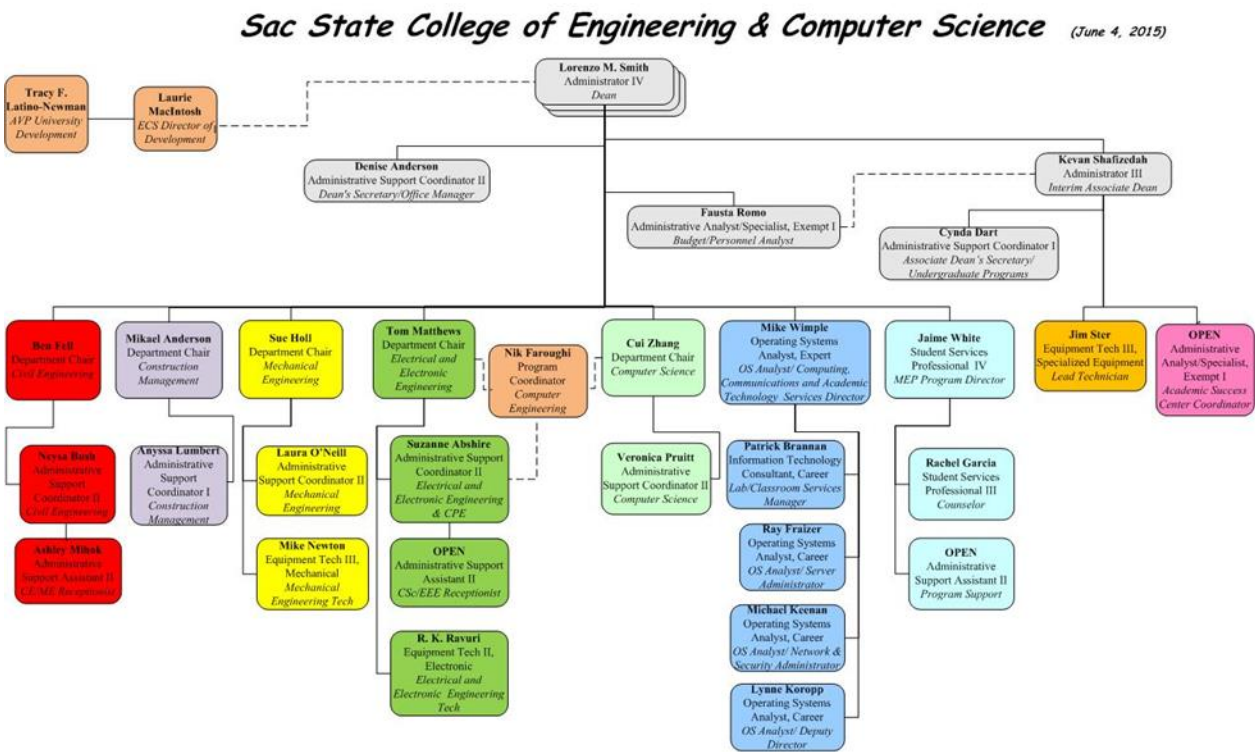


Figure D - 2   Organizational Chart of the College of Engineering and Computer Science

4. Academic Support Units

List the names and titles of the individuals responsible for each of the units that teach courses required by the program being evaluated, e.g., mathematics, physics, etc.

Biological Sciences: Ruth Ballard, Chair
Chemistry: Linda Roberts, Chair
Mathematics and Statistics: David Zeigler, Chair
Physics and Astronomy: William DeGraffenreid, Chair
English: David Toise, Chair

5. Non-academic Support Units

List the names and titles of the individuals responsible for each of the units that provide non-academic support to the program being evaluated, e.g., library, computing facilities, placement, tutoring, etc.

Library: Amy Kautzman, Dean
Maria Kochis, Librarian for Mechanical Engineering
Information Resources Technology: Larry Gilbert, Vice President
Career Services: Brigette Clark, Director
MESA Engineering Program: Jaime White
University Office of Academic Program Assessment: Amy Liu

6. Credit Unit

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

California State University, Sacramento operates on a semester calendar. A semester consists of fifteen weeks of instruction plus one week of final exams. One credit unit is received for each one hour of lecture, two hours of activity, or three hours of laboratory scheduled per week of the semester.

Table D-1. Program Enrollment and Degree Data

Bachelor of Science in Mechanical Engineering

	Academic Year		Enrollment Year					Total Undergrad	Total Grad	Degrees Awarded			
			1st	2nd	3rd	4th	5th			Associates	Bachelors	Masters	Doctorates
Current Year	2014/ 15	FT	130	95	124	250		599	19		130 (est)	13 (est)	
		PT	54	19	49	68		190	34				
1	2013/ 14	FT	169	86	129	214		598	17				
		PT	18	21	49	58		146	32		128	11	
2	2012/ 13	FT	145	67	105	184		501	10		87	13	
		PT	21	12	44	52		129	36				
3	2011/ 12	FT	98	69	96	170		433	23		77	9	
		PT	9	13	25	35		82	35				
4	2010/ 11	FT	120	52	77	148		397	9		63	16	
		PT	13	6	13	36		68	41				

Give official fall term enrollment figures (head count) for the current and preceding four academic years and undergraduate and graduate degrees conferred during each of those years. The "current" year means the academic year preceding the on-site visit.

FT--full time
PT--part time

Table D-2. Personnel

Bachelor of Science in Mechanical Engineering

Year[1]: __2014_______

	HEAD COUNT		FTE[2]
	FT	PT	
Administrative[2]		1	0.6
Faculty (tenure-track)[3]	10	3	11.4
Other Faculty (excluding student Assistants)	2	10	4
Student Teaching Assistants[4]		10	2
Technicians/Specialists	1		1
Office/Clerical Employees	1	1	1.5
Others[5]			

Report data for the program being evaluated.

1. *Data on this table should be for the fall term immediately preceding the visit. Updated tables for the fall term when the ABET team is visiting are to be prepared and presented to the team when they arrive.*

2. *Persons holding joint administrative/faculty positions or other combined assignments should be allocated to each category according to the fraction of the appointment assigned to that category.*

3. *For faculty members, 1 FTE equals what your institution defines as a full-time load*

4. *For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For undergraduate and graduate students, 1 FTE equals 15 semester credit-hours (or 24 quarter credit-hours) per term of institutional course work, meaning all courses — science, humanities and social sciences, etc.*

5. *Specify any other category considered appropriate, or leave blank.*

Appendix E – Survey Instruments

E - 1 Alumni Survey
E – 2 Industry Survey (2015)
E – 3 Industry Survey (2014)
E – 4 Graduating Senior Exit Interview

E – 1: ALUMNI SURVEY

Q2. Among the following factors, which **ONE** was the **MOST** important in selecting your major?
I enjoyed a course I had related to the major.
I thought it would prepare me for a career in the field.
I had always been interested in studying the major.
I heard good things from peers about the major.
My coursework at a community college led me to the major.
I was impressed with the faculty in the major at Sacramento State.
Q3. Please indicate your level of satisfaction with the following: - The quality of faculty instruction you received in your major courses
Very satisfied
Somewhat satisfied
Neutral
Somewhat dissatisfied
Very dissatisfied
Q4. Please indicate your level of satisfaction with the following: - The quality of the courses you took in your major
Very satisfied
Somewhat satisfied
Neutral
Somewhat dissatisfied
Very dissatisfied
Q5. Please indicate your level of satisfaction with the following: - The intellectual challenge you received in the major
Very satisfied
Somewhat satisfied
Neutral
Somewhat dissatisfied
Very dissatisfied
Q6. Please indicate your level of satisfaction with the following: - The ability of the department to schedule classes that would allow you to graduate within a reasonable period of time

Very satisfied
Somewhat satisfied
Neutral
Somewhat dissatisfied
Very dissatisfied

Q7. Please indicate your level of satisfaction with the following: - Your overall experience in the major

Very satisfied
Somewhat satisfied
Neutral
Somewhat dissatisfied
Very dissatisfied

Q8. Please indicate your level of satisfaction with the following: - The level of preparation you received from the major in relation to succeeding in the world after college

Very satisfied
Somewhat satisfied
Neutral
Somewhat dissatisfied
Very dissatisfied

Q9. Please indicate how well the curriculum **in your program** provided you with the following:
- The discipline-specific skills needed to succeed in your chosen field

Exceptionally well
More than adequately
Adequately
Less than adequately
Not at all
Not applicable

Q10. Please indicate how well the curriculum **in your program** provided you with the following:
- Understanding of the methods and practices of the profession

Exceptionally well

More than adequately
Adequately
Less than adequately
Not at all
Not applicable
Q11. To what extent did your major help you develop the following types of knowledge and proficiencies? - **Careful reading** (Reading is "the process of simultaneously extracting and constructing meaning through interaction and involvement with written language.")
Considerably
Sufficiently
Somewhat
Very little
Q12. To what extent did your major help you develop the following types of knowledge and proficiencies? - **Critical thinking** (Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.)
Considerably
Sufficiently
Somewhat
Very little
Q13. To what extent did your major help you develop the following types of knowledge and proficiencies? - **Creative thinking** (Creative thinking is both the capacity to combine or synthesize existing ideas, images, or expertise in original ways and the experience of thinking, reacting, and working in an imaginative way characterized by a high degree of innovation, divergent thinking, and risk taking.)
Considerably
Sufficiently
Somewhat
Very little
Q14. To what extent did your major help you develop the following types of knowledge and proficiencies? - **Understanding and using quantitative information** (Quantitative Literacy or Quantitative Reasoning is a competency and comfort in working with numerical data. Individuals with strong quantitative skills possess the ability to reason and solve quantitative problems from a wide array of contexts and situations. They understand and can create sophisticated arguments supported by quantitative evidence and they can clearly communicate those arguments in a variety of formats [using words, tables, graphs, mathematical equations, etc.])

Considerably
Sufficiently
Somewhat
Very little

Q15. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Information literacy and research skills** (Information literacy is a set of abilities requiring individuals to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information.")

Considerably
Sufficiently
Somewhat
Very little

Q16. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Effective writing** (Effective written communication is the development and expression of ideas in writing.)

Considerably
Sufficiently
Somewhat
Very little

Q17. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Effective oral communication** (Oral communication is a prepared, purposeful presentation designed to increase knowledge, to foster understanding, or to promote change in the listeners' attitudes, values, beliefs, or behaviors.)

Considerably
Sufficiently
Somewhat
Very little

Q18. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Teamwork** (Teamwork is behaviors under the control of individual team members [effort they put into team tasks, their manner of interacting with others on team, and the quantity and quality of contributions they make to team discussions].)

Considerably
Sufficiently

Somewhat		
Very little		

Q19. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Problem-solving** (Problem solving is the process of designing, evaluating and implementing a strategy to answer an open-ended question or achieve a desired goal.)

	Count	Percent
Considerably		
Sufficiently		
Somewhat		
Very little		

Q20. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Ethical reasoning and action** (Ethical reasoning is reasoning about right and wrong human conduct. It requires students to be able to assess their own ethical values and the social context of problems, recognize ethical issues in a variety of settings, think about how different ethical perspectives might be applied to ethical dilemmas and consider the ramifications of alternative actions.)

Considerably		
Sufficiently		
Somewhat		
Very little		

Q21. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Civic knowledge and engagement** (Civic engagement is "working to make a difference in the civic life of our communities and developing the combination of knowledge, skills, values, and motivation to make that difference. It means promoting the quality of life in a community, through both political and non-political processes." In addition, civic engagement encompasses actions wherein individuals participate in activities of personal and public concern that are both individually life enriching and socially beneficial to the community.)

Considerably		
Sufficiently		
Somewhat		
Very little		

Q22. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Intercultural knowledge and competence** (Intercultural knowledge and competence is "a set of cognitive, affective, and behavioral skills and characteristics that support effective and appropriate interaction in a variety of cultural contexts.")

Considerably		

Sufficiently
Somewhat
Very little

Q23. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **Foundations and skills for lifelong learning** (Lifelong learning is "all purposeful learning activity, undertaken on an ongoing basis with the aim of improving knowledge, skills, and competence.")

Considerably
Sufficiently
Somewhat
Very little

Q24. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **The ability to integrate or connect ideas or information** (Integrative learning is an understanding and a disposition that a student builds across the curriculum and co-curriculum, from making simple connections among ideas and experiences to synthesizing and transferring learning to new, complex situations within and beyond the campus.)

Considerably
Sufficiently
Somewhat
Very little

Q25. To what extent did your major help you develop the following types of knowledge and proficiencies?
- **The ability to apply your knowledge to new situations or problems**

Considerably
Sufficiently
Somewhat
Very little

Q26. Which of the following best describes your current **primary** activity?

Employed full-time
Employed part-time
Graduate/professional school full time

Graduate/professional school part time
Military service
Not employed, seeking employment, admission to graduate school, or other opportunity
Not employed by choice (homemaker, volunteer, traveling, etc.)
Q27. Which of the following best describes your career path since graduation? (Check all that apply)
Work in private sector
Work in non-profit sector
Work in public sector (local, state, or federal government)
Graduate school
Career training or other instruction (non-graduate school)
None of the above
Q28. How important to your current employer is your undergraduate degree?
Very important
Somewhat important
Only slightly important
Not important at all
Not applicable
Q29. My current job: (Check all that apply)
Is related to my undergraduate major
Uses important skills I gained during college
Is related to my desired career path
Is work I find meaningful
Allows me to continue to grow and learn
Pays enough to support my desired lifestyle
Pays health insurance benefits
Is likely to continue until I wish to leave
Not applicable
Q30. What is your gender?
Female
Male
Prefer not to say

Q31. What is your age?
20 - 24
25 - 29
30 - 34
35 - 39
40 - 44
45 - 49
50 or above
Prefer not to say
Q32. What is your racial/ethnic identity?
African American/Black, non-Hispanic
Native American or Alaska Native
Caucasian/White
Mexican/Hispanic/Latino
Asian
Pacific Islander/Native Hawaiian
Foreign/Nonresident Alien
Other/multiracial
Prefer not to say
Q33. Which of the following best describes you in relation to the degree(s) you received from Sacramento State?
I received a Bachelor's degree only.
I received a Master's degree only.
I received both a Bachelor's and Master's degree.
I do not have a degree from Sacramento State.
Q34. In what year did you receive your Bachelor's degree?
2009
2010

2011
2012
2013
Q35. In what year did you receive your Master's degree?
2009
2010
2011
2012
2013
Q36. Are you currently working as a mechanical engineer or in a related field?
Yes
No
Q37. What is your primary area of specialization in mechanical engineering or a related field?
Q38. How many years of experience in mechanical engineering or a related field do you have?
Q39. Have you obtained your professional engineering (P.E.) license?
Yes
No
Q40. Have you been in touch with the Mechanical Engineering Department since you graduated?
Yes
No

E – 2: Industry Survey
CSUS Mechanical Engineering
(Administered 2015)

Employer: ___________________________________

1. To what extent are your employees encouraged to pursue graduate degrees?

Extremely Important	Very important	Moderately important	Slightly important	Not at all important

2. In which of the following areas do you think graduates of the CSUS ME programs are strongest? (please rank 1 thru 5)

Machine Design	Manufacturing	Thermal and Fluids Systems	Materials	Other (please indicate field)

3. Which of the following areas are addressed most in the work of your company? (please rank 1 thru 5)

Machine Design	Manufacturing	Thermal and Fluids Systems	Materials	Other (please indicate field)

4. In which of the following areas do you do you anticipate your greatest work force needs in the future? (please rank 1 thru 5)

Machine Design	Manufacturing	Thermal and Fluids Systems	Materials	Other (please indicate field)

5. Please indicate your level of agreement with the following:
The CSUS ME program prepares employees to…

a) Apply creativity in the design of systems, components, processes, and/or experiments and in the application of experimental results, working effectively on multi-disciplinary teams.

Extremely Important	Very important	Moderately important	Slightly important	Not at all important

b) Communicate effectively through speaking, writing, and graphics including the use of appropriate computer technology.

Extremely Important	Very important	Moderately important	Slightly important	Not at all important

6. Please indicate how important you believe the following program objectives are for a mechanical engineering education:

a) Entering professional employment and/or graduate study in the following areas of mechanical engineering practice: machine design, thermal and fluids systems, materials, and manufacturing.

Extremely Important	Very important	Moderately important	Slightly important	Not at all important

b) Using knowledge of the principles of science, mathematics, and engineering to identify, formulate, and solve problems in mechanical engineering.

Extremely Important	Very important	Moderately important	Slightly important	Not at all important

c) Applying creativity in the design of systems, components, processes, and/or experiments and in the application of experimental results, working effectively on multi-disciplinary teams.

Extremely Important	Very important	Moderately important	Slightly important	Not at all important

d) Communicating effectively through speaking, writing, and graphics, including the use of appropriate computer technology.

Extremely Important	Very important	Moderately important	Slightly important	Not at all important

e) Using understanding of **professional, ethical, and social responsibilities**, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of your professional career.

Extremely Important	Very important	Moderately important	Slightly important	Not at all important

7. Do you have any suggestions to improve the Mechanical Engineering program?

E – 3: Industry Survey
CSUS Mechanical Engineering
(administered 2014)

1. Using a five point scale with **1 being least important and 5 being most important** rank the following topics in mechanical engineeri terms of the skills engineers in your company need to know.

a. Computer aided design **rank:__________**
b. Dynamics **rank:__________**
c. System Modelling **rank:__________**
d. Engineering Materials **rank:__________**
e. Manufacturing **rank:__________**
f. Electronics **rank:__________**
g. Test Methods **rank:__________**
h. Technical Communications **rank:__________**
i. Machine Design **rank:__________**
j. **Other Topics:_______________ rank:__________**

2. Using the same five point scale, how important is a Masters degree in Mechanical Engineering for engineers in your company. **rank:________**

3. Using a five point scale with **1 being no knowledge and 5 being expert user** rank <u>your knowledge</u> of the following software package

a. Solidworks **rank:__________**
b. Creo/ProE **rank:__________**
c. Autocad **rank:__________**
d. Matlab **rank:__________**
e. CAMP-G **rank:__________**
f. Nastran **rank:__________**
g. Labview **rank:__________**
h. MathCad **rank:__________**
i. Fluent **rank:__________**
j. **Other software_____________rank:__________**

4. Using a five point scale with **1 being not important and 5 being very important** rank the following software packages in terms of <u>usefulness for engineers</u> in your company.

a. Solidworks **rank:__________**
b. Creo/ProE **rank:__________**
c. Autocad **rank:__________**
d. Matlab **rank:__________**
e. CAMP-G **rank:__________**
f. Nastran **rank:__________**
g. Labview **rank:__________**
h. MathCad **rank:__________**
i. Fluent **rank:__________**
j. **Other software:______________ rank:__________**

5. Using a five point scale with **1 being least important and 5 being most important** how important is professional development for engineers in your company. **rank**:_______

6. What topics if any do you believe are <u>not sufficiently covered</u> in engineering education?

____
____
____

7. Does your company offer professional training for its employees ________________________________

8. Using a five point scale with **1 being least important and 5 being most important** rank the following skills in terms of importance f engineers in your company

a. The ability to plan, conduct, analyze and interpret experiments **rank**:_______
b. The ability to identify, analyze, and solve technical problems **rank**:_______
c. The ability to apply creativity to mechanical design **rank**:_______
d. The ability to work in a team **rank**:_______
e. The ability to write effectively **rank**:_______
f. The ability to communicate in a presentation **rank**:_______

9. Do you have any other feedback for the Mechanical Engineering Program?

____
____
____

E – 4:
ME Graduating Senior Exit Interview –

Please rate the following five questions on a scale of 0 to 4 using the following rating: (you can think of it like the A to F scale):

4 - Exceptionally well
3 - More than adequately
2 - Adequately
1 - Less than adequately
0 - Very poorly

1. How well did the program help you to develop design skills?_____

2. How well did the program help you to develop computer skills?___

3. How well did the program help you to develop written and oral communications skills?____

4. How satisfied are you with the major program advising you received?____

5. How well did the program help you to develop you ability to work as part of a team?____

6. Have you passed the Fundamentals of Engineering (EIT) exam?
   Yes ____
   I took the FE exam but did not pass____
   I have not taken it____
   I have taken it and am waiting for the results____

Please answer the following questions:

1. What are the things you like about the ME program?

2. What are the things you would like to change about the ME program?

3. What course did you find to be the most useful? Why was this course the most useful?

4. What course or courses would you like to change? What are the changes you would like to see?

5. Do you feel prepared to go into industry and develop new technology? Please explain.

6. Do you feel your education is complete? Please explain.

7. How do you plan to keep yourself current?

8. Are you taking a permanent job? If so, where will you be working?

9. Are you going to grad school?

10. Do you have any other comments?

Appendix F – Student Outcome Rubrics

Mechanical Engineering Student Learning Outcomes

(a) An ability to apply knowledge of mathematics, science, and engineering
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) An ability to function on multidisciplinary teams
(e) An ability to identify, formulate, and solve engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) A recognition of the need for, and an ability to engage in life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Assessment Rubrics

Student Outcome: (a) An ability to apply knowledge of mathematics, science, and engineering

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Apply math, scientific, or engineering principles to analyze engineering problems	Applied concepts of math, scientific, or engineering principles most appropriate to analyze engineering problems	Applies a math, scientific, or engineering principle to analyze an engineering problem, but is not the most appropriate solution	Applies a math, scientific, or engineering principle that applies to an engineering problem, but has trouble in model the development	Does not connect the between math, scientific, or engineering principles
Interpret mathematical or scientific work	Shows appropriate engineering interpretation of mathematical and scientific terms	Most mathematical terms are interpreted correctly	Mathematical terms are interpreted incorrectly	No mathematical terms are interpreted

Student Outcome: (b) An ability to design and conduct experiments, as well as to analyze and interpret data

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Identify Constraints	Identified all constraints and given information	Identified most constraints and given information.	Identified some constraints but misses most important information.	Identified few or no constraints.
Follow Data Collection Procedures	Followed all of the required data collection procedures.	Followed most of the required procedures.	Followed some of the required procedures.	Followed few or none of the required procedures.
Analyze Data	Calculated all necessary results required to make an interpretation.	Calculated most of the necessary results required to make an interpretation.	Calculated some of the necessary results required to make an interpretation.	Calculated none of the necessary results required to make an interpretation.
Interpret Results	Reported results with detailed interpretation or insight.	Reported results with some interpretation or insight.	Reported results with little evaluation or insight.	Reported results with no interpretation or insight.

Student Outcome: (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Define Design Constraints	Constructs a clear and insightful list of design constraints with evidence of all relevant contextual factors.	Describes design constraints with evidence of most relevant contextual factors, and constraints are adequately detailed.	Identifies design constraints with most relevant contextual factors, but description is superficial.	Identifies a limited number of design constraints or related contextual factors.
Identify Design Strategies	Identifies multiple approaches for solving the problem that apply within a specific context.	Identifies multiple approaches for solving the problem, only some of which apply within a specific context.	Identifies only a single approach for solving the problem that does apply within a specific context.	Identifies one or more approaches for solving the problem that do not apply within a specific context.
Propose Design Strategy	Proposes one or more strategies that indicate a deep comprehension of the constraints. Solutions are sensitive to contextual factors.	Proposes one or more strategy that indicate comprehension of the design constraints. Strategies are sensitive to contextual factors of the problem.	Proposes one strategy that is generic in nature rather than individually designed to address the specific contextual factors.	Proposes a design strategy that is difficult to evaluate because it is vague or only indirectly addresses the project constraints.
Evaluate Design Strategy	Complete analysis of proposed strategy relative to all key design constraints.	Analysis of proposed strategy fails to adequately address at most one key design constraint.	Analysis of proposed strategy fails to address multiple key design constraints.	Evaluation is superficial in general or fails to adequately address most of the key design constraints

Student Outcome: (d) An ability to function on multidisciplinary teams

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Contributes to Team Meetings	Helps the team move forward by articulating the merits of alternative ideas or proposals.	Offers alternative solutions or courses of action that build on the ideas of others.	Offers new suggestions to advance the work of the group.	Shares ideas but does not advance the work of the group. Completes all assigned tasks by deadline.
Contributes Outside of Team Meetings	Completes all assigned tasks by deadline; work accomplished is thorough, comprehensive, and advances the project. Proactively helps other team members complete their assigned tasks to a similar level of excellence.	Completes all assigned tasks by deadline; work accomplished is thorough, comprehensive, and advances the project.	Completes all assigned tasks by deadline; work accomplished advances the project.	Completes all assigned tasks by deadline.
Fosters Constructive Team Climate	Consistently does at all of the team building techniques listed below.	Consistently does three of the team building techniques listed below.	Consistently does two of the team building techniques listed below.	Consistently does one of the team building techniques listed below.
Responds to Conflict	Addresses destructive conflict directly and constructively, helping to manage/resolve it in a way that strengthens overall team cohesiveness and future effectiveness.	Identifies and acknowledges conflict and stays engaged with it.	Redirecting focus toward common ground, toward task at hand (away from conflict).	Passively accepts alternate viewpoints/ideas/opinions.

Team Building Techniques

- Treats team members respectfully by being polite and constructive in communication.
- Uses positive vocal or written tone, facial expressions, and/or body language to convey a positive attitude about the team and its work.
- Motivates teammates by expressing confidence about the importance of the task and the team's ability to accomplish it.
- Provides assistance and/or encouragement to team members.

Student Outcome: (e) An ability to identify, formulate, and solve engineering problems

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Identify problem requirement and problem limitations	Identify all problem requirements, and understand problem limitations	Describe overall problem requirements and problem limitations	Identify problem requirements and problem limitations	Did not recognize problem requirements and missed major problem limitations
Define problem scope	Well defined and documented problem scope	Define major problem scope elements	Missed some of the problem components	Crucial problem elements were missed
Perform experiment to determine engineering properties	Identify specific type of experiment to all measured engineering properties that is applicable to the project	Experiment conducted with major required engineering propertied measured	Experiment conducted with several needed engineering properties were missed	Experiments were not appropriate for project
Analyze engineering alternatives	Select cost-effective, workable alternative and provide engineering alternatives	An alternative was selected, but few alternatives were discussed	Single method was evaluated, alternatives were not considered	No project alternatives were identified

Student Outcome: (f) An understanding of professional and ethical responsibility

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Demonstrates understanding of role of ethics in professional practice	Refers to four or more elements of the ASME Code of Ethics	Refers to three elements of the ASME Code of Ethics	Refers to two elements of the ASME Code of Ethics	Refers to zero or one element of the ASME Code of Ethics
Assesses an engineer's responsibility for public health and safety	Provides four or more clear, relevant, and logical examples	Provides three clear, relevant, and logical examples	Provides two clear, relevant, and logical examples	Provides zero or one clear, relevant, and logical example
Weighs how an engineer's actions affect other professionals	Presents relevant and appropriate content exhibiting creativity and free thought	Presents acceptable, but limited, well-explained content	Presents content lacking in quantity and quality; concepts not well explained	Does not present meaningful content
Weighs how an engineer's actions affect his/her career	Presents relevant and appropriate content exhibiting creativity and free thought	Presents acceptable, but limited, well-explained content	Presents content lacking in quantity and quality; concepts not well explained	Does not present meaningful content

Student Outcome: (g) An ability to communicate effectively (written)

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Meets audience needs	Delivers material at level and format needed by the audience	Material mostly delivered at appropriate level, considering audience; appropriate format	Material delivered at a consistent level, but inappropriate for audience; appropriate formats	Material delivered at a variety of levels and inappropriate formats
Organizes material in a logical manner	Report is well organized and clearly written. The underlying logic is clearly articulated and easy to follow	. Report is organized and clearly written for the most part. In some areas the logic or flow of ideas is difficult to follow	Report is unorganized, but the reader can understand the general idea and logic used	Report lacks an overall organization. Reader has to make considerable effort to understand the underlying logic and flow of ideas
Provides adequate explanations, justifications, or supporting evidence	. Explanations, justifications, and/or evidence are complete. All applicable aspects are addressed in the narrative	. Regardless if answer is correct, some important aspects of explanation, justification, or evidence is missing. Supporting information is mostly complete	Regardless if answer is correct, some important aspects of explanation, justification, or evidence missing. Supporting information is incomplete .	Regardless if answer is correct, not well explained, justified or supported with evidence. Major elements of supporting information are missing
Develop visual materials which effectively support narrative (e.g., figures and tables)	Visual materials are clear in content and visual presentation; correctly formatted; materials integrated seamlessly into narrative	Visual materials are mostly clear in content and format with some exceptions; materials consistently relevant to narrative	Visual materials are mostly clear in content; some format errors; materials mostly relevant to narrative	Visual materials are unclear in content and irrelevant to narrative; incorrect format; not referenced
Apply appropriate language, sentence structure, and terminology	Language is unambiguous, correct for subject matter. Sentence structure is varied and promotes flow. Parallel structure properly used.	Language is mostly unambiguous, correct terminology. Sentences reasonably variable, few inappropriate uses of parallel structure.	Language is often ambiguous, mostly correct terminology, clear. Sentences lack variety. Inappropriate uses of parallel structure	Language is ambiguous, incorrect terminology. Sentences are overly simple or repetitive. Improper use of parallel structure hinders understanding
Construct grammatically correct text	No grammar, spelling or punctuation errors	Occasional errors which don't affect meaning	Meaning is clear to readers who can ignore errors	Grammatical errors confuse meaning

Student Outcome: (g) An ability to communicate effectively (oral)

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Devise an organized presentation	Presentation organization in a clear and consistent that was appropriate for subject matter	Organization was appropriate, but presentation of details lacked clarity	Organization was mostly appropriate, but presentation of details lacked clarity	Lacked overall (global) organization and lacked detailed-level organization
Apply appropriate language	Language is unambiguous, correct for subject matter, enhance presentation, and appropriate for audience	Language is mostly unambiguous, correct terminology, enhance presentation, considers audience	Language is often ambiguous, mostly correct terminology, clear, misses audience	Language is ambiguous, incorrect terminology, confusing, does not consider audience
Deliver content effectively	Mannerisms, smoothness, pace and tone make presentation compelling, speaker appears polished and confident	Mannerisms, smoothness, pace and tone make the presentation interesting, and speaker appears comfortable	Mannerisms, smoothness, pace and tone make the presentation understandable, and speaker appears tentative	Mannerisms, smoothness, pace and tone detract from the understandability of the presentation, speaker appears uncomfortable
Develop visual materials which effectively support oral delivery (e.g., slides)	Visual materials are clear in content and visual presentation; materials integrated seamlessly into presentation	Visual materials are mostly clear in content and visual presentation with some exceptions; materials consistently referenced by speaker	Visual materials are mostly clear in content and visual presentation; materials regularly referenced by speaker	Visual materials are unclear in content and visual presentation; materials not integrated well with presentation

Student Outcome: (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Comprehend the role of engineering designs in quality of life and economic activity	Able to assess the competition for financial resources; can predict the potential impact of a design on society	Can discuss the competition for financial resources; can discuss the impact of a design on society	Able to list a few sources of funding; can describe the social impact of a past design	Unaware of connection between engineering and the economy; unaware of effect of designs on social impacts and aesthetics
Comprehend the environmental/ sustainability impact of engineering decisions	Able to interpret major environmental issues of designs and their effect on sustainability	Can discuss major environmental issues and demonstrates some awareness of long-term sustainability issues	Able to list major environmental issues, but unable to understand those issues in a life-cycle/sustainability context	Unaware of connection between engineering and environmental quality or sustainability issues
Understand role of engineering in reducing risks from known hazards	Identify designs that can reduce the risk from hazards presented for a specific situation	Can discuss examples of projects that have reduced risks from hazards	Can list conventional approaches to reduce hazards	Unaware of the role engineering has in reducing risks from hazards

Student Outcome: (i) A recognition of the need for, and an ability to engage in life-long learning

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**

Recognizes the need for lifelong learning	Planning to continue formal education	Some interest in continuing formal education; has plans for professional development	Recognizes need for professional development	Has no specific plans for career growth
Engages in lifelong learning	Takes a leadership role in a student organization and/or has participated in a engineering competition	Participates actively in a student professional organization and/or engineering competition	Participates in a student professional organization	Belongs to no student professional organizations

Student Outcome: (j) A knowledge of contemporary issues

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
Knowledge of practices in the field, including technologies and engineering techniques	Able to describe widely used engineering techniques and technologies and list emerging technologies	Describe widely used engineering techniques and technologies	List some current engineering techniques and technologies	Unable to list current engineering practices and techniques
Knowledge of recent engineering disasters, failures, and shortcomings and successes	Can discuss multiple engineering failures and successes	Can describe some engineering failures and successes	Can list some engineering failures and successes	Unable to list any engineering failures and successes
Recognize the influence of various political/social issues	Able to discuss in-depth major political/social issues at national, state and local level	Able to comment on major political/social issues, but is unable to articulate a position	Can list some major political/social issues	Unable to comment on political/social issues; unaware of world and local happenings

Student Outcome: (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Performance Indicator	**Exemplary (Outstanding)**	**Satisfactory (Proficient)**	**Developing (Apprentice)**	**Unsatisfactory (Novice)**
List various	List all appropriate	List multiple	List a single	Did not recognize

solution techniques	solution techniques	solution techniques	solution technique	any appropriate solution techniques
Develop skills to apply engineering tools	Apply acquired skills to use engineering tools	Have some skills with engineering tools	Have skills but no knowledge of available tools	Lack of skills and no knowledge of available engineering tools
Apply modern engineering tools to solve engineering problems	Knowledge and ability to identify and use tools to solve engineering problems	Some knowledge and ability to use tools to solve engineering problems	Identify appropriate tools with basic ability to use to solve engineering problems	Limited ability to apply tools in solving engineering problems
Perform analysis of engineering problems using modern engineering tools	Understand and perform complete analysis of engineering problems using modern tools	Some understanding and basic ability to perform analysis using modern tools	Knowledge of available tools and limited ability to apply these tools	No knowledge or ability to apply tools to perform engineering analysis

Appendix G – Interim Report June 2010

Due Process Response
to the EAC Draft Statement
of January 2010

B.S. Degree in Mechanical Engineering

Additional Information

Department of Mechanical Engineering
College of Engineering & Computer Science
California State University, Sacramento
June 14, 2010

Table of Contents

This document presents additional actions taken by the Department of Mechanical Engineering to address the weaknesses cited in the Final Draft Statement of the October 2009 visit. The two areas involved relate to Criteria 2 and 3 as stated below:

Program Weaknesses

Criterion 2. Program Educational Objectives *Criterion 2 requires that each program have in place and assessment and evaluation process that periodically documents and demonstrates the degree to which these objectives are attained. The program has used and Educational Benchmarking Incorporated alumni survey to assess attainment of the program educational objectives. The data collected tend to address program outcomes rather than the career and professional attainment of graduates. Other alumni survey data obtained through employer interviews do not address the educational objectives either, but are useful for improving the quality of the program in other ways, including assessing the needs of the program's constituencies. Because the data do not align well with the objectives and some of the data have not been evaluated, the program lacks strength of compliance with this criterion.*

Due Process Response

An additional survey of alumni of the program was launched on January 25, 2010. This survey specifically addresses the program educational objectives. The survey was sent to alumni who graduated between three and 10 years ago. The data were collected and anaylyzed by the Department Assessment Committee and this report will be evaluated by the faculty during the 2010-2011 academic year.

Part of the survey included the following questions about alumni experience that are directly related to the Department's program objectives:

1. *To what extent are you* ***engaged in professional employment and/or graduate study in one of the following areas of mechanical engineering practice: machine design, thermal and fluids systems, materials, and manufacturing****?*
2. *Please indicate how much you agree that the ME program prepared you to* ***use knowledge of the principles of science, mathematics, and engineering, to identify, formulate, and solve problems in mechanical engineering?***
3. *Please indicate how much you agree that the ME program prepared you to* ***apply creativity n the design of systems, componenets, processes, and /or experiments and in the application of experimental results, working effectively on multi-disciplinary teams?***
4. *Please indicate how much you agree that the ME program prepared you to* ***use your understanding of professional, ethical, and social responsibilities, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of their professional careers?***

5. *Please indicate how much you agree that the ME program prepared you to* ***use your understanding of professional, ethical, and social responsibilities, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of their professional careers?***

The questions listed above correspond directly to the Mechanical Engineering Program's five educational objectives. Respondents were asked to rate their response on a five point scale with scores ranging from five (indicating strong agreement) to one (indicating strong disagreement). The survey results for these questions are shown:

Objective 1: 100% of the respondents have worked in the profession.
Objective 2: 92.3 % strongly agree or agree that the program is achieving the objective.
Objective 3: 92.3 % strongly agree or agree that the program is achieving the objective.
Objective 4: 76.9 % strongly agree or agree that the program is achieving the objective.
Objective 5: 69.2 % strongly agree or agree that the program is achieving the objective.

Based on these results, the Mechanical Engineering Program is achieving its educational goals.

Additional questions were included to determine the how much alumni agreed with the Mechancical Engineering Program Objectives:

Objective 1: 91.2% feel the objective is extremely important or very important.
Objective 2: 100% feel the objective is extremely important or very important.
Objective 3: 100% feel the objective is extremely important or very important.
Objective 4: 100% feel the objective is extremely important or very important.
Objective 5: 83.6% feel the objective is extremely important or very important.

Based on these results, the Mechanical Engineering Program Objectives are consistent with what alumni deem important to a mechanical engineering education.

Complete results are shown in Appendix A.

Future Plans

The Department will continue to survey alumni every three years. As part of our continuous improvement plan we will engage our constituents as we re-evaluate the program objectives before surveying alumni. The survey will be modified to reflect any change in the program objectives.

Criterion 3. Program Outcomes *Criterion 3 requires that there be an assessment and evaluation process that periodically documents and demonstrates the degree to which the program outcomes are attained. The program has implemented a relatively recent assessment plan involving learning objectives and measurable outcomes in courses; however, documentation and consistencey of use are not evident. Furthermore, a plan for using the assessment data to demonstrate attainment of program outcomes has not been defined or implemented.*

Due Process Response

Each course in the Mechanical Engineering curriculum was assessed in both Fall 2009 and Spring 2010. All faculty are involved in direct assessment of the learning objectives and measurable outcomes in the courses. The Department Assessment Committee developed a standard assessment mechanism using detailed rubrics specific to each course. Additionally, the students in each course were surveyed to assess their perception of their success with respect to each course outcome. Each course outcome is mapped to both area outcomes and program outcomes. A baseline evaluation for each course was determined using data from both Fall 2009 and Spring 2010.

Faculty assessment rubrics provide detailed information regarding the instruments used for evaluation of specific outcomes and the level required for success. The evaluation is based on a 4 point scale for comparison to the standard A through F (A=4.0) used by the University. The number of students achieving each level of success is presented. Faculty also provide reflections on the course assessment results. (see Appendix D for data from Fall 2009)

In addition to the faculty assessment of student success in achieving the course objectives, the students in each course are surveyed to assess their perception of their success with respect to each course outcome. The assessment was based on a 4 point scale for comparison.

The faculty assessment data are compared to the final course grades and the students' evaluation of their success with the course outcomes. The Department Assessment Committee will review these data to ensure all program outcomes are being addressed and make suggestions for modifications. The Committee findings will be presented to the Department and Industry Advisory Committee in August 2010.

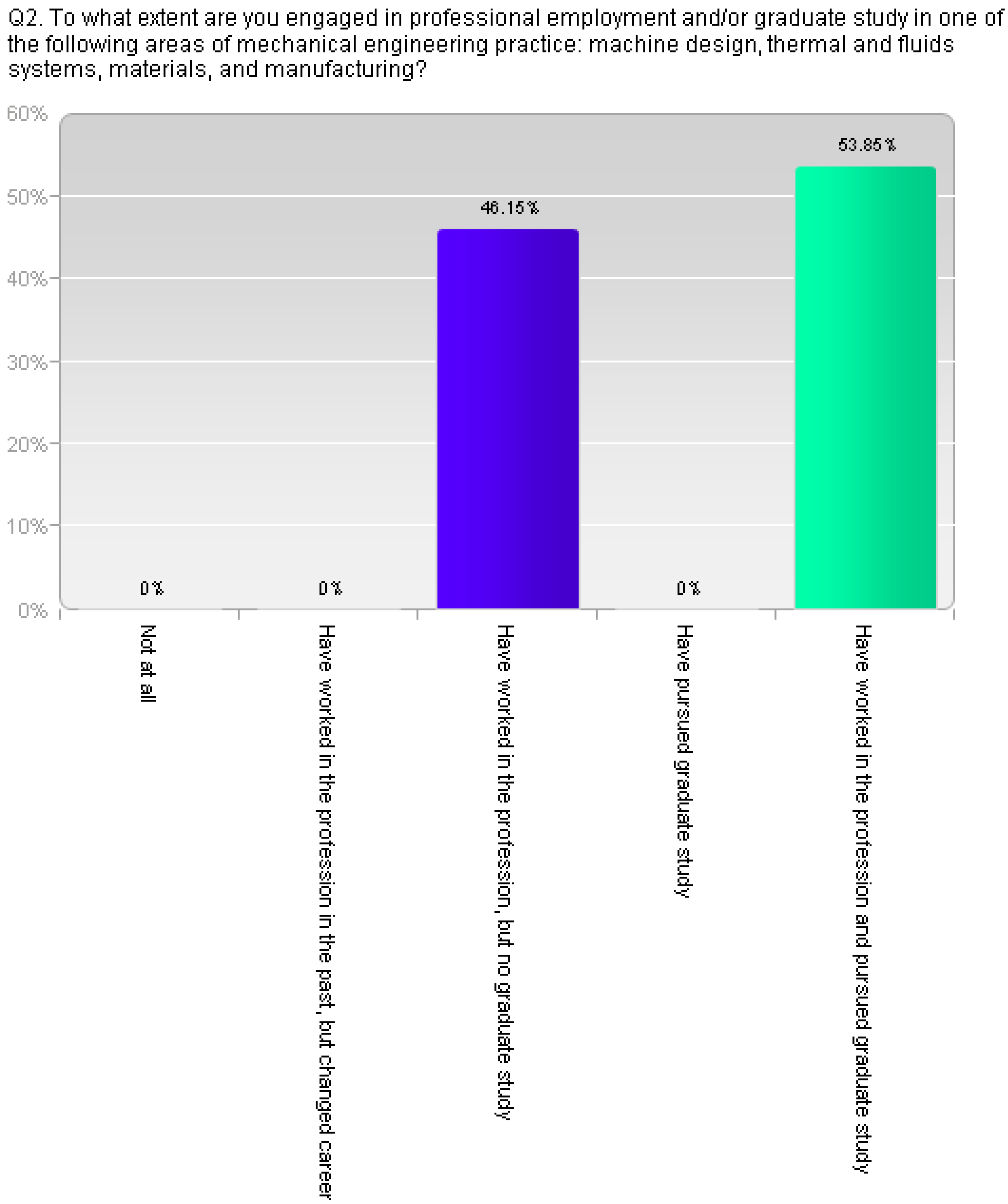
Future Work

A systematic evaluation of the program and course objectives to be conducted in future years was developed. In each year specific courses and program objectives will be evaluated and compared to the baseline data generated in the 2009-2010 year. The data generated will be evaluated for continuous improvement.

As the faculty evaluate assessment data, specific recommendations for improvement will be incorporated; assessment data will be used to evaluate how these changes impact the program.

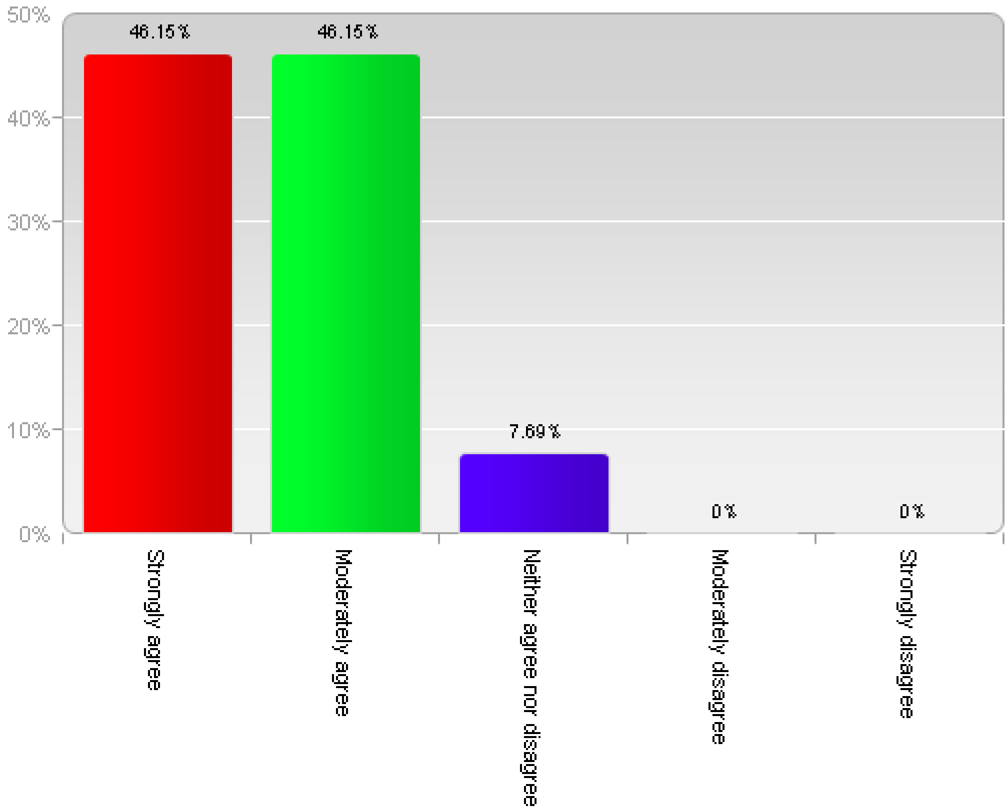
APPENDIX A

Alumni Survey of Program Objectives

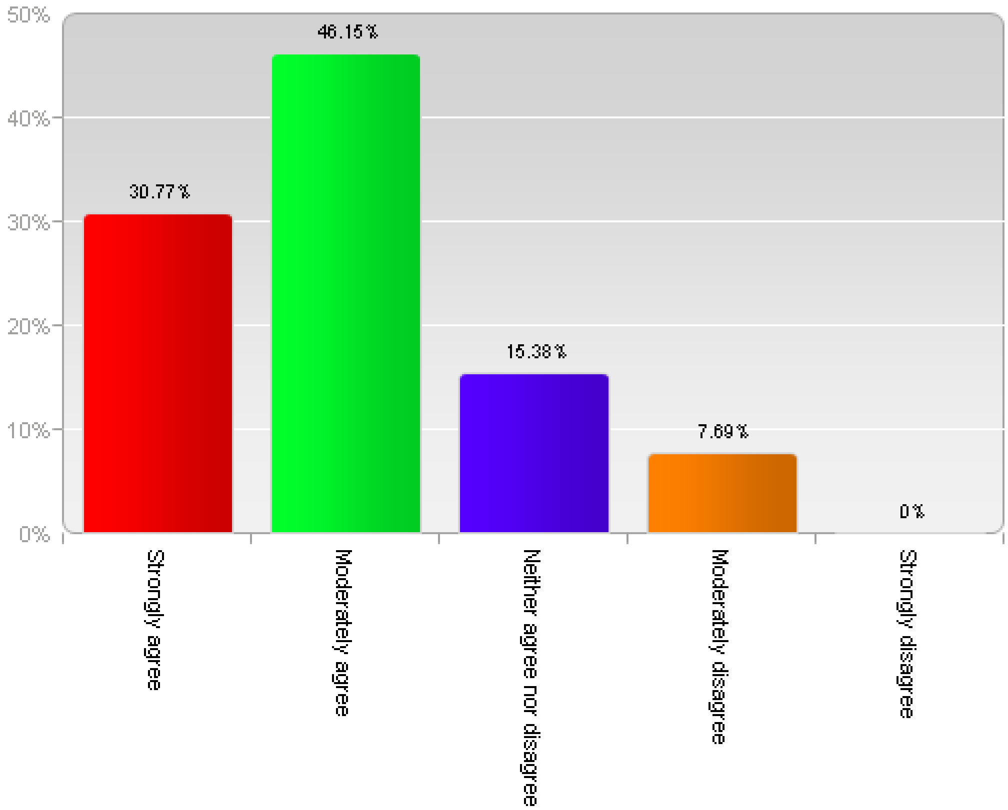


Q2. To what extent are you engaged in professional employment and/or graduate study in one of the following areas of mechanical engineering practice: machine design, thermal and fluids systems, materials, and manufacturing?
60%
50%
40%
30%
20%
10%
0%
0 %
0 %
46.15 %
0 %
53.85 %
Not at all
Have worked in the profession in the past, but changed career
Have worked in the profession, but no graduate study
Have pursued graduate study
Have worked in the profession and pursued graduate study

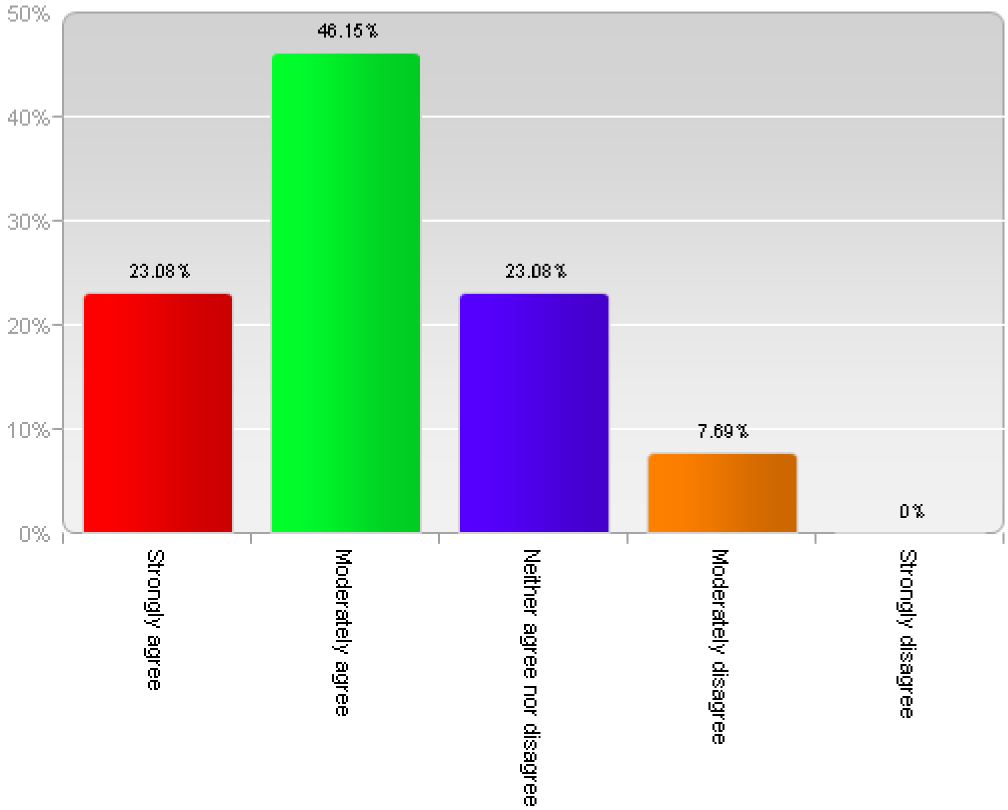
Q3. Please indicate your level of agreement with the following:The ME program prepared me to . . . - Use knowledge of the principles of science, mathematics, and engineering to identify, formulate, and solve problems in mechanical engineering



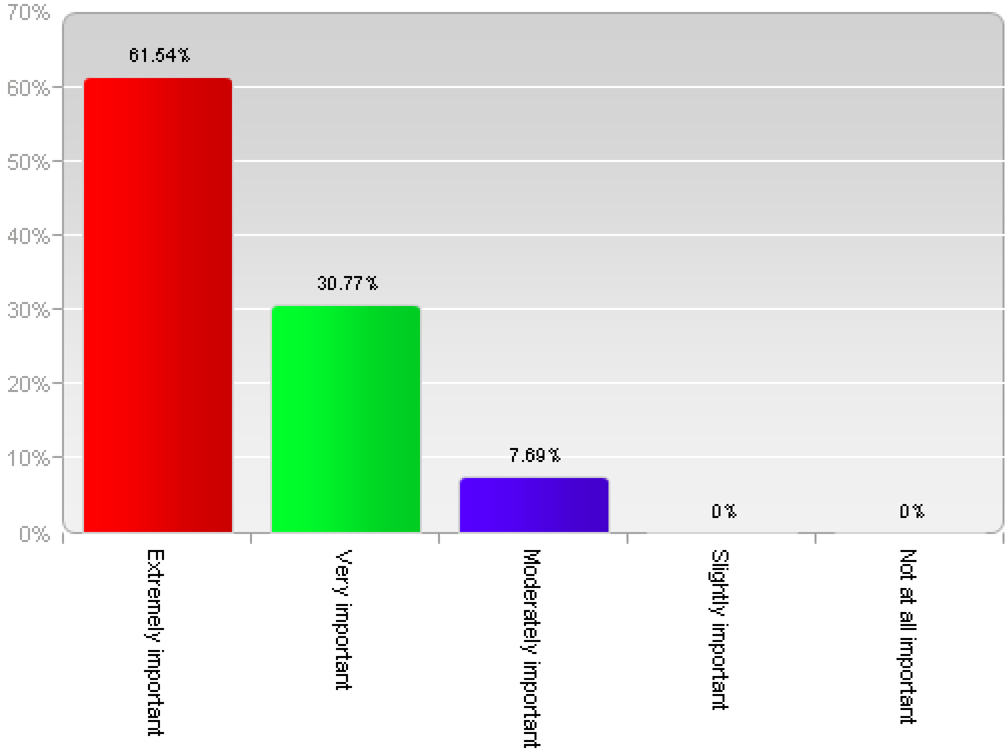
Q5. Please indicate your level of agreement with the following:The ME program prepared me to . . . - Communicate effectively through speaking, writing, and graphics including the use of appropriate computer technology



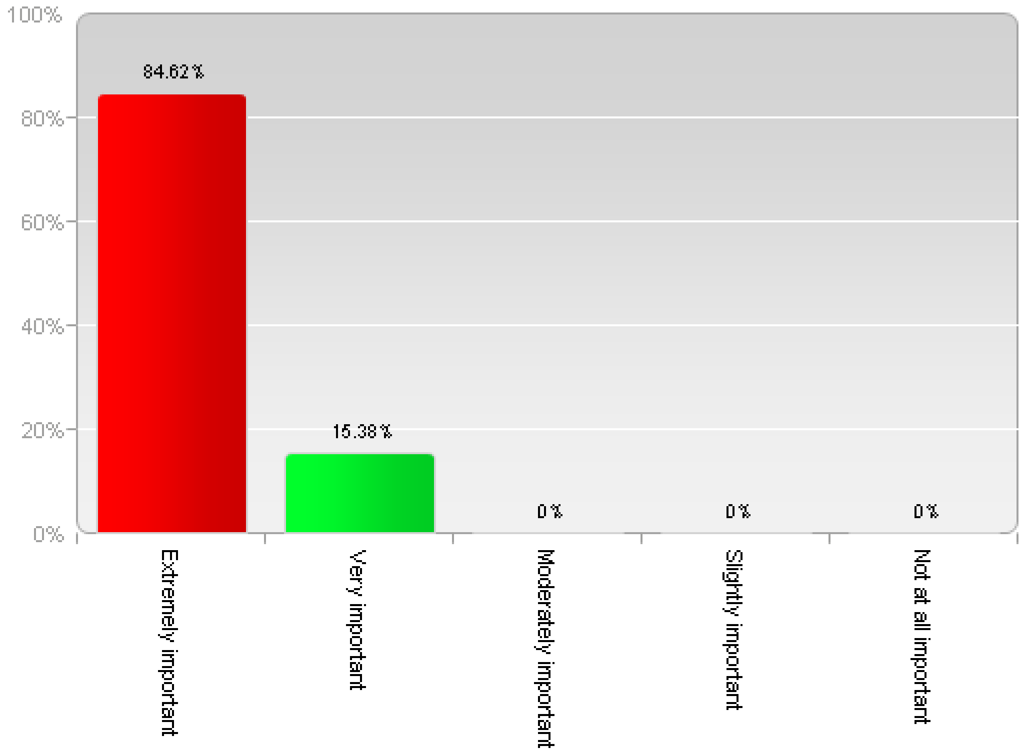
Q6. Please indicate your level of agreement with the following:The ME program prepared me to . . . - Use my understanding of professional, ethical, and social responsibilities, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of their professional careers



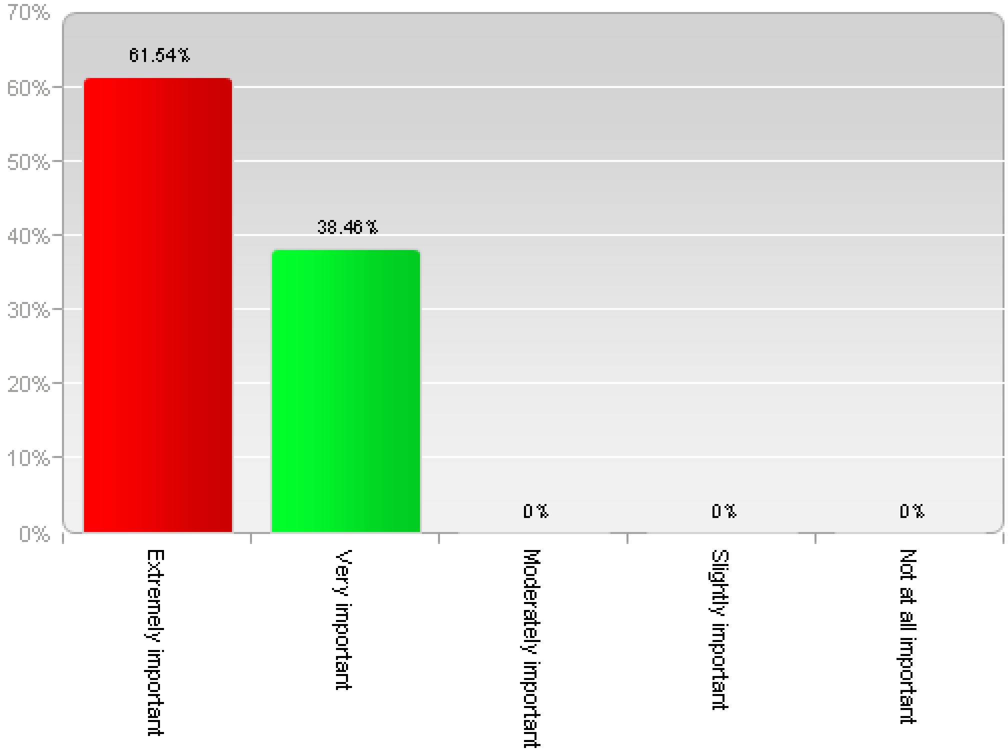
Q7. Please indicate how important you believe the following program objectives are for a mechanical engineering education: - Entering professional employment and/or graduate study in the following areas of mechanical engineering practice: machine design, thermal and fluids systems, materials, and manufacturing



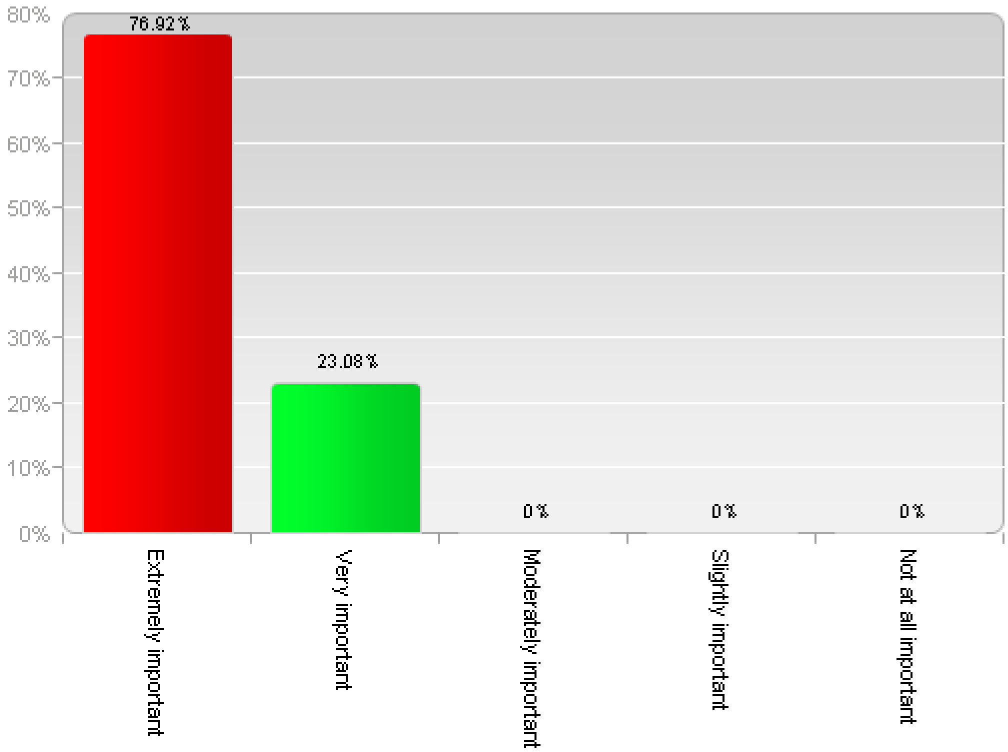
Q8. Please indicate how important you believe the following program objectives are for a mechanical engineering education: - Using knowledge of the principles of science, mathematics, and engineering to identify, formulate, and solve problems in mechanical engineering



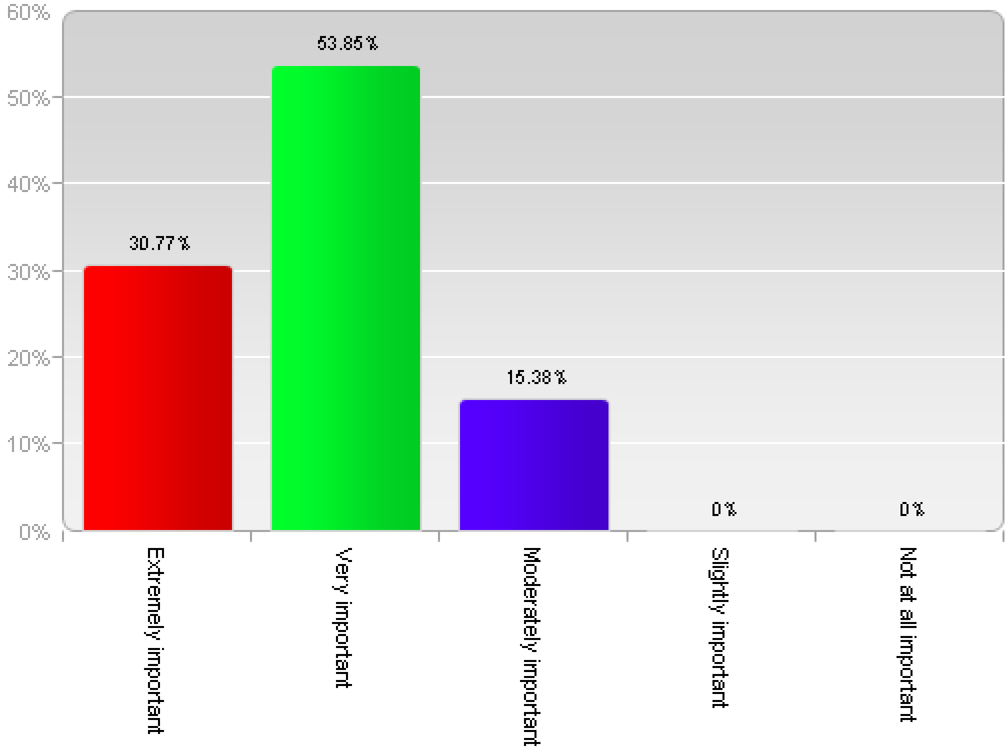
Q9. Please indicate how important you believe the following program objectives are for a mechanical engineering education: - Applying creativity in the design of systems, components, processes, and/or experiments and in the application of experimental results, working effectively on multi-disciplinary teams



Q10. Please indicate how important you believe the following program objectives are for a mechanical engineering education: - Communicating effectively through speaking, writing, and graphics, including the use of appropriate computer technology



Q11. Please indicate how important you believe the following program objectives are for a mechanical engineering education: - Using understanding of professional, ethical, and social responsibilities, the nature and background of diverse cultures, and the importance of life-long learning in the conduct of their professional careers



APPENDIX B

2009-2010 Assessment Data

(Baseline)

The student assessment of their achievement and the faculty assessments (GPA and outcome evaluation) followed a consistent pattern (Tables B-II and C-II). The students consistently assessed their success higher than the faculty evaluations; the upper division students' assessment was much closer to the faculty indicating that they are more mature regarding their perceptions. The Fall and Spring data were compiled to develop baselines for comparison to future assessment data. The Department Assessment Committee will evaluate the data, look for trends, and identify areas of strength and weakness at the course and objective level. Specific course objectives, measurables, and assessment tools will be evaluated as part of the process. The assessment data and relationships to course and results will be discussed with the Department to develop strategies for program improvement.

We will continue to be especially mindful of the differences between the background of native and transfer students to ensure that all students achieve the program outcomes by the time they finish the program.

Table B-I. Program Outcome evaluated in each course (Baseline 2009-2010)

Outcomes evaluated with specific course objectives - 2009-2010 Baseline											
Course	**a. Knowledge of science, math, and engineering principles**	**b. Plan, conduct, analyze, and interpret experiments**	**c. Apply creativity in design of systems, components, processes**	**d. Function effectively as a member of a team**	**e. Identify, analyze, and solve engineering problems**	**f. Understand professional, ethical and social responsibilities**	**g. Communicate effectively through speaking, writing, and graphics**	**h. Understand the impact of engineering solutions in a global and societal context**	**i. Understand the commitment to life-long learning and participation in professional societies**	**j. Develop an understanding of contemporary issues**	**k. Ability to apply techniques, skills, and modern engineering tools necessary for engineering practice**
Engr 6	2.65		2.925	2.925	2.925		2.815			3.025	3.025
Engr 45	2.88	3.13		3.13	2.88	3.13	3.04			3.13	3.13
Engr 110	2.418				2.418	2.4			2.4		2.35
Engr 124	2.645		2.98		2.87	2.79		2.79	2.76	2.76	2.92
ME 37	3.01	2.685	2.925	3.585	2.93	3.43	3.5				3.42
ME 105	2.955		3.275	3.715	3.115	3.72	3.14		3.43		3.23
ME 108	2.6				2.57	2.65		2.65	2.65	2.65	2.62
ME 116	3.05		2.92		2.88		3.05		2.85		2.93
ME 117	3.16		3.17		3.15	3.14	3.14		3.14		3.17
ME 126	3.225			2.64	2.83	2.64	2.64				2.78
ME 128	3.21	3.48		3.48	3.11	2.6	3.19	3.16	2.91	3.16	3.11
ME 138	3.455		3.455	3.59	3.455	3.34	3.55				3.505
ME 171	2.885		2.97		2.96						
ME 172	2.525		2.69		2.645	2.48	2.66		2.485	2.56	
ME 180	2.47	2.545		2.545	2.47		2.545				
ME 190	3.39		3.56	3.88	3.56	3.88	3.4	3.58	3.56	3.57	3.56
ME 191	3.92	3.14	3.12	3.96	3.13	3.93	3.97	3.55	3.42	3.48	3.95

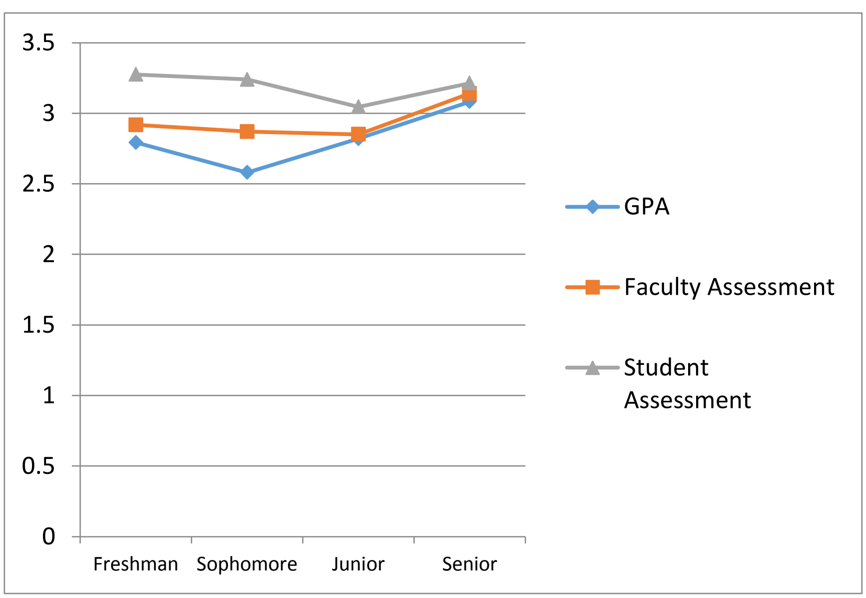
AVERAGE	**2.97**	**3**	**3.09**	**3.34**	**2.935176**	**3.09**	**3.13**	**3.146**	**2.96**	**3.04**	**3.12**

Table B-II Average Data (Baseline 2009-2010)

Course	GPA	Faculty Assessment	Student Assessment
Engr 6	2.77	2.845	3.375
Engr 45	2.58	2.87	3.24
Engr 110	2.355	2.415	2.54
Engr 124	2.61	2.8575	3.605
ME 37	2.815	2.99	3.175
ME 105	3.195	3.14	3.05
ME 108	2.495	2.62	2.98
ME 116	2.87	2.92	2.66
ME 117	3.41	3.16	2.9
ME 126	2.76	2.915	3.335
ME 128	3.025	3.095	3.125
ME 138	3.525	3.485	3.58
ME 171	3.04	2.9	2.75
ME 172	2.48	2.65	2.87
ME 180	2.5	2.5	3.195
ME 190	3.7	3.56	3.365
ME 191	3.445	3.48	3.37

AVERAGES

	GPA	Faculty Assessment	Student Assessment
Freshman	2.7925	2.9175	3.275
Sophomore	2.58	2.87	3.24
Junior	2.82	2.85	3.045
Senior	3.082	3.14	3.213



APPENDIX C

Spring 2010 Assessment Data

Table C-I. Specific Course Outcomes are listed with each Program Outcome evaluated (Spring 2010)

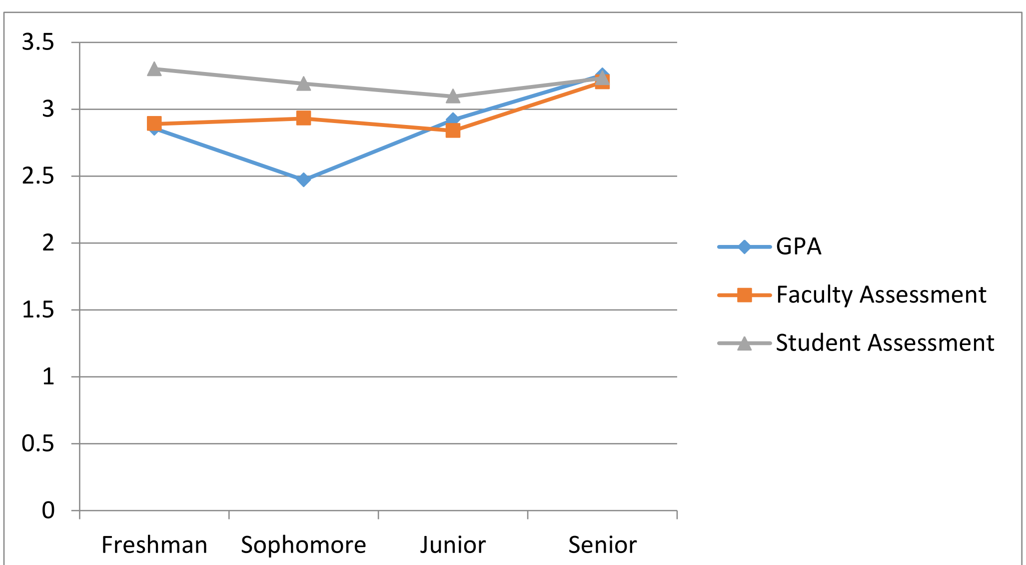
Outcomes evaluated with specific course objectives											
Course	**a. Knowledge of science, math, and engineering principles**	**b. Plan, conduct, analyze, and interpret experiments**	**c. Apply creativity in design of systems, components, processes**	**d. Function effectively as a member of a team**	**e. Identify, analyze, and solve engineering problems**	**f. Understand professional, ethical and social responsibilities**	**g. Communicate effectively through speaking, writing, and graphics**	**h. Understand the impact of engineering solutions in a global and societal context**	**i. Understand the commitment to life-long learning and participation in professional societies**	**j. Develop an understanding of contemporary issues**	**k. Ability to apply techniques, skills, and modern engineering tools necessary for engineering practice**
Engr 6	2.66		3.06	3.06	3.06		2.86			2.78	2.78
Engr 45	2.94	3.12		3.12	2.94	3.12	3.09			3.12	3.12
Engr 110	2.436				2.436	2.17			2.17		2.35
Engr 124	2.6		2.8		2.67	2.66		2.66	2.63	2.63	2.69
ME 37	3.22	2.53	3.21	3.62	2.95	3.23	3.45				3.37
ME 105	3.14		3.36	3.61	3.25	3.61	3		3.31		3.32
ME 108	2.6				2.57	2.65		2.65	2.65	2.65	2.62
ME 116	3.05		2.92		2.88		3.05		2.85		2.93
ME 117	3.16		3.17		3.15	3.14	3.14		3.14		3.17
ME 126	3.16			2.81	2.88	2.81	2.81				2.8
ME 128	3.15	3.75		3.75	3.18	3	3.19	3.11	2.91	3.11	3.18
ME 138	3.23		3.23	3.5	3.23	3.01	3.46				3.34
ME 171	2.9		2.98		2.93						
ME 172	2.55		2.88		2.78	2.52	2.88		2.53	2.52	
ME 180	2.53	2.61		2.61	2.53		2.61				
ME 190	3.39		3.56	3.88	3.56	3.88	3.4	3.58	3.56	3.57	3.56
ME 191	3.92	3.14	3.12	3.96	3.13	3.93	3.97	3.55	3.42	3.48	3.95

Table C-II Averaged Data Spring 2010

Course	GPA	Faculty Assessment	Student Assessment
Engr 6	3	2.84	3.4
Engr 45	2.47	2.93	3.19
Engr 110	2.3	2.43	2.49
Engr 124	2.75	2.645	3.61
ME 37	2.71	2.94	3.2
ME 105	3.41	3.22	3.13
ME 108	2.57	2.62	3
ME 116	3.03	2.92	2.75
ME 117	3.41	3.16	2.9
ME 126	2.73	2.94	3.32
ME 128	3.12	3.24	3.18
ME 138	3.49	3.35	3.63
ME 171	3.15	2.93	2.94
ME 172	2.83	2.79	2.96
ME 180	2.66	2.59	3.21
ME 190	3.8	3.56	3.41
ME 191	3.79	3.48	3.29

AVERAGES

	GPA	Faculty Assessment	Student Assessment
Freshman	2.855	2.89	3.3
Sophomore	2.47	2.93	3.19
Junior	2.92	2.838125	3.095
Senior	3.254	3.202	3.232



Example of Faculty Assessment of Course Outcomes

Spring 2010

ME 180 Assessment Spring 2010

Learning Outcomes for ME 180:

By the end of the semester, the student will be able to:

1. Understand the concepts of true stress, true strain, strain hardening coefficient, and their relations to strength and toughness of a material; analyze experimental data to evaluate the above parameters. (ME Outcomes: a, b, d, e, g)
2. Understand the concepts of creep, activation energy, and stress relaxation; use the concepts to predict creep life under practical engineering situation. (ME Outcomes: a, e)
3. Analyze complex and principal states of stress and strain using Mohr's circles, and apply the concepts to evaluate laboratory data involving pressure vessels and strain gauges. (ME Outcomes: a, b, d, e, g)
4. Use stress based and strain based approaches to fatigue of smooth and cracked structural members. Understand the concept of stress concentration and its role in material failure. (ME Outcomes: a, e)
5. Understand the concepts of stress intensity and fracture toughness. Use Fracture Mechanics principles to predict fracture behavior under plane stress and plane strain. Understand the "leak before break" criterion. Acquire ability to apply Fracture Mechanics in mechanical design. (ME Outcomes: a, e)
6. Learn techniques involved in measuring fatigue crack growth using electron microscopy and striation spacing. Analyze fatigue life using Paris equation for incremental fatigue crack growth rate. (ME Outcomes: a, e)

Methodology for Assessing Performance of the ME 180 Learning Objectives:

1. The student's ability to understand the fundamental concepts involving true stress, true strain, strain hardening coefficient, and their relations to strength and toughness of a material was assessed in quiz 1. In addition, the students performed a tensile test in the laboratory, analyzed data, plotted true stress-true strain graphs, and wrote a lab reports.
2. The student's ability to understand the concept of creep and activation energy was assessed in the quiz 2. The students were expected to write an appropriate creep model, formulate the relevant equations, and calculate activation energy and creep strain.
3. The student's ability to analyze complex and principal states of stress and strain was assessed in quiz 3 and 4. The problem involved stress and strain analysis involving elastic deformation, and analysis based on Mohr's circle. The students also performed laboratory experiment on a pressure vessel with strain gauges, analyzed data and wrote lab reports.
4. The student's ability to analyze stress and strain controlled fatigue behavior was assessed in quiz 5, 6 and the final exam. The problems involved writing appropriate equations and calculating fatigue life and fatigue strength and stress concentration of smooth and notched specimens, and also calculate fatigue life based on elastic and plastic strains.
5. The student's ability to understand the underlying principles of Fracture Mechanics and apply them to mechanical design was assessed in quiz 7 and the final exam. The students had to demonstrate their concepts of stress intensity, fracture toughness and failure criteria.
6. The student's ability to understand the relationship between electron fractography and fatigue crack growth and fatigue life was assessed in the final exam. The problem required the students to define the problem, formulate appropriate equations, and calculate the crack length at fracture, and number of cycles to failure.

RELATIONSHIP TO ME PROGRAM OUTCOMES:

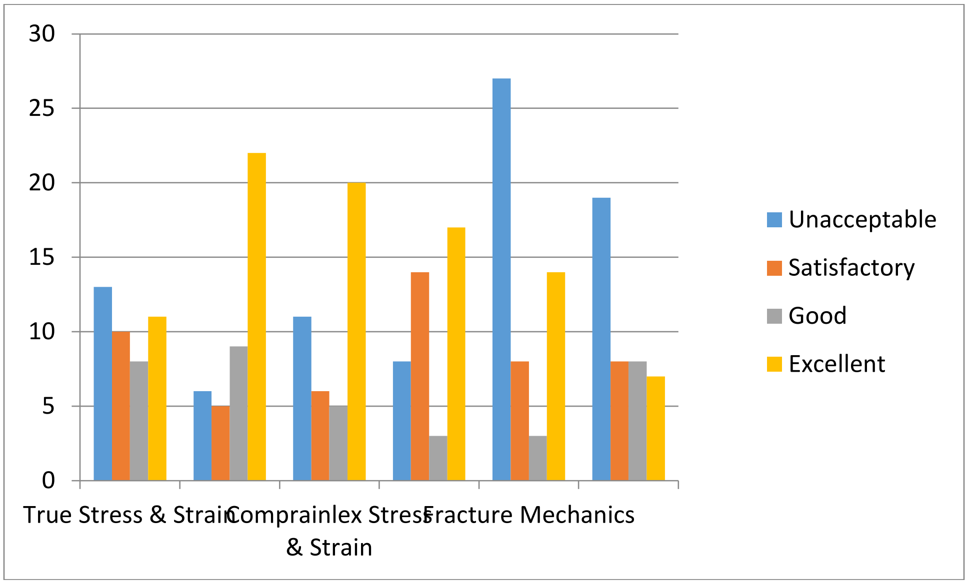
This course is related to the following outcomes:

a. demonstrate knowledge of science, mathematics, and engineering principles in technical problem solving;
b. plan, conduct, analyze, and interpret experiments, and apply experimental results using the principles of science, mathematics, and appropriate use of computer technology;
d. function effectively as part of a team;
e. identify, analyze, and solve engineering problems;
g. communicate effectively through speaking, writing, and graphics, including appropriate use of computer technology.

Grading Rubric for Mechanical Properties of Materials Assessment					
Criteria	**Unacceptable (1) D/F**	**Satisfactory (2) C**	**Good (3) B**	**Excellent (4) A**	**Score**
Analyze an evaluate true stress-true strain data	Unable to demonstrate underlying concepts, and set up equations properly. 13/42	Most concepts conveyed satisfactorily with some errors in equations setup. 10/42	Concepts conveyed clearly with minor errors in equations and calculations. 8/42	Able to demonstrate concepts completely and solve problem with very minor or no errors 11/43	2.53
Understand and evaluate creep behavior	Unable to write creep equations and solve problem 6/42	Creep equations written, simplified and solved with some errors 5/42	Creep equations written, simplified and solved with minor errors 9/42	Problem setup, simplification and solution complete and correct with only minor or no errors 22/42	3.12
Analyze complex stresses and strains	Unable to state the equations, draw the Mohr's circle and analyze stresses and strains 11/42	Able to formulate equations, draw the Mohr's circle and analyze stress-strain with some errors 6/42	Moderate errors in formulating equations, drawing Mohr's circle and analyze stress-strain 5/42	Very minor or no errors in equations, Mohr's circle or analysis 20/42	2.81

Criteria	Unacceptable (1) D/F	Satisfactory (2) C	Good (3) B	Excellent (4) A	Score
Analyze Understand and evaluate fatigue behavior.	Unable to formulate, analyze and calculate properly 8/42	Able to formulate equations, analyze and calculate with some errors 14/42	Moderate errors in analysis, formula setup and calculations 3/42	Problem setup, analysis and solution complete and correct with no or very minor errors. 17/42	2.69
Analyze fracture mechanics principle, and apply the concepts in mechanical design	Unable to demonstrate underlying concepts, and apply them in mechanical design 17/42	Concepts conveyed satisfactorily, but show errors in applying concepts in design 8/42	Convey concepts well, but moderate errors in solving design problems 3/42	Able to demonstrate concepts clearly and completely and solve problem with very minor or no errors 14/42	2.33
Analyze fracture and fatigue life based on crack growth rate	Unable to convey underlying, write the appropriate equations, and calculate the fatigue life 19/42	Concepts demonstrated satisfactorily, but commit errors in formula setup and calculations 8/42	Demonstrate concepts well but make moderate mistakes in setting up equations and calculations 8/42	Able to demonstrate concepts clearly and completely, set up equations and solve problems with very minor or no errors 7/47	2.07

Average Instructor Assessment: 2.59
Average Student Assessment: 3.21
Course GPA: 2.66



Reflection:
This is the first semester that we offered the ME 180 workshop. Because of schedule conflict, many students could not come to the workshop, but those who came benefited considerably from it. The course GPA went up to 2.66 compared to 2.48 in fall 2009, perhaps due to the benefit of the workshop. About 26% of the students did very well in the class, and demonstrated excellent grasp of the subject matter and the underlying concepts. On the other hand, about 24% of the students did poorly and showed very little mastery of the material. However, the class as a whole performed vey well in the lab, thanks to an excellent lab instructor. This demonstrates the value of our lab classes, and the importance of hands-on instructions. Those who performed poorly in the discussion class appeared to have inadequacy in their grasp of the background prerequisite materials, namely ENGR 45 – Engineering Materials, and ENGR 112 – Mechanics of Materials.   Also, many students in the class were graduating seniors, and many of them were preoccupied with their senior projects during the last few weeks of the semester. I believe this resulted in relatively poor overall grades in the last two examinations.

Signature Attesting to Compliance

By signing below, I attest to the following:

That Mechanical Engineering has conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely inf01mation regarding compliance with ABET's *Criteriafor Accrediting Engineering Programs* to include the General Criteria and any applicable Program Criteria, and the ABET *Accreditation Policy and Procedure Manual*.

Dr. Lorenzo Smith, Dean

LMS   6/23/15

Signature

Signature   **Date**