California Maritime Academy
Department of Mechanical Engineering
Assessment System Manual

Revised June 2010

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Overview

This document presents the assessment system for the Mechanical Engineering department at the California Maritime Academy (CMA), a specialized campus of the California State University. The assessment methods presented have been selected for compatibility with the ABET EAC criteria, but are application for other internal and external program reviews (e.g. WASC review and CSU program review). The main purpose of this assessment procedure is to monitor the performance of the program, to ensure it meets its educational objectives, and to use the data collected for continuous improvement of the program.

The document is intended as a guide to faculty members in acquiring, analyzing, and reporting assessment data. By following the procedures described, we help ensure that we have a uniform and consistent assessment system in place for the department. The data will provide evidence on how well we are achieving our outcomes and objectives, and will help guide future program improvements.

Mechanical Engineering at the California Maritime Academy

The California Maritime Academy (CMA), was originally founded in 1929 as the California Nautical School. It became the 22nd campus of the California State University (CSU) in 1995. The California Maritime Academy is the smallest campus of the California State University system. It offers degree programs in Business Administration, Facilities Engineering Technology, Global Studies and Maritime Affairs, Marine Engineering Technology, Marine Transportation, and Mechanical Engineering. The Mechanical Engineering program is the only engineering program at the campus, and confers only the bachelor degree. At present, the department consists of 6 faculty and 148 students.

All those who receive the ME degree follow the same core curriculum, which is designed to maintain the mission and learning objectives of the academy as well as the educational objectives of the program. However, students may choose to overlay additional coursework and training that is oriented toward particular job fields within the broader spectrum of mechanical engineering.

The US Coast Guard License (USCG) option, which leads to a USCG Third Assistant Engineer's license, is designed for students who wish to use their engineering degree as a marine engineer. The curriculum includes the courses that define the core ME program as well as the license and cruise course requirements that define the USCG option. Students in this option must complete all of the competencies for the Standards for Training and Certification of Watch-keepers (STCW) as set by the International Maritime Organization (IMO). In addition they are required to take and pass the 3rd Assistant Engineer's License exam as administered by the U.S. Coast Guard. These students participate in three sea-training cruises: two aboard the CMA training ship Golden Bear and one aboard a commercial vessel.

Those students who follow the ME option are not interested in pursuing a career in the merchant marine. In keeping with our mission and values, the ME option retains some of the strong practical training and hands-on aspects of the USCG option, but to a lesser degree. The curriculum includes the courses that define the core ME program as well as the requirement for sea training in their first year. This practical training distinguishes CMA from most engineering schools, and provides an added dimension to our graduates. In addition to one cruise, the ME option requires two summer internships for students to work onsite in an industry or research facility for a 2-3 month period under an engineering supervisor.

Based upon surveys and contact between faculty and alumni, we find our ME graduates in a variety of fields. Many sail with the merchant marine, at least for a few years, but it is common to see graduates change their career path and seek a shore-side engineering position or return to school for graduate study. In addition to the maritime transportation industry there is a significant representation of our alumni in the areas of power generation, HVAC, and facility commissioning and engineering.

The ME program identifies its significant constituencies as students, faculty, alumni, the engineering profession and prospective employers, and our External Advisory Board (EAB). The department seeks to include these constituencies in its assessment process.
Our External Advisory Board includes representation from industry, the ASME professional society, and academia. The EAB meets twice a year: once in the fall and once in the spring semester. The spring meeting is scheduled on the same day as the senior design presentations to allow EAB member participation in the assessment of student performance. Additional interaction among employers, students, alumni and faculty takes place during an annual career fair on campus. CMA alumni are typically strong supporters of our program and are involved with the Academy through the alumni association and its board of directors.

Vision and Mission Statements

The *vision* of the California Maritime Academy is:

> *The California Maritime Academy will be a leading educational institution recognized for excellence in business, engineering, operations, and policy of the transportation and related industries for the Pacific Rim and beyond.*

The *mission* of California Maritime Academy is to:

- *Provide each student with a college education combining intellectual learning, applied technology, leadership development, and global awareness*
- *Provide the highest quality licensed officers and other personnel for the merchant marine and national maritime industries*
- *Provide continuing education opportunities for those in the transportation and related industries*
- *Be an information and technology resource center for the transportation and related industries.*

The mission of the Mechanical Engineering program is:

> *The mission of the Mechanical Engineering program is to produce entry-level professionals capable of applying their knowledge of science and engineering in the design, analysis, evaluation, and production of engineering devices and systems. It also provides students with the necessary academic preparation for further education and professional development in their chosen careers.*

Institution-wide Student Learning Outcomes

Consistent with the mission of the California Maritime Academy to provide each student with a college education combining intellectual learning, applied technology, leadership development, and global awareness, The learnig community at CMA has defined a set of institutional learning outcomes. Our graduates will develop and apply the following competencies through participation in curricular and co-curricular learning opportunities provided by the Academy:

I. Intellectual Learning

- Communications
    - The ability to coherently and persuasively share information with others via oral, written, visual and listening communication skills.
- Critical and creative thinking

- The ability to comprehend, analyze and objectively evaluate new information and ideas, so as to develop informed opinions, and to explain things in a new or different way, often through synthesizing or applying intuition.

- Problem solving and quantitative literacy
  - The ability to exercise intellectual inquiry via the use of sound reasoning to identify, predict, analyze and solve problems, and to formulate, evaluate, and communicate conclusions and inferences from numerical information.
- Human development and the natural world
  - The ability to demonstrate an understanding of fundamental concepts in the humanities, social, physical and life sciences.
- Lifelong learning
  - The ability to employ self-knowledge of the social and cognitive factors influencing the learning process, to engage in ongoing reflection and exploration of the purpose of personal development, and to synthesize and apply knowledge and experiences to new personal and professional applications.

II. Applied Technology and Professional Development

- Mastery of discipline specific skills in maritime related fields
  - The ability to demonstrate competency in discipline specific skills.
- Information fluency and computing technology
  - The ability to define a specific need for information, and to then locate, access, evaluate, and effectively apply the needed information to the problem at hand and to effectively use computers and computing applications in order to create, access, store, process, analyze and communicate information.
- Use of simulation tools
  - Ability to use simulation tools in problem solving and analysis.

III. Leadership, Teamwork and Personal Development

- Leadership, teamwork and interpersonal relationships
  - The ability to work with other people in achieving common goals, and, when necessary, to envision new goals and to motivate and empower others to achieve them and to interact constructively with a diverse group of people and foster collegiality, good will, and community among them.
- Professional conduct
  - The ability to behave and perform in a manner that is accepted in one's profession and to move oneself continuously toward a goal or set of goals, despite personal difficulties, obstacles, and time constraints.

IV. Global Awareness and Social Responsibility

- Ethical awareness
  - The ability apply standards of proper conduct and responsibility towards society in one's professional and personal life.
- Global stewardship
  - The ability to demonstrate an awareness of diversity in global culture and environment, and an understanding of the responsibilities associated with promoting the welfare of state, country, whole of humanity, and planet.

Assessment System History and Current Status

The ME Assessment System, shown in Figure 1, consists of two main processes (loops): the Program Educational Objective processes and the Program Outcome processes.

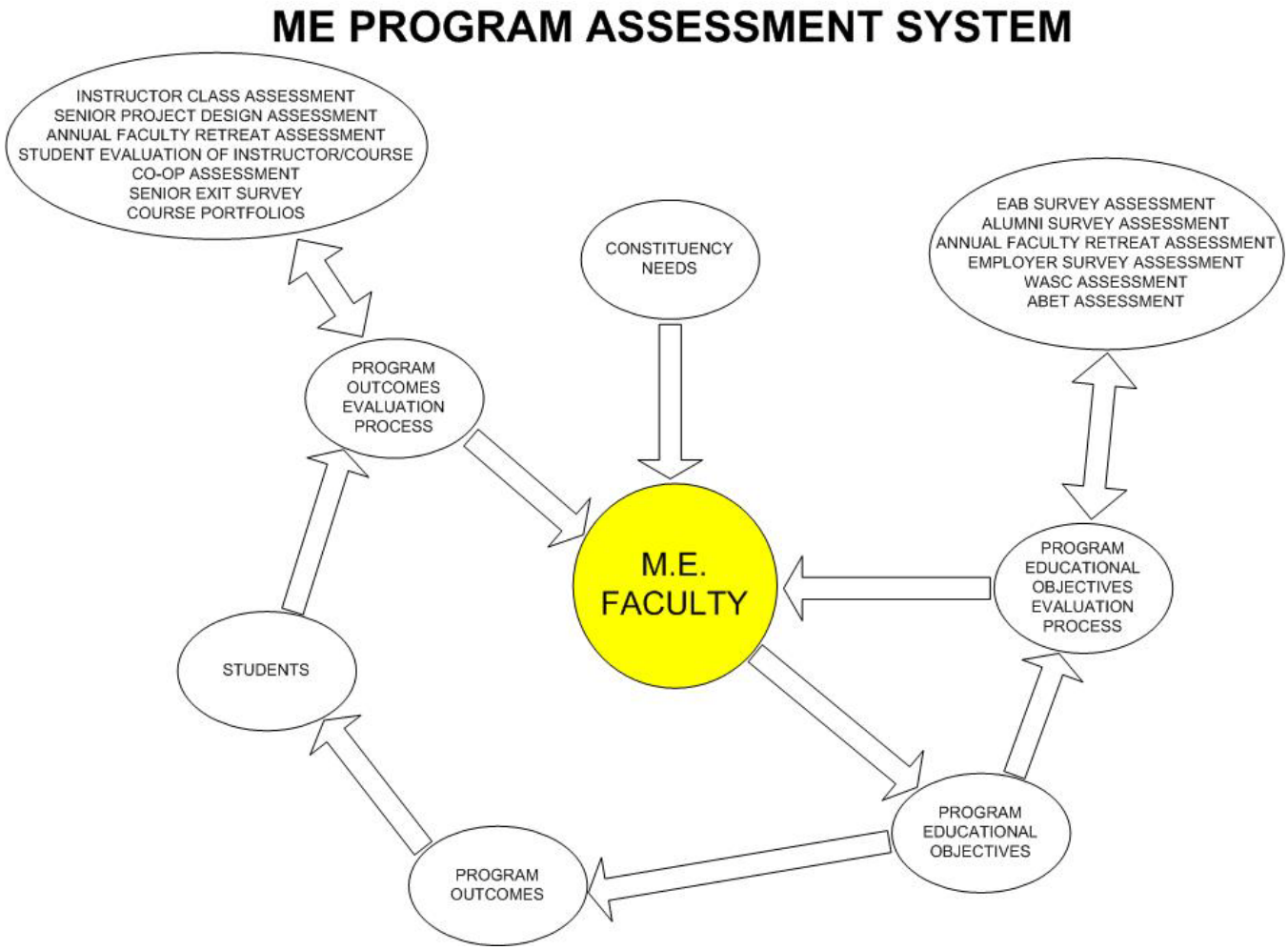

Figure 1

Program Educational Objectives Processes

The 2008 ABET program review identified a weakness in the PEO and the process used to define them. In response to this, the process for defining PEO was revised to be more inclusive of our constituencies, and the PEO were redefined. The response was transmitted to ABET EAC, and as a result this weakness was determined to be resolved. The process for defining PEO is as follows:

- The faculty will review existing program objectives to ensure that they are consistent with the mission of the academy, the department mission and the ABET criteria, and will create revised objectives as necessary.
- The objectives will be provided to a representative group of graduates and employers for evaluation and suggested revisions.
- The faculty will evaluate responses from graduates and employers, and will modify the objectives to reflect the responses.
- The modified list of program objectives will be presented to the External Advisory Board for comment and final approval.
- This process will normally be done every 3 years, but will also be done anytime that the mission statements of the institution or department, or the ABET criteria are changed.

The current ME Program Educational Objectives (PEOs), revised in April 2009 using this process are listed below. They are published in the official school catalog as well as the school web site: www.csum.edu:

Mechanical engineering graduates of the California Maritime Academy will:

A. Be well educated professionals who utilize their intellectual learning, applied technology experience, leadership skills, and global awareness in successful careers; and continue to improve their skills through lifelong learning and advanced studies.

B. Effectively practice as professional engineers, managers, and leaders in the maritime and energy industries and a wide variety of other fields; and as licensed engineers in the merchant marine.

C. Successfully combine fundamental engineering knowledge, core leadership skills, and the practical experience gained at the Academy to turn ideas into reality for the benefit of society.

D. Be influential members of multidisciplinary teams; creatively and effectively contributing to the design, development, and objective evaluation of engineering components, systems, and products; and clearly communicating the work in an appropriate manner to their customers and colleagues.

E. Personally assume and actively encourage peers to uphold the professional, ethical, social, and environmental responsibilities of their profession.

The process to assess and evaluate attainment of the PEO includes indirect measures that include EAB, employer, and alumni surveys as well as WASC (Western Association of Schools and Colleges), and ABET reports. Additionally, meetings such as the President's retreat, Academic Senate retreat, and the ME department retreats provide opportunities for the ME faculty to evaluate attainment of the PEO and alignment with institutional objectives and the needs of constituents.

The EAB and Employer surveys seek to assess and evaluate the degree to which our graduates meet and achieve our PEOs from the EAB and employers' perspectives. This assessment process takes place periodically: the surveys are collected and are processed every six years, and the results are used to evaluate the achievement of the program objectives. The surveys are included in Appendix A.

Alumni input on objectives is solicited and documented through periodic alumni surveys. These surveys seek not only to find if our alumni believe that we are satisfying our objectives, but also how important they consider each objective is to them. This survey is also included in Appendix A.

In addition to the indirect surveys to assess our Program Educational Objectives, the annual direct (and indirect) assessment of our Program Outcomes is also used to assess attainment of our PEO, as they are linked together as discussed later.

As a final step in the Educational Objectives review process, the recommendations of the faculty are presented to the EAB for discussion, revision and approval. This EAB review is documented in the minutes of the meeting.

Program Outcomes Processes

The program outcomes (PO) that are in place are published in the official school catalog and school web site. They are communicated to the students in course syllabi and are communicated to entering ME students in ENG 110, Introduction to Engineering and Technology. They are communicated to the alumni, employers, and EAB in various forms such as surveys to solicit feedback for the department. The PO are reviewed using a similar process to the PEO to ensure that they remain in alignment with the institution and the constituents.

The current ME Program Educational Objectives (PEOs), revised in October 2009 using this process are listed below. They are published in the official school catalog as well as the school web site: www.csum.edu.

Graduates of our program will have:

1. an ability to apply knowledge of mathematics, science, and engineering
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. an ability to function on multi-disciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
12. an ability to apply principle of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes
13. ability to work professionally in both thermal and mechanical systems areas

14. an ability to apply the "hands-on" knowledge to solve/understand engineering design problems/systems
15. an ability to demonstrate leadership roles
16. an ability to comprehend and convey technical information.

The evaluation processes for achieving POs include both indirect and direct tools. Indirect methods include the midterm student evaluations (MSE) of courses,, the student evaluations of instructor and course (SEI/C), the instructor class assessments (ICA) (all as part of course portfolios), senior project design assessments, senior exit survey, co-op report assessment, and the alumni survey.

Direct measurements of the achievement of program outcomes involve measuring the achievement of course outcomes, and the linkage of these course objectives to the program objectives.

Course Outcome (CO) Assessment and Linkage to PO and PEO

The program outcomes and objectives are achieved through a curriculum that offers a number of required as well as elective courses. Each course has defined course outcomes and course objectives that are linked to the program outcomes and objectives, and a set of rubric-based performance criteria that are used to provide quantitative measurement of how well course outcomes are achieved. Course objectives, outcomes, and performance criteria are all shown and included in the ABET Syllabi for each course. An example for one course is shown in Appendix B.

Tools for assessing course outcomes include assessment of student works (such as homework, quizzes, exams, reports, and/or project designs) that measure a specific course outcome through a performance criterion using a rubric. The rubric system assures consistency in the outcome evaluation process. The course outcomes are then used to measure the program outcomes for that course. Appendix C contains examples of the rubrics used.

The linkage among program outcomes and course outcomes is shown in Table 1. The course outcomes are thus directly and quantitatively assessed, and are tied to the program outcomes as shown in the course syllabi; therefore if the course outcomes are met, that provides direct quantitative evidence that program outcomes are met.

There are a number of program outcomes that are related to each program educational objective. The program objectives and program outcomes are related as shown in Figure 2. Because the outcomes and objectives are linked, evidence that the program outcomes are met supports the conclusion that program educational objectives are being achieved.

Note that the direct assessment of PEO and PO through the assessment of course outcomes is supplemented by the indirect measurements of PO and PEO described above.

The Process for Assessing Course Outcomes and Program Outcomes

The process to ensure that the Program Outcomes are met begins with the course assessments. For each course, the instructor assembles the rubric based assessments of student work used to assess that course outcome. From this data, the instructor calculates the average value and standard deviation of the rubric scores, as well as the percentage of students that achieved a score of 3 (satisfactory performance) or better. The quantitative assessment of all course outcomes associated with a particular program

outcome (according to Table 1) are listed under that program outcome number, and a table of overall program outcome data is created

In addition to this direct course outcome data, the qualitative survey data is also tabulated in a similar manner for each program outcome.. These data include Capstone Project I and II courses surveys of faculty and the external advisory board members; the senior exit survey; and the student evaluation of the instructor and course (SEIC) surveys performed in each class.

Each summer the ME faculty meet to review these program outcome assessment results and other program issues. The rubric data among instructors is reviewed for consistency by the faculty. The data is then reviewed and analyzed by the faculty, and a report is prepared summarizing the assessment results.

The department considers a program outcome to be satisfactorily met if there are *multiple* courses assessing that outcomes and if all course outcomes associated with the program outcome satisfy both the following criterion:

- average assessment value of at least 3 (on a 1 to 5 scale)
- at least 70% of the students assessed achieve a 3 or better score.

Program outcomes that do not meet these criteria require further assessment from the faculty to determine what issues exist and how they might be addressed. Outcomes that do meet the criteria do not require further assessment, but they may be further addressed at the discretion of the faculty

	Outcome	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Course																
Year 1	ENG 110									X	X						
Year 2	ENG 210	X										X					
	ENG 250	X				X						X	X				
	ENG 250L	X										X					
	ME 220											X					
	ME 230					X											X
	ME 232	X				X											
	ME 240	X				X											
	ME 330	X				X							X				
	ME 332	X				X											
Year 3	ENG 300	X				X						X					
	ME 339	X	X			X		X				X	X	X			X
	ME 340	X				X											
	ME 342	X				X	X							X			X
	ME 344	X				X							X				
	ME 350	X				X											
	ME 350L		X														
	ME 360	X				X											
	ME 360L		X									X					
	ME 392	X		X		X							X	X			
	ME 434	X				X				X		X	X	X			
	ME 440	X		X		X								X			
Year 4	ME 394	X		X		X		X		X			X	X			
	ME 349	X	X					X				X		X			X
	ME 429			X											X		
	ENG 440	X				X		X	X	X	X						
	ME 430	X	X			X		X				X	X	X			
	ME 432	X				X						X	X	X			
	ME 442	X		X	X			X		X				X			X
	ME 444	X		X		X		X		X				X			
	ME 460	X				X						X					
	ME 460L		X									X					
	ME 490			X	X	X		X									X
	ME 492			X	X	X		X				X	X	X		X	
	ME 494			X	X			X				X		X	X	X	

Table 1 Linkage of Course Outcomes to Program Outcomes

Table 2: Program Educational Objectives vs. Program Outcomes Grid

Program Educational Objectives Mechanical engineering graduates of the California Maritime Academy will:	**Program Outcomes**															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
A) Be well educated professionals who utilize their intellectual learning, applied technology experience, leadership skills, and global awareness in successful careers; and continue to improve their skills through lifelong learning and advanced studies.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
B) Effectively practice as professional engineers, managers, and leaders in the maritime and energy industries and a wide variety of other fields; and as licensed engineers in the merchant marine.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C) Successfully combine fundamental engineering knowledge, core leadership skills, and the practical experience gained at the Academy to turn ideas into reality for the benefit of society.	X	X	X		X						X	X	X	X	X	
D) Be influential members of multidisciplinary teams; creatively and effectively contributing to the design, development, and objective evaluation of engineering components, systems, and products; and clearly communicating the work in an appropriate manner to their customers and colleagues.				X			X		X	X				X	X	X
E) Personally assume and actively encourage peers to uphold the professional, ethical, social, and environmental responsibilities of their profession.				X		X	X	X	X	X						

1. an ability to apply knowledge of mathematics, science, and engineering
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. an ability to function on multi-disciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
12. an ability to apply principle of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes
13. ability to work professionally in both thermal and mechanical systems areas
14. an ability to apply the “hands-on” knowledge to solve/understand engineering design problems/systems
15. an ability to demonstrate leadership roles
16. an ability to comprehend and convey technical information.

Appendix A:

Instructions for the Instructor

Instructions for the Instructor

(Revised Spring 2010)
Each faculty member in the department will be assigned classes to assess. The faculty member will be in charge of maintaining a portfolio for the course. The portfolio shall contain:

1. Class Course Syllabus (handed out to students)
2. ABET Course Syllabus (any extra material required by ABET but not handed out)
3. Direct Evaluation Methods and Results for Course Outcomes using Performance Criteria/Rubric System Description
4. Indirect Assessment Methods and Results
    a. Mid-term Student Evaluation of Instructor/Course results
    b. Student Evaluation Of Instructor/Course average scores and student comments
    c. Instructor Class Assessment
5. Sample Copies of HW/Special Assignments/Quiz/Exam/Report/Project

Syllabus

The syllabus shall accurately describe the course, its objectives and outcomes, as well as how the outcomes tie into the program outcomes. Part of the definition of course outcomes is to choose the proper way to assess these outcomes for both program outcome assessment and individual course improvement.

Samples of a course syllabus and an ABET syllabus are included in Appendix *C Program Outcome Assessment Loop. A summary of the information to include in the syllabus for assessment is below:*

Course objectives: Objectives list the overall goals of the course. They should be referenced to tie into the program objectives

Course outcomes: Outcomes list measurable goals of the course. They should be referenced to tie into the program outcomes.

Outcome rubric: Performance criteria to assess course outcomes. Rubrics should describe what will be measured, how the data will be collected, and a criterion for success or failure.

What data to collect

The basis for the data collection is the indirect assessment surveys and the quantitative rubric-based assessments. Both forms of assessment measure a course's level of meeting its course outcomes. If the course outcomes are met, then it can be concluded that the program outcomes are being met, based on the matrix connecting course outcomes with the program outcomes (Table 1).

Indirect Assessment

The indirect assessments are generally surveys. The students are surveyed mid-semester and at the end of the course, and the instructor is surveyed at the end of the course. Appendix C contains the following examples:

- A typical mid-term assessment survey.
- A typical student evaluation of the course survey.
- A typical instructor class assessment.

Quantitative Assessment

The rubric-based assessment is a quantitative technique that allows the instructor to assess the student progress at meeting the course outcomes. Any form of student work that addresses the outcomes, such as midterm exam questions, homework, oral presentations, etc. may be used. The work is assessed based on how well the student has met the course outcomes. This data is used for program assessment as well as course improvement. Model rubrics are included in Appendix D.

The syllabus for each course should define the outcome rubrics to be used, as well as the outcomes themselves (for examples, see Appendix B)

Data Collection

The instructor shall keep the data from each course in a course portfolio (or in electronic form), which may also include sample work from the class. The portfolio should have assessment data from previous years if available. The instructor's class assessment (ICA) should summarize the assessment data from the course. Also, an excel file can be used to tabulate the data uniformly for use by the program to assess its outcomes. Appendix B has examples of each of these forms.

Timeline for the semester

- Syllabus and planned assessment should be done by the beginning of class.
- The midterm assessments shall be done around the 7^{th} week of classes.
- The rubric-based assessment shall be done as the work is presented in the class, and tabulated by the end of the semester.
- Other assessment shall be finished by the end of the course.
- Annually (typically in the summer), the faculty shall meet to discuss the assessment results and review which faculty are assigned to which courses.

Appendix B:

Program Educational Objectives Assessment Loop

EAB Survey

The surveys asked the participants to rate their level of agreements, on a scale of 1 to 5, on how well prepared our graduates are in regard to the 14 items listed below. (1 = unsatisfactory, 2 = marginal, 3 = average, 4 = very good, 5 = outstanding). The 14 items are listed below:

1. Effectively apply engineering/technology in their profession
2. Compete professionally as an engineer
3. Be a leader
4. Have/apply global awareness skills
5. Be a lifelong learner
6. Realize/apply both the thermal and mechanical stems
7. Apply engineering fundamentals in solving problems
8. Model/formulate/solve engineering problems
9. Think creatively and critically
10. Synthesize information
11. Communicate effectively
12. Function effectively in multidisciplinary teams
13. Design/conduct/assess engineering experiments
14. Be a professional, ethical, socially responsible engineer

The following table shows the linkage between the above items and PEOs. Objectives are indicated with capital letters.

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PEO	A,C	A,B,C, D, E	A, E	A	A	B,C, D	C	C	D	D	E	D	D	E

Assessment Process for the External Advisory Board Survey

1. The Mechanical Engineering department will conduct, evaluate, and tabulate the External Advisory Board Survey. The surveys are to be conducted every 3 or 6 years (depending on ABET accreditation length) and the results are to be transmitted to the Dean and to the Mechanical Engineering Department Chair.

2. The Dean and the Chair are to review the results and transmit them to the faculty/staff.

3. If a program-related problem is identified as a result of this assessment, then the Dean and the Chair are to refer the problem to a faculty member or an appropriate committee for a resolution to the problem.

4. Process/actions/recommendations for “problem resolution” are to be documented and reported to the Dean and the Chair.

California Maritime Academy
Mechanical Engineering Department
External Advisory Board Assessment

Your assessment of the following statements will help the Mechanical Engineering Department assess its Educational Program Objectives. The department appreciates your response. Please rate your level of agreement with the following items. Note the scale used.

The mechanical engineering graduates from CMA are well prepared to:

	No Opinion	1 Unsatis-factory	2 Marginal	3 Average	4 Very Good	5 Outstand-ing
1) effectively apply engineering/ technology in their profession	☐	☐	☐	☐	☐	☐
2) compete professionally as an engineer	☐	☐	☐	☐	☐	☐
3) be a leader	☐	☐	☐	☐	☐	☐
4) have/apply global awareness skills	☐	☐	☐	☐	☐	☐
5) be a lifelong learner	☐	☐	☐	☐	☐	☐
6) realize/apply both the thermal and mechanical stems	☐	☐	☐	☐	☐	☐
7) apply engineering fundamentals in solving problems	☐	☐	☐	☐	☐	☐
8) model/formulate/solve engineering problems	☐	☐	☐	☐	☐	☐
9) think creatively and critically	☐	☐	☐	☐	☐	☐
10) synthesize information	☐	☐	☐	☐	☐	☐
11) communicate effectively	☐	☐	☐	☐	☐	☐
12) function effectively in multidisciplinary teams	☐	☐	☐	☐	☐	☐
13) design/conduct/assess engineering experiments	☐	☐	☐	☐	☐	☐
14) be a professional, ethical, socially responsible engineer	☐	☐	☐	☐	☐	☐

15) What industry do you work in?

□ Aerospace	□ Automotive/IC Engines	□ Banking/Investment	□ Bioengineering
□ Computer Engineering	□ Education	□ Electronics/Electric Packaging	□ Entertainment
□ Environmental Engineering	□ Nuclear Engineering	□ Petroleum/Off-Shore Drilling	□ Power
□ Pressure Vessels/Piping	□ Pharmaceutical	□ Telecommunications	
□ Transportation/Shipping	□ Textile	□ Other _____	

16) What is your primary job function?

□ Management	□ Product Design	□ Systems Design	□ Production Engineering
□ Testing/Quality Control	□ Education	□ Plant Engineering	□ Operation/Maintenance
□ Research & Development	□ Other _____		

17) What do you think are the strengths of the ME program at CMA?

18) What do you think are the weaknesses of the ME program at CMA? Any suggestions on how to improve?

19) Any other comments or suggestions?
(Use the back if necessary.)

Alumni Survey

The Alumni Survey is a comprehensive survey that not only surveys our graduates on the type of industry in which they are employed, their primary job function, and job title, but also seeks to obtain from them the degree to which our program outcomes and objectives are achieved. This assessment process takes place periodically, the surveys are collected and are processed about every six or three years, and the results are used to evaluate the achievement of the program objectives

Assessment Process for the Alumni Survey

1. The ME department will conduct, evaluate, and tabulate the Alumni Survey. The surveys are to be conducted regularly from students who have graduated in recent years. The results are to be transmitted to the Dean's Office and to the Mechanical Engineering Department Chair.

2. The Dean and the Chair are to review the results and transmit them to the faculty/staff.

3. If a program-related problem is identified as a result of this assessment, then the Dean and the Chair are to refer the problem to a faculty member or an appropriate committee for a resolution to the problem.

4. Process/actions/recommendations for "problem resolution" are to be documented and reported to the Dean and the Chair.

California Maritime Academy
Mechanical Engineering Department
Mechanical Engineering Alumni Survey

The information that you provide in this survey will help the Mechanical Engineering Department to improve the quality of its program. The department appreciates your response.

I. Alumni/Career Information

Gender/Ethnicity: □ Male □ Female
□ African-American □ Asian □ Caucasian □ Hispanic □ Native American □ Other

Year of Graduation from CMA? _____

Did you graduate from CMA within the past □ one year □ three years □ five years □ ten years?

Did/Are you attend/attending graduate school? □ Yes □ No

Highest degree earned? □ B.S. □ M.S. □ Ph.D. □ Other _____

Certificates/credentials earned after graduation? _____ Date: _____

What industry do you work in?

□ Aerospace	□ Automotive/IC Engines	□ Banking/Investment	□ Bioengineering
□ Computer Engineering	□ Education	□ Electronics/Electric Packaging	□ Entertainment
□ Environmental Engineering	□ Nuclear Engineering	□ Petroleum/Off-Shore Drilling	□ Power
□ Pressure Vessels/Piping	□ Pharmaceutical	□ Telecommunications	
□ Transportation/Shipping	□ Textile	□ Other _____	

What is your primary job function?

□ Management	□ Product Design	□ Systems Design	□ Production Engineering
□ Testing/Quality Control	□ Education	□ Plant Engineering	□ Operation/Maintenance
□ Consulting	□ Graduate Student	□ Research &Development	
□ Other _____			

What is your job title?

□ Staff Engineer	□ Project Engineer	□ Chief/Principal Engineer	□ Design Engineer
□ Senior Engineer	□ Development Engineer	□ Project Manager	□ Educator
□ President/Vice President	□ Sales Engineer	□ Manufacturing Engineer	□ Operator
□ Quality Assurance Manager	□ Plant Engineer	□ Other _____	

How many years have you worked as an engineer?
□ 1-2 □ 3-4 □ 5-6 □ >7

Have you taken the Fundamental Examination (old EIT exam)? □ Yes Year _____ □ No

If yes, did you pass the exam? □ Yes □ No

Are you a licensed Professional Engineer? □ Yes Year _____ □ No

If no, are you planning to become one? □ Yes □ No

II. Assessment of Program Outcomes

Please rate the following Program Outcomes. These outcomes are the abilities/skills/attributes expected of engineering graduates. Rate each outcome in two respects. First, how important each outcome has been to your employment and, second, how well your education at CMA prepared you for that outcome.

Program Outcomes	1 Not Important	2 Somewhat Important	3 Important	4 Very Important	5 Extremely Important	1 Not Prepared	2 Somewhat Prepared	3 Prepared	4 Very Prepared	5 Extremely Prepared
1) An ability to apply knowledge of mathematics, science, and engineering	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2) An ability to design and conduct experiments, as well as to analyze and interpret data	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3) An ability to design a system, component, or process to meet desired needs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4) An ability to function on multi-disciplinary teams	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5) An ability to identify, formulate, and solve engineering problems	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6) An understanding of professional and ethical responsibility	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7) An ability to communicate effectively	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8) The broad education necessary to understand the impact of engineering solutions in a global and societal context	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9) A recognition of the need for, and an ability to engage in life-long learning	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10) A knowledge of contemporary issues	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12) An ability to apply principle of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13) Ability to work professionally in both thermal and mechanical systems areas	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14) an ability to apply the "hands-on" knowledge to solve/understand engineering design problems/systems	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15) An ability to demonstrate leadership roles	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16) an ability to comprehend and convey technical information	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

III. Assessment of Program Educational Objectives

Please rate the following Program Educational Objectives. These objectives are statements that describe the expected accomplishments of graduates after graduation. Rate each item with respect to the degree of preparation that you received/experienced. Please note the scale used.

Are you aware of the ME Program Educational Objectives? ☐ Yes ☐ Somewhat ☐ No

Program Educational Objectives	No Opinion	1 Not Prepared	2 Somewhat Prepared	3 Prepared	4 Very Prepared	5 Extremely Prepared
A. Be well educated professionals who utilize their intellectual learning, applied technology experience, leadership skills, and global awareness in successful careers; and continue to improve their skills through lifelong learning and advanced studies.	☐	☐	☐	☐	☐	☐
B. Effectively practice as professional engineers, managers, and leaders in the maritime and energy industries and a wide variety of other fields; and as licensed engineers in the merchant marine.	☐	☐	☐	☐	☐	☐
C. Successfully combine fundamental engineering knowledge, core leadership skills, and the practical experience gained at the Academy to turn ideas into reality for the benefit of society.	☐	☐	☐	☐	☐	☐
D. Be influential members of multidisciplinary teams; creatively and effectively contributing to the design, development, and objective evaluation of engineering components, systems, and products; and clearly communicating the work in an appropriate manner to their customers and colleagues.	☐	☐	☐	☐	☐	☐
E. Personally assume and actively encourage peers to uphold the professional, ethical, social, and environmental responsibilities of their profession.	☐	☐	☐	☐	☐	☐

IV. Overall Assessment of Alumni Experience

Please rate the following items with respect to the overall preparation that you received/experienced for each item. Please note the scale used.

	No Opinion	1 Not Prepared	2 Somewhat Prepared	3 Prepared	4 Very Prepared	5 Extremely Prepared
Your overall preparation to:						
1) effectively apply engineering/technology in your profession	☐	☐	☐	☐	☐	☐
2) compete professionally as an engineer	☐	☐	☐	☐	☐	☐
3) be a leader	☐	☐	☐	☐	☐	☐
4) have/apply global awareness skills	☐	☐	☐	☐	☐	☐
5) be a lifelong learner	☐	☐	☐	☐	☐	☐
6) realize/apply both the thermal and mechanical stems	☐	☐	☐	☐	☐	☐
7) apply engineering fundamentals in solving problems	☐	☐	☐	☐	☐	☐
8) model/formulate/solve engineering problems	☐	☐	☐	☐	☐	☐
9) think creatively and critically	☐	☐	☐	☐	☐	☐
10) synthesize information	☐	☐	☐	☐	☐	☐
11) communicate effectively	☐	☐	☐	☐	☐	☐
12) function effectively in multidisciplinary teams	☐	☐	☐	☐	☐	☐
13) design/conduct/assess engineering experiments	☐	☐	☐	☐	☐	☐
14) be a professional, ethical, socially responsible engineer	☐	☐	☐	☐	☐	☐

15) Would you recommend the ME program at CMA to a relative/friend? ☐ Yes ☐ Maybe ☐ No

16) What do you think are the strengths of the ME program at CMA?

17) What do you think are the weaknesses of the ME program at CMA? Any suggestions on how to improve?

18) Any other comments?
(Use the back if necessary.)

	1 Poor	2 Inadequate	3 Fair	4 Good	5 Excellent
19) How do you rate this survey?	☐	☐	☐	☐	☐

Employer Survey

Assessment Process for the Employer Survey

1. The Career Development Center will conduct the Employer Survey. The surveys are to be conducted every three or six years, depending on the ABET accreditation cycle. The Mechanical Engineering Department will evaluate and tabulate the surveys. The results are to be transmitted to the Dean's Office and to the Mechanical Engineering Department Chair.

2. The Dean and the Chair are to review the results and transmit them to the faculty/staff.

3. If a program-related problem is identified as a result of this assessment, then the Dean and the Chair are to refer the problem to a faculty member or an appropriate committee for a resolution to the problem.

4. Process/actions/recommendations for "problem resolution" are to be documented and reported to the Dean and the Chair.

California Maritime Academy
Mechanical Engineering Department
Employer Survey Assessment

Your assessment of the following statements will help the Mechanical Engineering Department assess its Program Educational Objectives. The department appreciates your response. Please rate your level of agreement with the following items. Note the scale used.

The mechanical engineering graduates from CMA are well prepared to:

	No Opinion	1 Unsatis-factory	2 Marginal	3 Average	4 Very Good	5 Outstand-ing
1) effectively apply engineering/ technology in their profession	☐	☐	☐	☐	☐	☐
2) compete professionally as an engineer	☐	☐	☐	☐	☐	☐
6) be a leader	☐	☐	☐	☐	☐	☐
7) have/apply global awareness skills	☐	☐	☐	☐	☐	☐
8) be a lifelong learner	☐	☐	☐	☐	☐	☐
6) realize/apply both the thermal and mechanical stems	☐	☐	☐	☐	☐	☐
7) apply engineering fundamentals in solving problems	☐	☐	☐	☐	☐	☐
8) model/formulate/solve engineering problems	☐	☐	☐	☐	☐	☐
9) think creatively and critically	☐	☐	☐	☐	☐	☐
10) synthesize information	☐	☐	☐	☐	☐	☐
11) communicate effectively	☐	☐	☐	☐	☐	☐
12) function effectively in multidisciplinary teams	☐	☐	☐	☐	☐	☐
13) design/conduct/assess engineering experiments	☐	☐	☐	☐	☐	☐
15) be a professional, ethical, socially responsible engineer	☐	☐	☐	☐	☐	☐

15) Number of CMA graduates who have worked under your supervision? _____

16) What industry do you work in?

□ Aerospace	□ Automotive/IC Engines	□ Banking/Investment	□ Bioengineering
□ Computer Engineering	□ Education	□ Electronics/Electric Packaging	□ Entertainment
□ Environmental Engineering	□ Nuclear Engineering	□ Petroleum/Off-Shore Drilling	□ Power
□ Pressure Vessels/Piping	□ Pharmaceutical	□ Telecommunications	
□ Transportation/Shipping	□ Textile	□ Other _____	

17) What is your primary job function?

□ Management	□ Product Design	□ Systems Design	□ Production Engineering
□ Testing/Quality Control	□ Education	□ Plant Engineering	□ Operation/Maintenance
□ Research & Development	□ Other _____		

18) What is your job title?

□ Staff Engineer	□ Project Engineer	□ Chief/Principal Engineer	□ Design Engineer
□ Senior Engineer	□ Development Engineer	□ Project Manager	□ Educator
□ President/Vice President	□ Sales Engineer	□ Manufacturing Engineer	□ Operator
□ Quality Assurance Manager	□ Plant Engineer	□ Other _____	

19) What is your employee job title?

□ Staff Engineer	□ Project Engineer	□ Chief/Principal Engineer	□ Design Engineer
□ Senior Engineer	□ Development Engineer	□ Project Manager	□ Plant Engineer
□ Quality Assurance Manager	□ Sales Engineer	□ Manufacturing Engineer	□ Operator
□ Other _____			

20) Do you encourage the CMA graduates to become licensed Professional Engineers? □ Yes □ No

21) What do you think are the strengths of the ME program at CMA?

22) What do you think are the weaknesses of the ME program at CMA? Any suggestions on how to improve?

23) Any other comments or suggestions?
(Use the back if necessary.)

WASC Assessment Survey

Process for the WASC Assessment

1. During the annual retreat, the ME faculty study the self-study report prepared by the WASC Committee. The report is evaluated.

2. Any findings are noted/listed. The department is to take actions on the findings within a year and report to the Academic Dean at its next annual retreat.

3. The ME faculty further reviews the WASC accreditation team report during the annual retreat. The department is to take actions on any concern/weakness/deficiency noted by the team within one year and report to the Academic Dean at its next annual retreat.

California Maritime Academy
Mechanical Engineering Department
WASC Assessment

This assessment is to be performed by the ME faculty after a WASC visit is completed and the WASC team findings are reported.

1) Did the WASC report indicate any concern/weakness/deficiency in regard to the "intellectual learning" experiences of students? ☐ Yes ☐ No If yes, please comment.

2) Did the WASC report indicate any concern/weakness/deficiency in regard to the "applied technology" experiences of students? ☐ Yes ☐ No If yes, please comment.

3) Did the WASC report indicate any concern/weakness/deficiency in regard to the "leadership development" experiences of students? ☐ Yes ☐ No If yes, please comment.

4) Did the WASC report indicate any concern/weakness/deficiency in regard to students' abilities to apply knowledge of mathematics, science, and engineering? ☐ Yes ☐ No If yes, please comment.

5) Did the WASC report indicate any concern/weakness/deficiency in regard to students' design process skills and their abilities to model and formulate problems? ☐ Yes ☐ No If yes, please comment.

6) Did the WASC report indicate any concern/weakness/deficiency in regard to students' abilities to think creatively and critically, and to synthesize information? ☐ Yes ☐ No If yes, please comment.

7) Did the WASC report indicate any / concern/weakness/deficiency in regard to students' abilities to communicate effectively? ☐ Yes ☐ No If yes, please comment.

8) Did the WASC report indicate any concern/weakness/deficiency in regard to students' abilities to function on multidisciplinary teams? ☐ Yes ☐ No If yes, please comment.

9) Did the WASC report indicate any concern/weakness/deficiency in regard to students' abilities to use mathematical, computational, experimental, "hands-on", and data analysis techniques to design, conduct, and assess engineering experiments? ☐ Yes ☐ No If yes, please comment.

10) Did the WASC report indicate any concern/weakness/deficiency in regard to students' understanding of professional, social, and ethical responsibilities? ☐ Yes ☐ No If yes, please comment.

ABET Assessment Survey

Process for the ABET Assessment

1. During the annual retreat, the ME faculty study the self-study report prepared by the ABET Committee before a visit is to take place. The report is evaluated.

2. Any findings are noted/listed. The department is to take actions on the findings within a year and report to the Academic Dean at its next annual retreat.

3. The ME faculty further reviews the ABET accreditation team report during the annual retreat. The department is to take actions on any concern/weakness/deficiency noted by the team within one year and report to the Academic Dean at its next annual retreat.

California Maritime Academy
Mechanical Engineering Department
ABET Assessment

This assessment is to be performed by the ME faculty after an ABET visit is completed and the ABET team findings are reported.

1) Did the ABET report indicate any concern/weakness/deficiency in regard to the "intellectual learning" experiences of students? ☐ Yes ☐ No If yes, please comment.

2) Did the ABET report indicate any concern/weakness/deficiency in regard to the "applied technology" experiences of students? ☐ Yes ☐ No If yes, please comment.

3) Did the ABET report indicate any concern/weakness/deficiency in regard to the "leadership development" experiences of students? ☐ Yes ☐ No If yes, please comment.

4) Did the ABET report indicate any concern/weakness/deficiency in regard to students' abilities to apply knowledge of mathematics, science, and engineering? ☐ Yes ☐ No If yes, please comment.

5) Did the ABET report indicate any deficiencies in regard to students' design process skills and their abilities to model and formulate problems? ☐ Yes ☐ No If yes, please comment.

6) Did the ABET report indicate any concern/weakness/deficiency in regard to students' abilities to think creatively and critically, and to synthesize information? ☐ Yes ☐ No If yes, please comment.

7) Did the ABET report indicate any concern/weakness/deficiency in regard to students' abilities to communicate effectively? ☐ Yes ☐ No If yes, please comment.

8) Did the ABET report indicate any concern/weakness/deficiency in regard to students' abilities to function on multidisciplinary teams? ☐ Yes ☐ No If yes, please comment.

9) Did the ABET report indicate any concern/weakness/deficiency in regard to students' abilities to use mathematical, computational, experimental, "hands-on", and data analysis techniques to design, conduct, and assess engineering experiments? ☐ Yes ☐ No If yes, please comment.

10) Did the ABET report indicate any concern/weakness/deficiency in regard to students' understanding of professional, social, and ethical responsibilities? ☐ Yes ☐ No If yes, please comment.

Appendix C:

Program Outcome Assessment Loop

Capstone Project Surveys

Assessment Process for the Project Design Presentation Assessment

1. The Instructor of Record for the project design course will call for senior design presentations. Faculty members are to be notified of the scheduling, project design title, design group names, and the technical advisor.

2. Assessment forms for each of the design projects are to be made and handed out to the faculty/IAB members during the presentation.

3. The Instructor of Record is to collect the forms and present the results to the ME faculty during the ME Faculty Retreat.

4. If a program-related problem is identified as a result of this assessment, then the Chair is to refer the problem to a faculty member or an appropriate committee for a resolution to the problem.

5. Processes/actions/recommendations for "problem resolution" are to be documented and reported to the department chair.

California Maritime Academy
Mechanical Engineering Department
Senior Project Design (I) Assessment
Term _____

Student Name(s): _____

_____

_____

Project Design Title: _____

Assessment by: □ ME Faculty □ Non-ME Faculty □ Other

Please respond to the following statements. Please note the scale used.

The senior design students satisfactorily demonstrated: (The numbers below correspond to the Program Outcomes)

Program Outcomes	Not Applicable	1 Unsatis-factory	2 Marginal	3 Average	4 Good	5 Outstand-ing
1) The ability to apply knowledge of mathematics, science, and engineering	☐	☐	☐	☐	☐	☐
2) The ability to design and conduct experiments, as well as to analyze and interpret data	☐	☐	☐	☐	☐	☐
3) The ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	☐	☐	☐	☐	☐	☐
4) The ability to function on multi-disciplinary teams	☐	☐	☐	☐	☐	☐
5) The ability to identify, formulate, and solve engineering problems	☐	☐	☐	☐	☐	☐
7) The ability to communicate effectively	☐	☐	☐	☐	☐	☐
11) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	☐	☐	☐	☐	☐	☐
12) The ability to apply principle of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes	☐	☐	☐	☐	☐	☐
13) The ability to work professionally in both thermal and mechanical systems areas	☐	☐	☐	☐	☐	☐
14) The ability to apply the “hands-on” knowledge to solve/understand engineering design problems/systems	☐	☐	☐	☐	☐	☐
15) The ability to demonstrate leadership roles	☐	☐	☐	☐	☐	☐
16) The ability to comprehend and convey technical information	☐	☐	☐	☐	☐	☐

California Maritime Academy
Mechanical Engineering Department
Senior Project Design (II) Assessment
Term _____

Student Name(s): _____

_____

Project Design Title: _____

Assessment by: □ ME Faculty □ Non-ME Faculty □ Other

Please respond to the following statements. Please note the scale used.

The senior design students satisfactorily demonstrated: (The numbers below correspond to the Program Outcomes)

Program Outcomes	Not Applicable	1 Unsatis-factory	2 Marginal	3 Average	4 Good	5 Outstand-ing
1) The ability to apply knowledge of mathematics, science, and engineering	☐	☐	☐	☐	☐	☐
2) The ability to design and conduct experiments, as well as to analyze and interpret data	☐	☐	☐	☐	☐	☐
3) The ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	☐	☐	☐	☐	☐	☐
4) The ability to function on multi-disciplinary teams	☐	☐	☐	☐	☐	☐
5) The ability to identify, formulate, and solve engineering problems	☐	☐	☐	☐	☐	☐
6) An understanding of professional and ethical responsibility	☐	☐	☐	☐	☐	☐
7) The ability to communicate effectively	☐	☐	☐	☐	☐	☐
9) A recognition of the need for, and an ability to engage in life-long learning	☐	☐	☐	☐	☐	☐
11) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	☐	☐	☐	☐	☐	☐
13) The ability to work professionally in both thermal and mechanical systems areas	☐	☐	☐	☐	☐	☐
14) The ability to apply the “hands-on” knowledge to solve/ understand engineering design problems/systems	☐	☐	☐	☐	☐	☐
15) The ability to demonstrate leadership roles	☐	☐	☐	☐	☐	☐
16) The ability to comprehend and convey technical information	☐	☐	☐	☐	☐	☐

Graduating Senior Survey

Assessment Process for the Graduating Senior Survey

1. The Mechanical Engineering Department will conduct, evaluate, and tabulate the Graduating Senior Survey. The surveys are to be conducted before or by the graduation date and the results are to be transmitted to the Dean's Office and the ME Chair.

2. The Dean and the Chair are to review the results and transmit them to the faculty/staff.

3. If a program-related problem is identified as a result of this assessment, then the Dean and the Chair are to refer the problem to a faculty member or an appropriate committee for a resolution to the problem.

4. Process/actions/recommendations for "problem resolution" are to be documented and reported to the Dean and the Chair.

California Maritime Academy
Mechanical Engineering Department
Senior Exit Survey
Spring _____

The information that you provide in this survey will help the Mechanical Engineering Department to improve the quality of its program. The department appreciates your response.

Personal Information (optional)

Name: _____

E-mail Address: _____

I. General Student/Career Information

1) Starting year at CMA? _____

2) Class standing at CMA? _____

3) Expected graduation date from CMA? _____

4) Your approximate GPA? ☐ less than 2.0 ☐ 2.0–2.5 ☐ 2.5–3.0 ☐ 3.0–3.5 ☐ 3.5–4.0

5) Your ME stem? ☐ Energy Stem ☐ Mechanical Stem

6) Your professional option? ☐ USCG License Option ☐ CPE-It Option

7) Are you planning to attend graduate school? ☐ Yes ☐ No If yes, where? _____

8) How many job interviews have you had? ☐ 0 ☐ 1-2 ☐ 3-4 ☐ >4

9) How many job offers have you received? ☐ 0 ☐ 1-2 ☐ 3-4 ☐ >4

10) Which type of job will you most likely accept?
☐ shore-based engineering ☐ shore-based operation & maintenance
☐ sea-based operation & maintenance

Company Name: _____

Position: _____

Comments:

II. Overall Assessment of the ME Curriculum

Please rate the following items in two respects. First, how much emphasis is given to each item in your program and, second, how satisfied you are in each item with respect to the education that you received.

	Too Little Emphasis	Adequate Emphasis	Too Much Emphasis	1 Not Satisfied	2 Somewhat Satisfied	3 Satisfied	4 Very Satisfied	5 Extremely Satisfied
A. Basic Subjects								
Mathematics	☐	☐	☐	☐	☐	☐	☐	☐
Physical Sciences	☐	☐	☐	☐	☐	☐	☐	☐
Humanities	☐	☐	☐	☐	☐	☐	☐	☐
Social Sciences	☐	☐	☐	☐	☐	☐	☐	☐
B. Professional Subjects								
USCG License Courses	☐	☐	☐	☐	☐	☐	☐	☐
Corps Activities	☐	☐	☐	☐	☐	☐	☐	☐
Cruise Experience	☐	☐	☐	☐	☐	☐	☐	☐
Co-Op Experience	☐	☐	☐	☐	☐	☐	☐	☐
C. Mech. Engr. Subjects								
Core Courses (ME & ENG)	☐	☐	☐	☐	☐	☐	☐	☐
Laboratories	☐	☐	☐	☐	☐	☐	☐	☐
Stem Courses (Energy or Mech.)	☐	☐	☐	☐	☐	☐	☐	☐
Project Design Courses	☐	☐	☐	☐	☐	☐	☐	☐

Comments:

III. Assessment of Program Outcomes

Please rate the following Program Outcomes. These outcomes are the abilities/attributes expected of engineering professionals. Rate each item based on your total learning experience in your program. In your opinion, first tell us how much emphasis is given to each item and, second, how satisfied you are in each item with respect to the education that you received. Please note the scale used.

Are you aware of the ME Department Program outcomes? ☐ Yes ☐ Somewhat ☐ No

Program Outcomes	Too Little Emphasis	Adequate Emphasis	Too Much Emphasis	1 Not Satisfied	2 Somewhat Satisfied	3 Satisfied	4 Very Satisfied	5 Extremely Satisfied
1) An ability to apply knowledge of mathematics, science, and engineering	☐	☐	☐	☐	☐	☐	☐	☐
2) An ability to design and conduct experiments, as well as to analyze and interpret data	☐	☐	☐	☐	☐	☐	☐	☐
3) An ability to design a system, component, or process to meet desired needs within realistic constraints	☐	☐	☐	☐	☐	☐	☐	☐
4) An ability to function on multi-disciplinary teams	☐	☐	☐	☐	☐	☐	☐	☐
5) An ability to identify, formulate, and solve engineering problems	☐	☐	☐	☐	☐	☐	☐	☐
6) An understanding of professional and ethical responsibility	☐	☐	☐	☐	☐	☐	☐	☐
7) An ability to communicate effectively	☐	☐	☐	☐	☐	☐	☐	☐
8) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	☐	☐	☐	☐	☐	☐	☐	☐
9) A recognition of the need for, and an ability to engage in life-long learning	☐	☐	☐	☐	☐	☐	☐	☐
10) A knowledge of contemporary issues	☐	☐	☐	☐	☐	☐	☐	☐
11) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	☐	☐	☐	☐	☐	☐	☐	☐
12) An ability to apply principle of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes	☐	☐	☐	☐	☐	☐	☐	☐
13) Ability to work professionally in both thermal and mechanical systems areas	☐	☐	☐	☐	☐	☐	☐	☐
14) An ability to apply the “hands-on” knowledge to solve/ understand engineering design problems/systems	☐	☐	☐	☐	☐	☐	☐	☐
15) An ability to demonstrate leadership roles	☐	☐	☐	☐	☐	☐	☐	☐
16) An ability to comprehend and convey technical information	☐	☐	☐	☐	☐	☐	☐	☐

IV. Overall Assessment of Student Experience

Please rate the following items with respect to the overall satisfaction that you received/experienced for each item. Please note the scale used.

Student Experience	No Opinion	1 Not Satisfied	2 Somewhat Satisfied	3 Satisfied	4 Very Satisfied	5 Extremely Satisfied
1) Quality of Instruction by the Faculty in:						
Mathematics	☐	☐	☐	☐	☐	☐
Physical Sciences (Chemistry/Physics)	☐	☐	☐	☐	☐	☐
Humanities/Social Sciences	☐	☐	☐	☐	☐	☐
Naval Science	☐	☐	☐	☐	☐	☐
Engineering Plant Operation (EPO)	☐	☐	☐	☐	☐	☐
Mechanical Engineering	☐	☐	☐	☐	☐	☐
Engineering Technology	☐	☐	☐	☐	☐	☐
2) Quality of Advisement with Respect to:						
Academic Planning	☐	☐	☐	☐	☐	☐
Advisor Availability	☐	☐	☐	☐	☐	☐
Advisor Willingness to Help	☐	☐	☐	☐	☐	☐
Clarity of Your Program Requirements	☐	☐	☐	☐	☐	☐
3) Quality of Facilities:						
Computing	☐	☐	☐	☐	☐	☐
Classrooms	☐	☐	☐	☐	☐	☐
Science Laboratories	☐	☐	☐	☐	☐	☐
Engineering Laboratories	☐	☐	☐	☐	☐	☐
Plant Operations Laboratories	☐	☐	☐	☐	☐	☐
Simulators	☐	☐	☐	☐	☐	☐
Library	☐	☐	☐	☐	☐	☐
4) Quality of Support Services:						
Academic/Financial:						
Admissions	☐	☐	☐	☐	☐	☐
Bookstore	☐	☐	☐	☐	☐	☐
Career Services:						
Commercial Cruise/Co-Op	☐	☐	☐	☐	☐	☐
Job Placement	☐	☐	☐	☐	☐	☐
Financial Aid	☐	☐	☐	☐	☐	☐
Information Technology Services	☐	☐	☐	☐	☐	☐
Library	☐	☐	☐	☐	☐	☐
Records Office	☐	☐	☐	☐	☐	☐

Student Experience	No Opinion	1 Not Satisfied	2 Somewhat Satisfied	3 Satisfied	4 Very Satisfied	5 Extremely Satisfied
Administrative Offices:						
President's Office	☐	☐	☐	☐	☐	☐
VP Academic Affairs	☐	☐	☐	☐	☐	☐
Dean's Office	☐	☐	☐	☐	☐	☐
Captain's Office	☐	☐	☐	☐	☐	☐
Other Services:						
Food Services	☐	☐	☐	☐	☐	☐
Health/Counseling Services	☐	☐	☐	☐	☐	☐
Housing Services	☐	☐	☐	☐	☐	☐
Recreation/Athletic Services	☐	☐	☐	☐	☐	☐
Parking/Transportation Services	☐	☐	☐	☐	☐	☐
Campus Security	☐	☐	☐	☐	☐	☐
5) What is your overall satisfaction with your education at CMA?	☐	☐	☐	☐	☐	☐
6) Would you recommend the ME program at CMA to a relative/friend?	Yes ☐	Maybe ☐	No ☐			
7) What do you think are the strengths of the ME program at CMA?						
8) What do you think are the weaknesses of the ME program at CMA? Any suggestions on how to improve?						
9) Any other comments? (Use the back if necessary.)						
10) How do you rate this survey?	1 Poor ☐	2 Inadequate ☐	3 Fair ☐	4 Good ☐	5 Excellent ☐	

Employer Evaluation of Cooperative Education Student

Please fax to Steve Pronchick
Mechanical Engineering Department
707-654-1110
or email to: stevep@csum.edu

or mail to: S. Pronchick
M.E. Department
California Maritime Academy
200 Maritime Academy Drive
Vallejo, CA 94590

Student Name _____

Company Name _____Supervisor's Name _____

May we discuss this evaluation with the student? Yes No

Thank you for taking the time to complete this evaluation. Your response will help us to assess and improve our preparation of students for careers in engineering. Please rate the following statements on a scale of 1 to 5:

1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = not applicable.

1.	The student worked well with other employees	NA 1 2 3 4 5
2.	They showed good judgment in making decisions	NA 1 2 3 4 5
3.	They were able to learn quickly	NA 1 2 3 4 5
4.	They communicated well orally	NA 1 2 3 4 5
5.	They communicated well in writing	NA 1 2 3 4 5
6.	They were enthusiastic and interested in the work	NA 1 2 3 4 5
7.	They were dependable	NA 1 2 3 4 5
8.	The quality of their work was good	NA 1 2 3 4 5
9.	Their attendance was regular	NA 1 2 3 4 5
10.	Their punctuality was regular	NA 1 2 3 4 5
11.	The student understands the need for, and is prepared for lifelong learning	NA 1 2 3 4 5
12.	The student understands the professional, social and ethical responsibilities of an engineer.	NA 1 2 3 4 5
13.	The student is able to participate in multi-disciplinary team activities	NA 1 2 3 4 5
14.	The student is able to assume leadership roles.	NA 1 2 3 4 5
15.	The student is able to perform engineering problem solving.	NA 1 2 3 4 5
16.	The student is able to understand and convey technical information	NA 1 2 3 4 5
17.	The student is able to apply "hands-on" knowledge to solve/understand engineering problems/systems.	NA 1 2 3 4 5

Additional Remarks (attach additional page if needed)

EXAMPLE CLASS SYLLABUS

CALIFORNIA MARITIME ACADEMY
DEPARTMENT OF MECHANICAL ENGINEERING

PROFESSOR Bagheri
COURSE NUMBER ME 240
CREDITS 3
SEMESTER Spring 2010
E-mail: nbagheri@csum.edu
Phone: 654-1102
Office: Rm. 224
Office Hours: M,W, F 10:00-11:00
M,W, F 12:00-1:00

COURSE NAME: Engineering Thermodynamics

CLASS SCHEDULE: Monday, Wednesday, and Friday 9:00-9:50

COURSE DESCRIPTION:
Study of the basic principles of thermodynamics and their applications to engineering processes and cycles. Topics include study of the first and second laws and application of these laws to thermodynamic systems, and power and refrigeration cycles.

COURSE OBJECTIVES[1]:
1. To provide a fundamental knowledge of the conservation laws as applied to thermodynamics systems. [B, C, D]
2. To understand the physical processes involved in thermodynamic systems/cycles. [B, C, D]
3. To enhance students' engineering problem solving modeling/analysis abilities. [C, D]
4. To enable students to advance to any fields related to thermal systems. [A, B]

COURSE OUTCOMES[2]:
1. Students will learn about phase-change processes and properties of pure substances. [1], (Chapters 1, 3)
2. Students will be able to apply conservation laws (mass balance, energy balance, and entropy balance) to closed/open systems. [1, 5], (Chapters 4, 5, 6, 7)
3. Students will be able to understand, model, analyze, and solve thermodynamic processes and cycles. [1, 5], (Chapters 4, 5, 6, 7, 9, 10, 11)

COURSE PREREQUISITES:
PHY 200 Engineering Physics I

COURSE POSTREQUISITES:
ME 342 Refrigeration and Air Conditioning
ME 344 Heat Transfer
ME 440 Advanced Fluid Mechanics and Thermodynamics

TEXTBOOK:
Thermodynamics: An Engineering Approach, 6th Ed., Y. A. Cengel & M. A. Boles, McGraw-Hill.

OTHER REFERENCES:
Fundamentals of Engineering Thermodynamics, Moran & Shapiro, Wiley & Sons.
Fundamentals of Classical Thermodynamics, 5th Ed., Sonntag, Borgnakke, & Van Wylen, Wiley & Sons.

GRADING:

Homework…….....	15%
Quizzes.....	15%
Exam I.....	20%
Exam II.....	20%
Final Exam.....	30%

[1] Letters in the brackets refer to the Program Objectives.
[2] Numbers in the brackets refer to the Program Outcomes.

HOMEWORK:
Homework sets will be assigned by chapter number. There may be more than one set in a given chapter. You will have one week to turn in your homework set from the date it is assigned. You are encouraged to work in groups on your homework assignments, however, you are expected to turn in your own work and set. It is your responsibility to know about the due date as they are announced in class. Under no circumstances late homework will be accepted. Assigned homework problems will be discussed in class at least one class session before they are due. Take advantage of this and be prepared for discussion sessions.

QUIZZES:
There will be a total of five quizzes on chapters 3, 4, 5, 7, 9. Quizzes will be short and will be given at the end of the above chapters. Quizzes cannot be made up, however, your lowest quiz score will be dropped.

EXAMS:
All exams are open book and notes. No make-up exams will be given under any circumstances.

ATTENDANCE:
All students are to attend all classes unless an absence is properly authorized on the basis of the guidelines found in the student handbook. It is the student's responsibility to be familiar with the guidelines. Further, students having three unexcused absences will be withdrawn from class with a grade of WU.

Program Outcomes

1. **an ability to apply knowledge of mathematics, science, and engineering**
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. an ability to function on multi-disciplinary teams
5. **an ability to identify, formulate, and solve engineering problems**
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
12. an ability to apply principle of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes
13. ability to work professionally in both thermal and mechanical systems areas
14. an ability to apply the "hands-on" knowledge to solve/understand engineering design problems/systems
15. an ability to demonstrate leadership roles
16. an ability to comprehend and convey technical information.

ME 240 ENGINEERING THERMODYNAMICS COURSE OUTLINE

WEEK	SUBJECT	READING
1	Basic Concepts of Thermodynamics	Chapter 1
2	Energy, Energy Transfer	Chapter 2
3	Properties of Pure Substances	Chapter 3
4	Properties of Pure Substances, **QUIZ #1**	Chapter 3
5	Energy Analysis of Closed Systems	Chapter 4
6	Energy Analysis of Closed Systems, **QUIZ #2, EXAM I**	Chapter 4
7	Mass and Energy Analysis of Control Volumes	Chapter 5
8	Mass and Energy Analysis of Control Volumes, **QUIZ #3**	Chapter 5
9	The 2nd Law of Thermodynamics	Chapter 6
10	Entropy	Chapter 7
11	Entropy: **QUIZ #4, EXAM II**	Chapter 7
12	Gas Power Cycles	Chapter 9
13	Vapor and Combined Power Cycles, **QUIZ #5**	Chapter 10
14	Refrigeration Cycles	Chapter 11

Topics:

Chapter 1 Introduction and Basic Concepts: 1.1: Thermodynamics and Energy; 1.2: Dimensions and Units; 1.3: Systems and Control Volumes; 1.4: Properties of a System; 1.5 Density and Specific Gravity; 1.6: State and Equilibrium; 1.7: Processes and Cycles; 1.8: Temperature and Zeroth Law of Thermodynamics; 1.9: Pressure; 1.10: The Manometer; 1.11: The Barometer and Atmospheric Pressure

Chapter 2 Energy, Energy Transfer, and General Energy Analysis: 2.2: Forms of Energy; 2.3: Energy Transfer by Heat; 2.4 Energy Transfer by Work; 2.5: Mechanical Forms of Work; 2.6: The First Law of Thermodynamics; 2.7: Energy Conversion Efficiencies; 2.8: Energy and Environment

Chapter 3 Properties pf Pure Substances: 3.1: Pure Substance; 3.2: Phase of a Pure Substance; 3.3: Phase Change Processes of Pure Substances; 3.4 Property Diagram for Phase-Change Processes; 3.5: Property Tables; 3.6: The Ideal-Gas Equation of State; 3.7: Compressibility Factor

Chapter 4 Energy Analysis of Closed Systems: 4.1 Moving Boundary Work; 4.2: Energy Balance for Closed Systems; 4.3: Specific Heats; 4.4: Internal Energy, Enthalpy, and Specific Heats of Ideal-Gases; 4.5: Internal Energy, Enthalpy, and Specific Heats of Solids and Liquids

Chapter 5 Mass and Energy Analysis of Control Volumes 5.1: Conservation of Mass; 5.2: Flow Work and the Energy of a Flowing Fluid; 5.3: Energy Analysis of a Steady-Flow Systems; 5.4: Some Steady-Flow Engineering Devices; 5.5: Energy Analysis of Unsteady-Flow Processes

Chapter 6 The 2nd Law of Thermodynamics: 6.1: Introduction to the Second Law; 6.2 Thermal Energy Reservoir; 6.3: Heat Engines; 6.4: Refrigerator and Heat Pumps; 6.6: Reversible and Irreversible Processes; 6.7 The Carnot Cycle; 6.8 The Carnot Principles; 6.9: The Thermodynamic Temperature Scale; 6.10: The Carnot Heat Engine; 6.11: The Carnot Refrigerator and Heat Pump

Chapter 7 Entropy: 7.1: Entropy; 7.2: The Increase of Entropy Principle; 7.3: Entropy Change of Pure Substances; 7.4: Isentropic Processes; 7.5: Property Diagrams Involving Entropy; 7.7: The T-ds relations; 7.8: Entropy Change of Liquids and Solids; 7.9: The Entropy Change of Ideal Gases; 7.10 Reversible Steady-Flow Work; 7.11: Minimizing the Compressor Work; 7.12: Isentropic Efficiencies of Steady-Flow Devices; 7.13: Entropy Balance

Chapter 9 Gas Power Cycles: 9.1: Power Cycles Analysis; 9.2: The Carnot Cycle; 9.3: Air-Standard Assumptions; 9.4 Reciprocating Engines; 9.5: Otto Cycle; 9.6: Diesel Cycle; 9.7: Stirling and Ericsson Cycles; 9.8: Brayton Cycle-The Gas Turbine Cycles

Chapter 10 Vapor and Combined Power Cycles: 10.1: The Carnot Vapor Cycle; 10.2: Rankine Cycle; 10.3: Deviation from the Idealized Cycles; 10.4: Increasing the Efficiency of Rankine Cycles; 10.5: The Reheat Cycle; 10.6: The Regenerative Cycle

Chapter 11 Refrigeration Cycles: 11.1: Refrigerators and Heat Pumps; 11.2: The Reversed Carnot Cycle; 11.3: Ideal Refrigeration Cycle; 11.4: Actual Refrigeration Cycle; 11.6: Heat Pump Systems

EXAMPLE CLASS ABET SYLLABUS

CALIFORNIA MARITIME ACADEMY
DEPARTMENT OF MECHANICAL ENGINEERING

ME 240 Engineering Thermodynamics
(Required)

CATALOG DATA: Class Hour: 3, Credit: 3
Study of the basic principles of thermodynamics and their applications to engineering processes and cycles. Topics include study of the first and second laws and application of these laws to thermodynamic systems, and power and refrigeration cycles.

COURSE PREREQUISITE:
PHY 200 Engineering Physics I

COURSE POSTREQUISITES:
ME 342 Refrigeration and Air Conditioning
ME 344 Heat Transfer
ME 440 Advanced Fluid Mechanics and Thermodynamics

TEXTBOOK:
Thermodynamics: An Engineering Approach, 6th Ed., Y. A. Cengel & M. A. Boles, McGraw-Hill.

OTHER REFERENCES:
Fundamentals of Engineering Thermodynamics, 4th Ed., Moran & Shapiro, Wiley & Sons.
Fundamentals of Classical Thermodynamics, 5th Ed., Sonntag, Borgnakke, & Van Wylen, Wiley & Sons.

COURSE OBJECTIVES[3]:
1. To provide a fundamental knowledge of the conservation laws as applied to thermodynamics systems. [B, C, D]
2. To understand the physical processes involved in thermodynamic systems/cycles. [B, C, D]
3. To enhance students' engineering problem solving modeling/analysis abilities. [C, D]
4. To enable students to advance to any fields related to thermal systems. [A, B]

COURSE OUTCOMES[4]
1. Students will learn about phase-change processes and properties of pure substances. [1]
2. Students will be able to apply conservation laws (mass balance, energy balance, and entropy balance) to closed/open systems. [1, 5]
3. Students will be able to understand, model, analyze, and solve thermodynamic processes and cycles. [1, 5]

Course Outcome	Prog. Outcome	Performance Criteria	Metric	Accepted Criterion
1.1	1	Students will demonstrate that they are familiar with phase-change processes and properties of pure	Q #1 SEI/C Survey	3/5 3.5/5 or 70%

[3] Letters in the brackets refer to the Program Educational Objectives.
[4] Numbers in the brackets refer to the Program Outcomes.

		substances.		
2.1	1, 5	Students will demonstrate that they can apply mass, energy, and entropy balances to closed systems.	Q #2 SEI/C Survey	3/5 3.5/5 or 70%
2.2	1, 5	Students will demonstrate that they can apply mass, energy, and entropy balances to open systems.	Q #3 Q #4 SEI/C Survey	3/5 3/5 3.5/5 or 70%
3.1	1, 5	Students will demonstrate that they can model, analyze, and solve thermodynamics processes and cycles.	Q #5 SEI/C Survey	3/5 3.5/5 or 70%

COURSE EVALUATION METHODS:

I. Homework (15%), II. Quizzes (15%), III. Midterm Exams (40%), IV. Final Exam (30%), V. Midterm Student Evaluation (MSE) Survey, VI. Student Evaluation of Instructor/Course (SEI/C) Survey, VII. Instructor Class Assessment (ICA) Survey.

TOPICS:

I. Basic Concepts of Thermodynamics:
- Thermodynamics and Energy
- Dimensions and Units
- Closed and Open Systems
- Forms of Energy
- Properties of a System
- State and Equilibrium, Processes and Cycles
- Pressure, Temperature and the Zeroth Law of Thermodynamics

II. Properties of Pure Substances
- Pure Substance, Phases of a Pure Substance
- Phase-Change Processes, Property Diagrams for Phase-Change Processes
- Vapor Pressure, Property Tables
- The Ideal-Gas Equation of State
- Compressibility factor

III. The First Law of Thermodynamics: Closed Systems
- Heat Transfer, Work, Mechanical Forms of Work
- The First Law of Thermodynamics
- Specific Heats, Internal Energy, Enthalpy, and Specific Heats of Liquids and Solids

IV. The First Law of Thermodynamics: Control Volumes
- Thermodynamic Analysis of Control Volumes
- The Steady-Flow Process
- Some Steady-Flow Processes
- Unsteady-Flow Processes

V. The Second Law of Thermodynamics
- Thermal Energy Reservoirs
- Heat Engines, Energy Conversion Efficiencies
- Refrigerators and Heat Pumps, Coefficient of Performance
- Reversible and Irreversible Processes
- The Thermodynamic Temperature Scale
- The Carnot Heat Engine, The Carnot Refrigerator and Heat Pump

VI. Entropy
- The increase of Entropy Principle
- Entropy Change of Pure Substances
- Isentropic Process, Property Diagrams
- Tds Relations, Entropy Change of Liquids and Solids
- Entropy Change of Ideal Gases
- Reversible Steady-Flow Work
- Isentropic Efficiencies
- Entropy Balance

VII. Gas Power Cycles
- Air-Standard Assumptions
- Otto and Diesel Cycles
- Stirling and Ericsson Cycles
- Brayton Cycle, Regeneration, Intercooling, Reheating

VIII. Vapor Power Cycles
- Rankine Cycle
- Efficiency and Increase in Efficiency
- Reheat and Regenerative Rankine Cycles

IX. Refrigeration Cycles
- Refrigerators and Heat Pumps
- The Ideal and Actual Vapor-Compression Cycles
- Heat Pump Systems

CURRICULUM CONTRIBUTION:
Engineering Science: 3 Units
Engineering Design: 0 Units

PROGRAM OUTCOMES RELATIONSHIP:
Please see attached.

Prepared by: Nader Bagheri, January 2010

Mechanical Engineering Program

Program Outcomes

1. **an ability to apply knowledge of mathematics, science, and engineering**
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. an ability to function on multi-disciplinary teams
5. **an ability to identify, formulate, and solve engineering problems**
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
12. an ability to apply principle of engineering, basic science, and mathematics (including multivariate calculus and differential equations) to model, analyze, design, and realize physical systems, components or processes
13. ability to work professionally in both thermal and mechanical systems areas
14. an ability to apply the “hands-on” knowledge to solve/understand engineering design problems/systems
15. an ability to demonstrate leadership roles
16. an ability to comprehend and convey technical information.

Example assessment data collection

ME *** Spring 10	CO 4 PO 1, 13, 16				
	Rubric Element				
Test 2	1	2	3	4	Value
Student1	4	3	3		3.333333
Student2	4	3	3		3.333333
Student3	5	5	4.8		4.933333
Student4	3	2	2		2.333333
Student5	3	3	2		2.666667
Student6	5	5	4		4.666667
Student7	4	3	3		3.333333
Student8	5	5	3		4.333333
Student9	5	5	3		4.333333
Student10	5	4	3		4
Student12					
Student13	5	5	5		5
Student14	5	5	4		4.666667
Student15	4	3	2		3
Student16	5	5	4		4.666667
Student17	5	5	4		4.666667
Student18	2	1	1		1.333333
Student19	4	3	3		3.333333
Student20	4	3	2		3
Student21	3	2	2		2.333333
Student22	4	3	2		3
Student23					
Student24	5	4	4		4.333333
Number of Responses	**21**	**21**	**21**	**0**	**21**
Count number 1-1.5	0	1	1	0	1
Count number 1.5-2.5	1	2	6	0	2
Count number 2.5-3.5	3	8	7	0	8
Count number 3.5-4.5	7	2	5	0	4
Count number 4.5-5	10	8	2	0	6
Total number 1-5	21	21	21	0	21
Number greater than 3	**20**	**18**	**14**	**0**	**17**
Mean	**4.2**	**3.666667**	**3.038095**	**NA**	**3.647619**
Std Deviation	**0.9**	**1.238278**	**1.053791**	**#DIV/0!**	**1.014811**
Median	**4**	**4**	**4**	**4**	**4**

Example Midterm evaluation

Midterm Student Evaluation (MSE) Survey

Course: ME 240 **Instructor**: Dr. Bagheri **Semester/Year**: S 2010

Please provide specific written comments regarding the efficacy of the instructional environment that you have encountered thus far in this class. Your comments may help your instructor improve the quality of the instructional program he/she has designed. Please be specific regarding items such as:

1) Previous course preparation for this class. Do you feel you were ready for this class? Course prerequisite for this course is PHY 200: Engineering physics I.

2) Any comments regarding the instructor's presentation of course materials, use of board, or visual aides?

3) Any comments regarding course assignments, quizzes, exam contents, or student evaluation/grading?

4) Any comments related to enhancing the learning environment generated by this class?

Example student evaluation of instructor/course

Student Evaluation of Instructor/Course (SEI/C)

Course: ME 240 **Instructor**: Dr. Bagheri **Semester/Year**: _____

Your anonymous response is greatly appreciated. Your response will help the instructor and the department to improve the quality of instruction. It will also be used by the department and by the school to evaluate faculty. Please answer them accurately and responsively.

Please rate the following statements on a scale of 1 to 5: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = not applicable.

1a. The course is well organized…….	NA 1 2 3 4 5
1b. The course laboratory is well organized……	NA 1 2 3 4 5
2. The course objectives, outcomes, topics, and requirements are clearly stated in the course syllabus and made clear by the instructor……..	NA 1 2 3 4 5
3. The textbooks (s) required for this course are adequate……	NA 1 2 3 4 5
4. The course assignments are challenging…….	NA 1 2 3 4 5
5. The exams/quizzes are reasonable in length, frequency, difficulty, and content…..	NA 1 2 3 4 5
6. The instructor seems to be well prepared…….	NA 1 2 3 4 5
7. The instructor teaches the course materials/concepts clearly……..	NA 1 2 3 4 5
8. The instructor is reasonable in grading/evaluating exams/quizzes/assignments…..	NA 1 2 3 4 5
9. I feel comfortable to ask questions in class or to speak to my professor outside the class…….	NA 1 2 3 4 5
10. I am satisfied with my learning/progress in this class……..	NA 1 2 3 4 5
11. I look forward to coming to this class……..	NA 1 2 3 4 5
12. Overall, I would rate the instructor as a good teacher……..	NA 1 2 3 4 5
13. Overall, this is a good course……	NA 1 2 3 4 5

Please rate the degree to which you agree with the following Performance criteria statements for this course:

14. Students will demonstrate that they are familiar with phase-change processes… and properties of pure substances. (PC 1.1; PC=Performance Criteria)	NA 1 2 3 4 5
15. Students will demonstrate that they can apply mass, energy, and entropy balances… to closed systems. (PC 2.1)	NA 1 2 3 4 5
16. Students will demonstrate that they can apply mass, energy, and entropy balances… to open systems. (PC 2.2)	NA 1 2 3 4 5
17. Students will demonstrate that they can model, analyze, and solve thermodynamic.. processes and cycles. (PC 3.1)	NA 1 2 3 4 5

Please provide comments that that might help your instructor to improve the quality of instruction. Any comments on any aspect of this course including previous course preparation for this class, amount of weekly work required and spent, course and exam contents, instructor presentation of course materials, and grading of exams and homework are greatly appreciated. Please use the back of this form to make additional comments.

Instructor Class Assessment (ICA) Survey

Course: ME 240 **Instructor:** Dr. Bagheri **Semester:** **Year:**

Midterm Student Evaluation (MSE) Survey Summary:

1) Previous course preparation for this class. Do you feel you were ready for this class? Course prerequisite for this course is: PHY 200: Engineering physics I.

2) Any comments regarding the instructor's presentation of course materials, use of board, or visual aides?

3) Any comments regarding course assignments, quizzes, exam contents, or student evaluation?

4) Any comments related to enhancing the learning environment generated by this class?

Instructor Evaluation of Course Outcomes and Student Evaluation of Instructor/Course (SEI/C) Survey Summary:

Course Outcome	Prog. Outcome	Performance Criteria	Metric	Accepted Criterion	Statistical Scores
1.1	1	Students will demonstrate that they are familiar with phase-change processes and properties of pure substances.	Q #1 SEI/C Survey	3/5 3.5/5 or 70%	
2.1	1, 5	Students will demonstrate that they can apply mass, energy, and entropy balances to closed systems.	Q #2 SEI/C Survey	3/5 3.5/5 or 70%	
2.2	1, 5	Students will demonstrate that they can apply mass, energy, and entropy balances to open systems.	Q #3 Q #4 SEI/C Survey	3/5 3/5 3.5/5 or 70%	
3.1	1, 5	Students will demonstrate that they can model, analyze, and solve thermodynamics processes and cycles.	Q #5 SEI/C Survey	3/5 3.5/5 or 70%	

Note to the instructor: Based on the course outcome evaluation results as well as the MSE and SEI/C Survey results, please discuss any concerns or any actions taken:

Assessment Process for Instructor Class Assessments:

1) Instructor Class Assessments (ICA) is to be done at the end of the semester in which the course is offered.
2) ICA forms are to be placed in the Course Portfolio.
3) The department faculty are to consider/discuss the assessment results during the Retreat meeting.
4) The responsible faculty member for each course is to file the results in the Course Portfolio and state necessary actions taken to remedy the shortfalls, if any. The Course Portfolio is to contain the instructor class assessment results for at least the previous 3 years.

Appendix D:

Rubrics

Simple Skill Analysis Rubric

Rubric to assess the degree to which an Engineering skill is demonstrated in a particular course assignment, quiz or test.

1. **Poor:** Student has not demonstrated any ability to perform this skill.
2. **Marginal:** Student had a partial, but unsatisfactory ability to perform the skill.
3. **Adequate:** Student can perform the skill at an adequate, acceptable level with some mistakes.
4. **Good:** Student can perform the skill fairly well with a few minor mistakes.
5. **Excellent:** Student has demonstrated mastery of the skill with complete correct work and method.

Engineering Analysis Rubric

Engineering Analysis Rubric (for assignments/projects requiring a process formulation to get result(s))

	Poor	Acceptable	Excellent
Identify and Formulate the Problem	Demonstrates little or no understanding of what information and assumptions are needed to perform the analysis. Approach is not directed to the objective of the analysis. Unable to organize the analysis.	Demonstrates some uncertainty in what information and assumptions are relevant to the analysis. Approach appears somewhat unfocused, but essentially effective. Information gathering is somewhat unorganized, but relevant.	Clearly Identifies relevant known properties and appropriate assumptions. Focuses the analysis on the desired result. Gathers information in an appropriate form.
	1	**3**	**5**
Analysis Method	Unable to identify effective solution methods, or employs methods that are inappropriate to the analysis.	Methods selected result in a cumbersome analysis with unnecessary work, but are essentially effective.	Employs an optimum method that efficiently leads to the desired results.
	1	**3**	**5**
Application of Analysis Method/Results	No results are obtained, or major errors are present.	Some errors in the application and calculations are present, but they are minor in nature.	Analysis is carried out correctly. Results are correct. Units are correctly used.
	1	**3**	**5**
Interpretation of Results	No discussion or interpretation was provided, although the results clearly required some critical review.	Some discussion of the results is present, but not in a critical manner appropriate to the analysis.	Results are critically reviewed for accuracy and meaning in a manner appropriate to the analysis.
	1	**3**	**5**

Research or Design Project Rubric

Course Research/Design Project Report Rubric

	Poor	Acceptable	Excellent
Research/Design Content	Limited research/design development with undeveloped ideas or few details, weak supporting evidence.	Some depth of research/design development with sufficient details, adequate supporting evidence.	Excellent depth of research/design development with clear details, specific and thorough supporting evidence.
	1	**3**	**5**
Research/Design Problem Formulation	Incomplete definition and description of the research/design project, serious deficiencies in use and application of engineering principles, incomplete understanding of design factors and constraints.	Somewhat complete definition and description of the research/design project, sufficient use and application of engineering principles. Sufficient understanding of the design factors and constraints.	Excellent definition and description of the research/design project, correct use and application of the engineering principles. Excellent understanding of the design factors and constraints.
	1	**3**	**5**
Results, Conclusions, and Recommendations	Missed results or poorly stated them, conclusions are unsupported, no or basic recommendations.	Results, conclusions, and recommendations are sufficiently stated.	Results and conclusions are clear and relevant. Recommendations reflect good understanding of the project.
	1	**3**	**5**
Computer-Aided Tools, Figures, Tables	Minimal application and use of computer-aided tools and graphics, undocumented figures and tables.	Computer-aided tools were sufficiently used to present/develop research/design project, figures and tables were sufficiently provided.	Computer-aided tools were effectively used to present/develop research/design project, figures and tables were completely provided.
	1	**3**	**5**
Report Format/Mechanics	Significant deficiencies in formatting, wording, spelling, grammar, or punctuation. Writing lacks sentence variety.	Adequate report formatting and usage of wording, grammar, and punctuation. Some sentence variety.	Excellent formatting, word usage, spelling, grammar and punctuation. Wide variety of sentence structure.
	1	**3**	**5**

Lab Report Rubric

Experimental Data Analysis/Design Lab Report Rubric

	Poor	Acceptable	Excellent
Effectiveness of Experimental Procedures/Design	Somewhat ineffective. Would allow experiments to achieve some goals.	Somewhat effective. Would allow experiments to achieve most goals.	Very effective. Would allow experiments to achieve all goals.
	1	**3**	**5**
Data Tabulation/Graphics	Little or no attempt to organize/tabulate/graph data in a comprehensible way.	Organized/tabulated/graphed most data correctly.	Data completely and appropriately organized/tabulated/graphed.
	1	**3**	**5**
Data Calculations/Interpretation	Significant errors in calculations. Little or no attempt to interpret data.	Calculated/interpreted most data correctly.	Data completely and appropriately calculated/interpreted.
	1	**3**	**5**
Statistical/Error Analyses of Data	Statistical methods were applied with significant errors or absent.	Statistical methods were attempted and most methods were correctly applied.	Statistical methods were fully and correctly applied.
	1	**3**	**5**
Data Results/Discussion/recommendations	Missed the point of the experiment or analyzed the most basic points. No or basic recommendations.	Adequate insight. Missed some important points. Sufficient recommendations.	Excellent insight. Results and discussions were complete and focused. Recommendations reflect good understanding of the experiment.
	1	**3**	**5**
Report Format/Mechanics	Significant deficiencies in formatting, wording, spelling, grammar, or punctuation. Writing lacks sentence variety.	Adequate report formatting and usage of wording, grammar, and punctuation. Some sentence variety.	Excellent formatting, word usage, spelling, grammar and punctuation. Wide variety of sentence structure.
	1	**3**	**5**

Capstone Project Presentation Rubric

Senior Project Design Presentation Rubric

	Poor	Acceptable	Excellent
Content	Lacks or demonstrates limited idea development with few details and/or weak supporting evidence.	Demonstrates some depth of idea development, with specific, sufficient details, and/or adequate supporting evidence.	Demonstrates reflective, analytical and/or insightful idea development; provides specific, thorough supporting evidence.
	1	**3**	**5**
Organization	Presentation is rambling and unfocused, with main theme and supporting details presented in a disorganized, unrelated way.	Presentation demonstrates some grasp of organization, with a discernible theme and supporting details	Presentation is clearly organized around a central theme. Each paragraph is clear and relates to the others in a well-planned framework.
	1	**3**	**5**
Delivery	Presentation does not stay on topic, difficult to understand, uses incomplete sentences, little or no consideration of audience, difficult to hear, appears tense.	Presenter adequately delivers the information while staying on the topic, considers the audience, speaks somewhat clearly.	Presenter effectively and creatively delivers the information while staying on the topic and considering the audience, uses voice variations, seems confident and delightful.
	1	**3**	**5**
Quality of Slides/Visual Aid	Slides are difficult to read and understand, spelling/grammar errors evident.	Slides are easy to read and understand, key words are used.	Slides support the presentation, are easy to read and understand, key words are used effectively.
	1	**3**	**5**
Time/Pace/Preparation	Goes over time, rushes to finish, pace too slow or fast, presentation is lacking in preparation.	Ends on time, does not rush, preparation shows satisfactory preparation.	Good pace, Presentation shows detailed preparation and practice in delivery.
	1	**3**	**5**

Capstone Project Report Rubric

	Poor	Acceptable	Excellent
Project Statement and Objectives	Unable to clearly state the scope of the project or identify and list the design objectives.	Sufficiently states the scope of the project and is able to identify and list the design objectives.	Excellent and clear understanding of the scope of the project and its objectives.
	1	**3**	**5**
Project Specifications and Constraints	Little understanding of the project specifications and its constraints.	Understands the specification process and the constraints.	Clearly identifies and list project specifications and offers realistic constraints.
	1	**3**	**5**
Alternative Design Evaluations	Unable to identify or basic considerations of the design alternatives.	Alternative approaches identified and evaluated at an acceptable level.	Clear identification and evaluation of the design alternatives.
	1	**3**	**5**
Conceptual and Preliminary Design Developments	Unable to conceptualize and offer a preliminary design.	Capable of conceptualizing and developing a preliminary design. Understands the conceptual and preliminary design processes.	Superior understanding of the conceptual and preliminary design processes. Develops a preliminary design that meets its objectives/constraints.
	1	**3**	**5**
Mathematical Modeling and Analysis	Unable to model, analyze, and evaluate the preliminary design. No apparent use of auxiliary techniques/tools to evaluate the design.	Adequate modeling, analysis, and evaluation of the design. Uses some auxiliary techniques/tools to evaluate the design.	Superior use of auxiliary techniques/tools in modeling, analyzing, and evaluating the design.
	1	**3**	**5**
Design Construction, Testing and Evaluations	Unable or little attempt to construct, test, and evaluate the design.	Design construction, testing, and evaluations were sufficiently performed.	Design construction, testing, and evaluation performed at a level that exceeded expectations. The design met its objectives/specifications.
	1	**3**	**5**
Final Detailed Design	No or little attempt to refine the preliminary design to a final design to meet the design objectives.	The analysis and testing design procedures were adequately followed to refine the preliminary design to a final design. Design objectives/specifications are met at an acceptable level.	Superior use of the design procedures to refine the design to a final detailed design .The design met or exceeded its objectives/specifications.
	1	**3**	**5**
Project Management and Team Functioning	Poor project planning/scheduling. Little coordination among team members.	Adequate project planning/scheduling to meet the deadline. Adequate coordination among team members.	Effective and efficient project planning/scheduling to finish the project on time and within the budget. Effective coordination among team members.
	1	**3**	**5**