ASSESSMENT REPORT 2004-2005 UPDATE
Mechanical Engineering

A. Undergraduate Assessment by Degree/Certificate Program

1. List in detail your Student Learning Outcomes (SLOs) for each undergraduate degree/certificate offered.

The overriding objective of the Department of Mechanical Engineering at the University of Hawaii is to prepare students for successful professional careers and lifelong learning and to instill in them principles of ethical behavior that will lead to their being concerned good citizens of their community and the world. Achievement of this overriding objective requires the achievement of the following three major "component objectives":

- to teach our students the basic laws of nature that are relevant to the fields of mechanical engineering, and to closely related fields, and how to use those laws to formulate and solve engineering problems using applicable analytical, computational, and experimental techniques;

- to develop in our students the skills pertinent to the design process, to think creatively, to communicate effectively, and to work collaboratively;

- to instill in our students an understanding and acceptance of their professional and ethical responsibilities, a respect for diversity of opinion and culture, and a concern for a healthy and aesthetic environment.

In order to achieve the Mission Statement, the ME students are educated to effectively develop:

a) An ability to apply knowledge of mathematics, science, and engineering

b) An ability to design and conduct experiments, analyze, and interpret data

c) An ability to design a system, component, or process to meet desired needs

d) An ability to solve multidisciplinary problems

e) An ability to identify, formulate, and solve engineering problems

f) An understanding of professional and ethical responsibility

g) An ability to communicate effectively

h) The broad education necessary to understand the impact of engineering solutions in a social context

i) A sound basis and motivation to engage in life-long learning

j) A knowledge of contemporary issues
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

l) An understanding and concern for the need of the State of Hawaii to expand and diversify its economic and technological base

m) Valuable lifelong friendships with classmates and a sense of pride in, and a desire to support, their Alma Mater after graduation

2. Where are these SLOs published (e.g., department web page)?

Department’s web page: www.eng.hawaii.edu/ME

3. Explain how your SLOs map onto your curriculum, i.e., how does your curriculum produce the specific SLOs in your students?

Each course has a specific set of SLOs, developed by the assessment committee, listing the number of hours spent per semester on each SLO. Students rank each SLO in order to provide feedback to the instructor and the committee as to how well each course is satisfying the SLOs for that class. The response from each class is assembled into a spreadsheet to ensure our published SLOs are being met.

4. What specific methodologies were used to collect data? In developing your response, consider the following questions:

   – What was the nature of the instruments or methods used? e.g., “Paper/pencil” survey; essay/writings; recording (video, audio); Capstone class, course, or project;

Forms listing each SLO for the class are completed by pencil by each student. There are three Capstone classes that are also used to meet the specific SLOs.

   – What was the nature of the data obtained in your assessment? There are a variety of forms of data you might get from or about your students, including:

      – Perceptual/attitudinal indicators that tell us about students’ perceptions of the program/department; their experience in the program/department; their attitude toward the program/department; their attitude toward the faculty;

Perceptual/attitudinal indicators are obtained by exit interviews with graduating seniors.

      – Performance indicators that tell us something about the level of competence with skills or content that students attained as a result of going through your program.

Some engineering students take an exam to qualify for a professional engineering license in the State of Hawaii. Input from our Industry Advisory Board, which represents a cross section of
our students’ employers, is also used to provide feedback to the program and allow for changes to ensure the SLOs are being achieved.

– *When* were the data collected? e.g., end of semester; multiple points in semester (for time-based comparisons);

Data is collected at the end of the semester in each class as well as upon graduation.

– *What population(s) is covered by your assessment(s)?*

  – This question helps us identify what student group you are trying to make statements about. For instance, are you attempting to ask questions about a) only majors in your department; b) both majors and minors; c) “service” students (those students taking your classes to satisfy requirements imposed from outside your program – general education needs, gate keeping or entry classes required for other colleges, departments, programs, etc.); or d) general student population taking your classes as electives.

All students registered in each course are covered. In addition, each student graduating in Mechanical Engineering is asked to provide a written and oral interview with the Chair.

– *Who* were your actual subjects and *how* were they used in the assessment?

  – This question tells us who you actually collected data from and how the data from these students helped you answer questions about your program. For example, did you randomly select students to participate? Did you collect data from pre-existing classes? Were they assigned to single groups; did you compare across multiple groups (e.g., cross sectional comparisons across incoming freshman; transfer students; graduating seniors);

All students in all classes and all graduating seniors are the subject for the assessment.

– *What is the size of your assessment sample relative to the possible student population you are drawing from (e.g., you sampled 30 majors out of a population of 100 majors)?*

All students are given the assessment forms to complete in each class, but there may be some that are absent on the last day of class. Between 90-100 percent of each class participates. Somewhat more than half of all graduating seniors participate in the voluntary exit interview with the Chair.

– *How many students were actually sampled? The whole population? A subset of the population?*

The whole population is intended to be sampled; however, it is impossible to ensure that the whole population, in fact, participates.
– How many students provided data vs. how many were solicited for data (i.e., What was your response rate?). For example, you might have asked all 20 graduating seniors to complete a survey but only 12 did so.

This answer varies by semester and, in fact, by each class. Again, 90-100 percent of students participate in the class survey and somewhat more than half of all graduating seniors participate in the exit interview.

– Who examined or assessed the data? e.g., were raters/assessors/coders/graders used? Were the raters graduate students (if so, how many were used? Was reliability established?); Were the raters faculty members? (if so, how many were used? Was reliability established?); Were ratings provided by internship supervisors?

The department staff (secretary, student help) compiles the responses for each class. The department chair conducts a one-on-one personal interview with graduating seniors and the Chair assesses the data.

– Where were the data collected? e.g., in class settings; scheduled outside of class; off campus.

The class responses are collected in class at the end of the semester. The exit interviews are conducted in the Chair’s office.

5. How were the assessment data/results used to inform decisions concerning the curriculum and administration of the program?

An assessment committee evaluates the class responses and provides feedback to the faculty and the department’s Industry Advisory Board. An external review committee (Accreditation Board for Engineering and Technology) reviews the program at least every six years. Our department was last reviewed in November 2003 and received its highest (six-year) accreditation.

– Was pedagogy changed?

Feedback is provided to each faculty member, which provided each with the opportunity to change teaching methods. It is fair to say the pedagogy hasn’t changed in most classes; however, new equipment allows some classes, particularly laboratories, to use new techniques.

– Did you make administrative changes?

Administrative changes in instructors assigned to courses have been made occasionally to address specific concerns of students.

– Were there changes in interactions with students? Advising, counseling, etc?

A greater effort has been made since 2000 to ensure that students keep the same advisor until they reach senior status. At that time they are assigned a senior advisor.
– Were degree requirements changed?

Yes, degree requirements have been changed as a result of feedback from our accreditation board. An additional capstone course in thermal design has been added to the curriculum, ethics and oral focus requirements have been introduced to senior-level classes, a greater flexibility in the required courses has been permitted; for example, substitute classes: ME 271 or CEE 271; Math 302 or Math 307; ME 371 or CEE 370; ME 360, PHYS 305, or MATH 407 are allowed.

– Were courses changed?

Courses are continually changed to keep abreast of new developments in engineering.

6. General Education Assessment Within the Major:

Manoa’s General Education Program includes the following requirements of majors. All students who graduate with the major:

1) are proficient in the primary information-accessing and information-processing methods of the field; by either integrating such skills within courses or research projects or by recommending an appropriate course offered in another department (computer/info sciences, etc.);

2) are proficient in the problem-solving and oral communication methods of the field;

3) have had training and experience in the modes of inquiry and analysis appropriate to the field. The purpose is to have all students actively engaged in scholarship at a high level, and to avoid having students completing their degrees by means of passive learning alone.

How have you met the above requirements in your degree program?

Engineering, in particular Mechanical Engineering, inherently requires proficiency in all of the requirements described above. Freshmen are introduced to the design process in ME 113, Introduction to Engineering Design, which continues in ME 213. Three additional laboratory courses are required as well as a capstone design course in thermal engineering and a two-course capstone sequence in mechanical design. All of the laboratories and capstone courses require oral presentations using PowerPoint and cover the W-, O-, and E-focus requirements.
Department of Mechanical Engineering
2004-2005 Assessment Report

Graduate Assessment by Degree/Certificate Program

1. List in detail your Student Learning Outcomes (SLOs) for each graduate degree/certificate offered.

The Department of Mechanical Engineering adheres to the student learning outcomes of the Graduate Division:

“In general, a student who has successfully completed the graduate degree requirements should be able to
1. Demonstrate mastery of the methodology and techniques specific to the field of study.
2. Communicate both orally and in writing at a high level of proficiency in the field of study.
3. Conduct research or produce some other form of creative work.
4. Function as a professional in the discipline.”

2. Where are these SLOs published?

These student learning outcomes will be provided on the department web site at

http://www.eng.hawaii.edu/ME/

3. Explain how your SLOs map onto your curriculum, i.e., how does your program of graduate studies produce the specific SLOs in your students?

The department offers three graduate degree programs: Master’s Degree Plan A, Master’s Degree Plan B, and PhD Degree. The M.S. and Ph.D. programs require that a student concentrate in one of three areas of concentration: Materials & Manufacturing; Mechanics, Systems & Controls; and Thermal and Fluid Sciences.

Master of Science Plan A (Thesis)

A.1. Course Requirements. A minimum of 30-credit hours are required. Students must have a B average (3.0 GPA) for all courses completed at the University of Hawaii toward the degree; for all courses taken as a classified graduate student; and for all graduate courses numbered 600 or above. These minimal 30 credit hours must include:

- A minimum of 12 credits in ME 600 series courses or other 600 series courses recommended by the student’s advisor and approved by the Graduate Chair
- A minimum of 1 credit of ME 691 Seminar
- A minimum of 8 credits of ME 700 Thesis
• A minimum of 9 credits of technical electives (400 level or above in engineering, mathematics or physical sciences approved by the student’s thesis committee)

The course work should constitute a coherent program in the student's area of concentration as described in paragraph 3.

The course requirements contribute substantially to achieving SLO 1.

A.2. Thesis Requirements. A thesis is required for a Master’s degree Plan A. A student must have a thesis committee that consists of at least three members of the graduate faculty of the University of Hawaii; the chairman and at least one other committee member must be on the Mechanical Engineering graduate faculty. When the thesis topic has been approved by the committee, the candidate then may register for ME 700. The committee chairman provides guidance to the M.S. candidate for primary direction of the research, research methodology, and preparation of research results. It is the joint responsibility of the chairman and the student to see that all members of the committee are kept informed of the scope, plan and progress of the research and thesis.

The format of the written thesis must follow the Style & Policy Manual for Theses and Dissertations specified by the Graduate Division.

M.S. candidates are required to pass a final oral examination that covers the thesis and related topics. A majority of the members of the committee must approve both the thesis and the student's performance in the thesis defense examination.

The Thesis Requirements contribute to SLOs 1, 3 and 4 by having candidates apply their knowledge to conduct thesis research with some independence. The requirements help to ensure SLOs 2 and 4 are achieved, because the thesis must be written, orally presented and defended at a professional level.

A.3 Seminar Requirements. M.S. candidates must attend at least 15 seminars from the department seminar series. ME 691 Seminar normally is taken in the last semester of residence. Registrants are expected to make one oral presentation. Attendance is taken by the coordinator for the departmental seminars.

The Seminar Requirements contribute to achieving SLO 2 since candidates can observe others giving presentations, and they also have the option of making a presentation. By attending the seminar, candidates also gain experience interacting with presenters with their questions and dialog. This contributes to achieving SLO 4.

Master of Science Plan B (Non-Thesis)

B.1. Course Requirements: A minimum of 30-credit hours are required. Students must have a B average (3.0 GPA) for all courses completed at the University of Hawaii toward the degree; for all courses taken as a classified graduate student; and for all graduate courses numbered 600 or above. These minimal 30 credit hours must include:

• A minimum of 18 credits in ME 600 series courses or other 600 series courses recommended by the student’s advisor and approved by the Graduate Chair
• A minimum of 1 credit of ME 691 Seminar
• A minimum of 2 credits of ME 699 Directed Reading
• A minimum of 9 credits of technical electives (400 level or above in engineering, mathematics or physical sciences approved by the student’s thesis committee)

The course work should constitute a coherent program in the student's area of concentration as described in paragraph 3.

The course requirements contribute substantially to achieving SLO 1.

B.2. Report Requirement: A report of the ME 699 Directed Reading must be submitted by the candidate. This report can document a research effort, albeit of less depth and rigor than a ME 700 Thesis, or study of a more practical nature, related perhaps to the student’s industrial background or interests.

The Report Requirement contributes to achieving SLOs 1, 3 and 4 by having candidates apply their knowledge to conduct a study with some independence. It contributes to achieving SLOs 2 and 4 because the report must be written and orally presented and defended at a professional level.

B.3. Seminar Requirements: This is the same Seminar Requirements of Master’s Plan A (A.3). The Seminar Requirements contribute to achieving SLO 2 since candidates can observe others giving presentations, and the candidate also has the option of making a presentation. By attending the seminar, candidates also gain experience interacting with presenters with their questions and dialog. This contributes to achieving SLO 4.

Doctoral Degree

The Doctor of Philosophy degree is awarded only for the most distinguished scholarly achievement. The quality of a candidate's work is judged by a variety of means culminating in a set of qualifying, comprehensive and final examinations and a dissertation. The dissertation must be a significant original contribution to knowledge in mechanical engineering. Students in the Ph.D. program are required to concentrate in one of the three areas of concentration described in paragraph 3. Moreover, students are required to show proficiency in a minor field which is within the compass of the three areas of concentration. Proficiency in the minor may be met by documenting satisfactory performance in course work (at least 9 credits, 6 of which must be at the graduate level).

Requirements for doctoral students are described in the following.

C.1. Course Requirements. The courses that a student takes shall be selected by the student in consultation with the student’s dissertation advisor. Students must satisfactorily complete a minimum of 50 credit hours in course work beyond the B.S. degree. ME 800 Dissertation Research credit hours are not counted toward the 50 credit hour requirement. The minimum GPA is the same as the M.S. degree (paragraph A.1).

The Course Requirements contribute substantially to achieving SLO 1.
C.2. Qualifying Examination. The purpose of this examination is to determine if a student has the potential to conduct research independently. The student must register for 3 credit hours of ME 699 Directed Research and form a Qualifying Examination Committee consisting of three members of the graduate faculty of the University of Hawaii; the chairman and at least one other committee member must be on the Mechanical Engineering graduate faculty. The exam consists of an oral defense of a written report of the student’s research. To pass, the student must demonstrate the ability to perform independent research. This requirement must be completed prior to the end of the student’s second semester of attendance.

The Qualifying Examination contributes to SLOs 2 and 3 since the student must communicate effectively both orally and in writing, and to demonstrate an ability to conduct research.

C.3. Comprehensive Examination. Each student must pass an oral comprehensive examination. The purpose of this examination is to ascertain the student’s comprehension of areas of study relevant to the dissertation topic. The comprehensive examination, to be administered by the student’s dissertation committee, will be taken only after completion of the course work specified in paragraph C.1. The dissertation committee will consist of at least five members of the U.H. graduate faculty, three of whom must be members of the M.E. graduate faculty. At least one member must be from a department other than M.E. This outside member must be a full member of the regular graduate faculty. There will be at least one committee member from the minor area of study. The committee will be chaired by the dissertation advisor.

The Comprehensive Examination contributes to SLOs 1, 2, and 4.

C.4. Dissertation. The doctoral dissertation is expected to be a scholarly presentation of an original contribution to knowledge resulting from independent research and should be suitable for publication.

The Dissertation contributes to SLOs 1, 2 and 3 since the student author must demonstrate facility with techniques and methodology pertinent to the research effort, communicate effectively in writing, and accurately and clearly state the creative substance of the research effort.

C.5. Final Examination. Each Ph.D. candidate will be required to pass an oral final examination based primarily upon the dissertation. The examination consists of a presentation of the research effort followed by questioning from the committee members.

The examination will be administered by the student’s full dissertation committee. Candidates shall pass the final examination upon the favorable recommendation of a majority of the committee.

The Final Examination contributes to SLOs 1, 2 and 3 for the reasons stated in paragraph C.4. In addition, the ability to respond to questions demonstrates professional conduct contributing to SLO 4.

C.6. Seminar Requirements: Ph.D candidates must attend at least 30 seminars from the department seminar series. ME 691 Seminar normally is taken in the last semester of residence. The Seminar Requirements contribute to achieving SLO 2 since candidates can observe others
giving presentations, and the candidate also has the option of making a presentation. By attending the seminar, candidates also gain experience interacting with presenters with their questions and dialog. This contributes to achieving SLO 4.

4. What population(s) is covered in your assessment(s)?

Graduate students in the Mechanical Engineering M.S. and Ph.D. programs.

5. Please list/describe all the assessment events and devices used to monitor graduate students progress through the program.

Master’s Degree

Entry Requirements: Admission to the graduate program in Mechanical Engineering depends on undergraduate performance, TOEFL and GRE scores, letters of reference, any program course deficiencies and the applicant’s Statement of Objectives. To be accepted by the Graduate Division, applicants must have the equivalent of a B average at the University of Hawaii (determined by Graduate Division).

Foreign students from universities that do not teach in English must pass the TOEFL examination with minimum scores of 550, or 600 for teaching assistants. All students must submit a record of their GRE scores. Students with above-average scores normally are accepted into the M.S. program. TOEFL and GRE scores as well as course transcripts are useful in evaluating skills needed to pursue graduate study. Letters of recommendation generally must be positive.

Applicants from Mechanical Engineering programs at some universities and from fields other than Mechanical Engineering might not have a sufficient background to pursue an M.S. degree in the chosen area of concentration. The Graduate Chair bases acceptance on an acceptable number of deficiency courses. For those applicants who are accepted, the Graduate Chair has an initial advising session with the applicant to make a final determination of any deficiency courses that must be taken in addition to the course requirements for the M.S. degree.

An applicant’s Statement of Objectives is helpful in determining if the applicant’s career goals can be met by the Department’s programs and available resources.

Course Requirement: There is a minimum GPA to maintain in course work via grade-based written and, occasionally, oral exams.

Research Requirement: Students must demonstrate a novel contribution made to their area of concentration by writing and orally defending a thesis documenting their work.

Ph.D. Degree

Entry Requirements: Acceptance of Ph.D. applicants is based on undergraduate and graduate performance in course work and research, TOEFL and GRE scores, letters of reference, any program course deficiencies, and the applicant’s Statement of Objectives (description same as M.S. degree). Also, Ph.D. applicants are required to have a M.S. degree in Mechanical Engineering or related field.
Course Requirement: There is a minimum GPA to maintain in course work via grade-based written and, occasionally, oral exams.

Examinations: The examinations described in paragraphs C.2 to C.5 are used to monitor student progress.

Research Requirement: Students must demonstrate a novel contribution made to their areas of concentration by writing and orally defending a dissertation documenting their work.

Consider the following questions:

- **How are written exams used to assess graduate students?**

Written exams in courses are used to assess mastery of subjects pertinent to a student’s area of concentration for both M.S. and Ph.D. programs.

A written report serves as a qualifying exam for Ph.D. students. In addition, the student must make an oral defense of this report.

- **How are independent and/or culminating projects used to assess graduate students?**

For the Master’s degree, a thesis (Plan A) or report (Plan B) is required. The thesis or report is judged and must be approved by the student’s M.S. committee comprised of three faculty members.

For the PhD degree Qualifying Examination, students must write a report documenting research completed during one semester. This examination, consisting of the report and an oral defense, is used to assess if the student is capable of independent research.

The main body of work for the PhD degree is the dissertation. The doctoral dissertation is expected to be a scholarly, original contribution to knowledge resulting from independent research and should be suitable for publication.

- **How are oral presentations/reports/performances used to assess graduate students?**

For the Master’s degree, a written thesis must be presented and defended during an oral examination.

For the PhD degree, an oral Qualifying Examination is used to judge student competence in conducting independent research. The oral Comprehensive Examination assesses a student’s technical skills needed to carry out research, and the oral Final Examination provides a final evaluation of the original contribution achieved in the research effort.

6. Please list/describe how your graduate students contribute to your discipline/academic area? Consider the following questions:

- **To what extent do your graduate students present their work at professional conferences?**
Graduate students are encouraged to present their research findings at conferences. Many of our graduate students have had this experience.

- **To what extent do your graduate students publish their work?**

Graduate students are encouraged to publish their research findings in conference proceedings and in journals. Many of our graduate students have had this experience.

7. **What attempts are made to monitor student post-graduate professional activities?**

The Graduate Chair will conduct exit interviews with graduates to ascertain their satisfaction with the graduate program in Mechanical Engineering and their immediate professional plans. Students will be encouraged to keep in touch with the Department.