A. Undergraduate Assessment by Degree/Certificate Program

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

All graduates of the Electrical Engineering Program are expected to have:

1. Knowledge of probability and statistics, including examples relevant to Electrical Engineering (program criteria). Knowledge of mathematics through differential and integral calculus, basic sciences, and engineering sciences necessary to analyze and design complex devices and systems containing hardware and software. Knowledge of advanced mathematics, including differential equations (program criteria).
2. Demonstrated an ability to design and conduct experiments, as well as to interpret data.
3. Demonstrated an ability to design a system or component that meets a specified need.
4. Demonstrated an ability to function in a multi-disciplinary team.
5. Demonstrated an ability to identify, formulate and solve electrical engineering problems.
6. Understanding of professional and ethical responsibility.
7. Demonstrated an ability to communicate effectively (written and oral).
8. Demonstrated an understanding of the impact of engineering solutions in a global and societal context.
10. Demonstrated a knowledge of contemporary issues.
11. Demonstrated an ability to use the techniques, skills, and modern tools necessary for engineering practice.

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

The student outcomes can be found by going to the department web site at

http://www-ee.eng.hawaii.edu

On the home page, it states “Our Department's Mission Statement and our Program Objectives and Outcomes can be found here.” By clicking “here”, you will find the SLOs as well as the Mission Statement and Program Objectives.

It is also in the UH Catalog
3. Explain how your SLOs map onto your curriculum, i.e., how does your curriculum produce the specific SLOs in your students?

Figures 1 and 2 illustrate how our curriculum prepares students for the eleven SLOs. Figure 1 has a list of the required courses, indicating how each contributes. The contribution rating is given by the Course Coordinator (a senior faculty who teaches the course) and our Undergraduate Curriculum Committee. They enter the ratings using the Course Assessment For Program Outcomes form (see Figure 3). Figure 1 gives an overall view of how the required courses contribute to the SLOs. Since this is for required courses, it applies to all students and provides a baseline of their electrical engineering (EE) education.

From Figure 1, we can see that all SLOs have some emphasis from multiple required courses. This shows that all SLOs have at least some coverage. Naturally, most courses have greater emphasis on technical SLOs because of the technical nature of electrical engineering.

Figure 2 corresponds to the EE Technical Electives. The technical electives are divided into three Tracks, which are areas of specialization: Computers, Electro-Physics, and Systems. Each Track is further divided into Groups I and II. A student must take 17 credit hours in a particular Track including all of Group I. The student must also take 3 credit hours of technical elective outside the chosen Track. This helps ensure technical breadth within the EE discipline.

Since technical electives are designed for technical depth (i.e., specialization), they are focused on SLOs that are technical.
# Figure 1. Student Learning Outcomes (SLOs) in relation to required courses.

**MATHEMATICS**
- Math 241 Calculus I (4 hrs)
- Math 242 Calculus II (3 hrs)
- Math 242L Calculus Computer Lab (1 hr)
- Math 243 Calculus III (3 hrs)
- Math 244 Calculus IV (3 hrs)
- Math 302 Introduction to Differential Equations (3 hrs)
- EE 342 EE Probability and Statistics (3 hrs)

**BASIC SCIENCES**
- Chem 161 General Chemistry I (3 hrs)
- Chem 161L General Chemistry Lab I (1 hr)
- Chem 162 General Chemistry II (3 hrs)
- Phys 170 General Physics I (3 hrs)
- Phys 170L General Physics Lab I (1 hr)
- Phys 272 General Physics II (3 hrs)
- Phys 272L General Physics Lab II (1 hr)
- Phys 274 General Physics III (3 hrs)

**ENGINEERING REQUIRED**
- EE 160 Programming for Engineers (4 hrs)
- EE 211 Basic Circuit Analysis I (4 hrs)
- EE 213 Basic Circuit Analysis II (4 hrs)
- EE 260 Introduction to Digital Design (4 hrs)
- EE 296 Sophomore Project (1 hr)
- EE 315 Signal and Systems Analysis (3 hrs)
- EE 323 Microelectronic Circuits I (3 hrs)
- EE 323L Microelectronic Circuits Lab I
- EE 324 Physical Electronics (3 hrs)
- EE 341 Introduction to Communication Systems (3 hrs)
- EE 341L Intro. to Communication Systems Lab (1 hr)
- EE 371 Engineering Electromagnetics I (3 hrs)
- EE 396 Junior Project (2 hrs)
- EE 496 Capstone Design Project (3 hrs)
- Engineering Breadth (3 hrs)

**GENERAL EDUCATION**
- ENG 100 Composition I (3 hrs)
- SP 251 Principles of Effective Public Speaking (3 hrs)
- Contemporary Ethical Issues (E) -- 1 course
- Writing Intensive (W) -- 5 courses

*Key:*  
- = 1, no emphasis  
- = 2, some emphasis  
- = 3, moderate emphasis  
- = 4, significant emphasis
**COMPUTERS**

**Group I**
- EE 361 Digital Systems and Computer Design (3 hrs)
- EE 361L Digital Systems & Computer Design Lab (1 hr)
- EE 366 CMOS VLSI Design (3 hrs)
- EE 367 Computer Data Structures and Algorithms (3 hrs)
- EE 367L Comp. Data Structures & Algorithms Lab (1 hr)

**Group II**
- EE 344 Networking I (4 hrs)
- EE 449 Computer Communication Networks (3 hrs)
- EE 461 Computer Architecture (3 hrs)
- EE 467 Object-Oriented Software Engineering (3 hrs)
- EE 468 Introduction to Operating Systems (3 hrs)
- EE 469 Wireless Data Networks (3)

**ELECTRO-PHYSICS**

**Group I**
- EE 326 Microelectronics Circuits II (3 hrs)
- EE 326L Microelectronics Circuits II Lab (1 hr)
- EE 327 Theory and Design of IC Devices (3 hrs)
- EE 372 Engineering Electromagnetics II (3 hrs)
- EE 372L Engineering Electromagnetics II Lab (1 hr)

**Group II**
- EE 328 Physical Electronics Lab Techniques (3 hrs)
- EE 328L Physical Electronics Lab (1 hr)
- EE 422 Electronic Instrumentation (3 hrs)
- EE 422L Instrumentation Lab (1 hr)
- EE 426 Advanced Si IC and Solid State Devices (3 hrs)
- EE 473 Microwave Engineering (3 hrs)
- EE 475 Optical Communications (3 hrs)

**SYSTEMS**

**Group I**
- EE 351 Linear Systems and Control (3 hrs)
- EE 351L Linear Systems and Control Lab (1 hr)
- EE 415 Digital Signal Processing (4 hrs)

**Group II**
- EE 344 Networks I (4 hrs)
- EE 442 Digital Communications (3 hrs)
- EE 449 Computer Communication Networks (3 hrs)
- EE 452 Digital Control Systems (3 hrs)
- EE 453 Modern Control Theory (3 hrs)

**Key:**
- = 1, no emphasis
- = 2, some emphasis
- = 3, moderate emphasis
- = 4, significant emphasis

**Figure 2.** Student Learning Outcomes (SLOs) in relation to EE Technical Electives.
Course Assessment For Program Outcomes

Instructions: This is used to assess how a course helps students meet EE Program Outcomes. It should be completed by faculty, who are Course Coordinators or instructors of the course. A Course Coordinator should complete it whenever a new syllabus is prepared. An instructor should complete it after teaching the course.

Course Number and Title:
Preparer’s Name and Date:
Are you a Course Coordinator or Instructor?:
Semester and Year:

In the table below, for each EE Program Outcome, assign an integer-valued rating from 1 (“not at all”) to 4 (“a great deal”) of how the course helps (or helped) students toward meeting the outcome.

<table>
<thead>
<tr>
<th>EE Program Outcome</th>
<th>Rating (1-4)</th>
</tr>
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<tbody>
<tr>
<td>1. Knowledge of probability and statistics, including examples relevant to</td>
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<tr>
<td>Electrical Engineering (program criteria). Knowledge of mathematics through</td>
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<tr>
<td>differential and integral calculus, basic sciences, and engineering sciences</td>
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<tr>
<td>necessary to analyze and design complex devices and systems containing</td>
<td></td>
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<tr>
<td>hardware and software. Knowledge of advanced mathematics, including</td>
<td></td>
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<tr>
<td>differential equations (program criteria).</td>
<td></td>
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<tr>
<td>2. Demonstrated an ability to design and conduct experiments, as well as to</td>
<td></td>
</tr>
<tr>
<td>interpret data.</td>
<td></td>
</tr>
<tr>
<td>3. Demonstrated an ability to design a system or component that meets a specified</td>
<td></td>
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<tr>
<td>need.</td>
<td></td>
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<tr>
<td>4. Demonstrated an ability to function in a multi-disciplinary team.</td>
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<tr>
<td>5. Demonstrated an ability to identify, formulate and solve electrical engineering</td>
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<tr>
<td>problems.</td>
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<tr>
<td>6. Understanding of professional and ethical responsibility.</td>
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<td>7. Demonstrated an ability to communicate effectively (written and oral).</td>
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<tr>
<td>global and societal context.</td>
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<td>10. Demonstrated a knowledge of contemporary issues.</td>
<td></td>
</tr>
<tr>
<td>11. Demonstrated an ability to use the techniques, skills, and modern tools</td>
<td></td>
</tr>
<tr>
<td>necessary for engineering practice.</td>
<td></td>
</tr>
</tbody>
</table>

Include any comments on improving the course. If you feel the design credit amount should be changed, please include your comments. You may use the space below and continue on a separate sheet.

Figure 3. Course Assessment Forms For Student Learning Outcomes (SLOs).
4. What specific methodologies are used to collect data? In developing your response, consider the following questions:

What was the nature of the instruments or methods used?

We currently assess our program through paper and pencil surveys and faculty input. The following are the surveys:

- **Student Surveys**: There are two surveys. The first is to rate a faculty’s effectiveness, and the second is to rate how the course helps students attain the eleven SLOs. These surveys are conducted per course and in class at the end of the semester. Students may also write comments on the survey.

- **Faculty Survey**: Faculty complete the survey shown in Figure 3 each time they teach a course. Faculty rate how their class fulfill the SLOs. They may also write comments on the survey.

- **Industrial Advisory Board (IAB) Survey**: The IAB is a committee of practicing engineers. The members typically come from companies and government agencies that hire our graduates, so they can provide an accurate assessment of our performance. We invite them for an on-campus meeting, which includes an overview of the program, lab tours, and interviews with students. At the end of the meeting, the IAB prepares a final report about our program, which includes surveys, comments, and recommendations.

- **Student Advisory Board (SAB) Survey**: The SAB is a committee of undergraduate students, advised by a faculty member. The committee develops and conducts their own survey for undergraduates. They compile and summarize the results into a final report, which includes the methodology and justification for the survey.

What is the nature of the data obtained in your assessment?

- **Student Survey**: The first survey has questions about effectiveness of the instructor, and instructor teaching style. In the second survey, students rate how the course improves their ability to achieve the SLOs. The survey is similar to Figure 3 except the ratings are from 0 to 3. Students may also write comments on the survey. The surveys have both perceptual/attitudinal and performance indicators.

- **Faculty Survey**: This is similar to the Student Survey but for faculty who teach the course. Faculty rate how their class fulfills the SLOs. They may also write comments on the survey. The survey has performance indicators.
• **Industrial Advisory Board (IAB) Survey**: IAB provides a final report about the program, which includes surveys, comments, and recommendations. The survey has performance indicators.

• **Student Advisory Board (SAB) Survey**: The committee develops and conducts their own survey for undergraduates. They compile and summarize the results into a final report, which includes the methodology and justification for the survey. The survey has both perceptual/attitudinal and performance indicators.

**When were the data collected?**

• **Student Survey**: These surveys are conducted in-class for each course, at the end of the semester.

• **Faculty Survey**: These surveys are conducted done for each course offering, but not all courses are surveyed every semester. Faculty complete the survey at the end of the semester following significant changes in the material covered.

• **Industrial Advisory Board (IAB) Survey**: This is done annually in October.

• **Student Advisory Board (SAB) Survey**: This is done annually but the date varies.

**What population(s) is covered in your assessment(s)?**

• **Student Survey**: Undergraduates majoring in electrical engineering.

• **Faculty Survey**: All faculty who teach courses.

• **Industrial Advisory Board (IAB) Survey**: The committee membership will range between 6-12 practicing engineers from industry and government agencies. Since some of the members are alumni, the IAB provides the alumni perspective too.

• **Student Advisory Board (SAB) Survey**: The 2004 SAB, conducted a survey covering all EE undergraduates majoring, which number about 300.

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

• **Student Surveys**: For each class, all students complete in-class surveys at the end of the semester. With the survey, students provide ratings about how the class helps them meet our SLOs. Students may also write comments. The ratings help to identify any deficiencies in meeting SLOs. We address all comments, and solve any problems.

• **Faculty Survey**: For each class, the instructor completes the survey shown in Figure 3 after the semester is over. The ratings help to identify any deficiencies in meeting SLOs. We address all comments, and solve any problems.
• **Industrial Advisory Board (IAB) Survey:** The department invites 6-12 practicing engineers to participate in the board. The engineers are from industry and government agencies. Since some of them are alumni, they provide alumni perspective too. The IAB complete a survey we prepare. The ratings in the survey help to identify any deficiencies in meeting SLOs. The IAB may also provide written comments. We address all comments, and solve any problems.

• **Student Advisory Board (SAB) Survey:** It varies with the SAB. The last SAB provided a final report Spring 2004. Their survey covered all undergraduates majoring in electrical engineering which number about 300. The ratings of the survey help to identify any deficiencies in meeting SLOs. The students also provide written comments on the surveys. We address all comments, and solve any problems.

**What is the size of your assessment sample relative to the possible student population you are drawing from?**

• **Student Survey:** The surveys are conducted in class at the end of the semester, so it attempts to sample all students in each class. But most classes do not have full participation.

• **Student Advisory Board (SAB) Survey:** It can vary depending on the SAB. The last SAB provided a final report Spring 2004. Their survey covered the entire EE student population, which is about 300. They received 174 completed surveys.

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

• **Student Survey:** The surveys are conducted in class at the end of the semester, so it attempts to sample all students in each class. Generally, the participation is at least 50%. As an example, Figure 4 shows the number of students who participated in the surveys in Fall 2004.

• **Student Advisory Board (SAB) Survey:** It can vary depending on the SAB. The last SAB provided a final report Spring 2004. Their survey covered the entire EE student population, which is about 300. They received 174 completed surveys.
<table>
<thead>
<tr>
<th>Course</th>
<th>Enrollment</th>
<th>Number Surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 160</td>
<td>54</td>
<td>24</td>
</tr>
<tr>
<td>EE 211</td>
<td>49</td>
<td>34</td>
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<tr>
<td>EE 213</td>
<td>24</td>
<td>19</td>
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<td>EE 260</td>
<td>41</td>
<td>33</td>
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<td>EE 315</td>
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<td>EE 324</td>
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<td>EE 326</td>
<td>20</td>
<td>16</td>
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<td>EE 341</td>
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<td>EE 449</td>
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<td>EE 467</td>
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<td>13</td>
</tr>
<tr>
<td>EE 468</td>
<td>24</td>
<td>14</td>
</tr>
</tbody>
</table>

Figure 4. Number of EE students surveyed in Fall 2004.

**How many students provided data vs. how many were solicited for data?**

- **Student Survey:** The surveys are conducted in-class at the end of the semester, so it attempts to sample all students in each class. Generally, the participation is at least 50%. As an example, Figure 4 shows the number of students who participated in the surveys in Fall 2004.

- **Student Advisory Board (SAB) Survey:** It can vary depending on the SAB. The last SAB provided a final report in Spring 2004. Their survey covered the entire EE student population, which is about 300. They received 174 completed surveys.

**Who examined or assessed the data?**

From 2001-2004, our ABET Core Committee assessed the data (ABET is the national accreditation organization for undergraduate engineering programs). From 2005, our ABET Committee has been assessing the data. The committees are responsible for ensuring the quality of the undergraduate program. They evaluate the final reports and surveys, and recommend changes to the curriculum and department resource allocations to support the curriculum.
Where were the data collected?

- **Student Survey**: In class.
- **Faculty Survey**: On campus.
- **Industrial Advisory Board (IAB) Survey**: On campus.
- **Student Advisory Board (SAB) Survey**: On campus.

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

From 2001-2004, our ABET Core Committee assessed the data. From 2005, our ABET Committee has been assessing the data. The committees are responsible for ensuring the quality of the undergraduate program. They evaluate the final reports and surveys, and recommend changes to the curriculum and department resource allocations to support the curriculum. The department chair or appropriate committee, such as our Undergraduate Curriculum Committee, will implement the changes.

Student Surveys, Faculty Surveys, IAB Reports, and SAB Reports have been used to inform decisions. There are two types of information in the surveys: ratings of how courses and the program meet the SLOs, and comments about how to improve the program. The ratings are used to check if there are any deficiencies in supporting the SLOs. So far we have not found significant deficiencies.

We address all comments from the surveys, and solve any problems.

- **Was pedagogy changed?**

  - **Recent Equipment Upgrades.** Over the last three years, we made a concerted effort to upgrade undergraduate instructional and computer labs. New equipment and computers were purchased for the basic circuits, analog circuits, digital circuits, and communications labs. Further improvements are planned, subject to the availability of funds. This issue was part of the 2001 IAB/SAB feedback.

  - **New Multimedia Teaching Facility.** In Fall 2001, we opened a multimedia facility (Holmes 389) with computer projection and distance learning capabilities to enhance classroom instruction. The need for more such facilities was indicated by the 2001 SAB.

  - **Upgrade of EE 211 and EE 213 Laboratories.** Comments from the IAB and SAB in 2002 suggested that the laboratory facilities for EE 211 Basic Circuit Analysis I and EE 213 Basic Circuit Analysis II could be improved. We purchased new workbenches, digital oscilloscopes, and power supplies for these laboratories. In Spring 2005, we purchased PCs and computer aided design tools for all workbenches.
• **Upgrade of EE 323L and EE 326L Laboratories.** In Spring 2005, we purchased new digital oscilloscopes, function generators, PCs and computer aided design tools for all workbenches in the laboratories. This upgrade was motivated by feedback from an instructor and graduate teaching assistant.

• **New EE Computer Lab.** An additional item for improvement has been identified by a retention consultant from Noel-Levitz, hired by the College of Engineering to review undergraduate issues College-wide. It was observed that access to computing facilities in the College is comparatively limited. To address this issue, we moved our general access computing lab to a substantially larger room (Holmes 389), and will upgrade and add additional facilities as funds permit. Student assistants have been hired to allow the lab to be open additional hours.

**- Did you make administrative changes?**

• **New Program Objectives and Outcomes.** Based on the requirements set by ABET, and the inputs received from 2001 IAB/SAB, we made changes to our educational objectives and SLOs in Spring 2002.

• **Faculty Committees and Work Flow.** We made administrative changes to manage and maintain the quality of the curriculum. Up until 2001, there was a single ABET Committee which oversaw the undergraduate curriculum. Meeting new ABET requirements proved challenging, and so in 2001, the work was divided into a number of committees: Interface Committee, Assessment Committee, Undergraduate Curriculum Committee, Assessment Committee and the ABET Core Committee. We have gone back to one ABET Committee in Spring 2005, since the workflow has abated.

• **Successful Recruitment of Faculty.** The 2001 IAB/SAB feedback suggested upgrading the analog circuit curriculum. Since then we recruited
  o Dr. Olga Boric-Lubecke in January 2003, whose area is analog circuit design with applications in biomedical and wireless communications.
  o Dr. Victor Lubecke in January 2003, whose area is MEMS, and semiconductor devices.
  o Dr. Diego Barrettino in August 2005, whose area is analog circuits with biological and biomedical applications.
We also recruited Dr. Yingfei Dong (August 2003) in computer engineering, Dr. Gurdal Arslan in control systems (August 2004), and Dr. Luca Macchiarulo (August 2004) in VLSI digital circuits.

• **Reorganized Planned Course Offerings.** We maintained a three year plan of course offerings. Students relied on this plan to determine the courses they need to graduate. However, implementing the plan became difficult especially for senior level technical electives. The courses depended on the available faculty and their expertise, and it was difficult to accurately predict which faculty would be available three years into the future. As a result, the three year plan became too rigid to support, which caused anxiety among
students, as reported by the 2004 SAB. To remedy this, we provided a new format for the three year plan that allowed flexibility for the senior level technical electives. Now the plan states that a minimum number of senior technical electives will be available among a specified collection of possible courses rather than specifying particular courses. The new format can be found at

http://www-ee.eng.hawaii.edu/EEPage/Courses/3yearplan.html

• **Mandatory teaching assistant (TA) training for new TAs.** The university has mandated and we have implemented mandatory departmental TA training for TAs in their first semester. This is done just before the semester begins. This helps to address TA problems pointed out by the IAB and SAB.

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

• **Improved Undergraduate Advising.** The 2004 IAB raised concerns about advising. To alleviate the problem, the ABET Committee recognized that there were two important stages of advising: early advising for students who are entering the program, and late advising for students who are graduating. Early advising was changed last Spring 2005 so that 95% of all freshman were advised by an expert, Dr. Tep Dobry, who is the College’s undergraduate advisor. The rest of the freshmen were advised by Dr. Wayne Shiroma, the Chair of the Undergraduate Curriculum Committee. The process of late advising is still being reviewed. But there is a plan to implement a FAQ to explain the options after graduation.

• **Listing EE 296, 396, 496 Project Advisors.** EE students are required to take project courses at the sophomore (EE 296), junior (EE 396), and senior (EE 496) levels. The projects can be done individually or in groups, and with faculty advisors. There is no formal classroom or laboratory. Students find their own advisors. The 2004 SAB requested that there be a list of faculty and their available projects. In Spring 2005, we implemented a list that is posted on our web site:

http://www-ee.eng.hawaii.edu/EEPage/Courses/EE496/EE_x96_Info_Fall2005.html

• **Teaching Assistants (TAs) have office hours in their laboratories.** The 2004 SAB reported that students who enrolled in instruction laboratories (e.g., EE 323L) wanted access outside of ordinary laboratory hours. They would use this extra time to practice their lab skills. We now require TAs to have their office hours in their laboratories, and make the lab available to students.

- **Were degree requirements changed?**

• **Design Your Own Track (DYOT).** The 2001 IAB/SAB found the existing Track System (Electro-Physics, Computers, and Systems) of upper division EE Technical Electives to be restrictive. It did not encourage students to take other courses that better fit their career goals. As a result, we have implemented a new elective option. A student, in
consultation with a faculty advisor, may choose an alternate set of EE Technical Electives. The set must be equivalent to a track, and then approved by our Undergraduate Curriculum Committee.

- **Engineering Breadth.** We relaxed our engineering course requirement of either CEE 270 (Applied Mechanics I) or ME 311 (Thermodynamics). The new requirement is any 300-level, 3-credit, non-EE engineering or physical/biological science course. This new requirement is known as “Engineering Breadth”. This change is based on the comments of the 2001 IAB/SAB. They questioned the usefulness of CEE 270 and ME 311 to electrical engineers. However, rather than eliminating the requirement, we broadened it. It is viewed that a non-EE engineering (or related) course requirement enhances a wider view of engineering.

- **MATH 307 replaces MATH 302 as a required advanced math course.** In the 2001 IAB Report it was suggested that Applied Linear Algebra be required. An EE faculty worked with the Department of Mathematics to introduce a new course MATH 307, which combines linear algebra and differential equations. This course had its first offering in Fall 2004. It is required of EE students and replaces MATH 302, which is focused only on differential equations.

- **Were courses changed?**

  - **Matlab for EE 213:** The 2001 IAB suggested that Matlab be required since it is a standard tool. Matlab is now a required topic in EE 213 Basic Circuit Analysis II.

6. **General Education assessment within the Major:**

**How have you met the following requirements in your degree program?**

1) **All students who graduate with the major 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:**

Electrical engineering courses provide the training for student to become proficient in the primary information-accessing and information-processing of the field. In lecture courses, students learn through textbooks and reference books. They are trained to analyze data, and to design systematically. In many courses, especially upper division courses, students do projects which require research in the library and the Internet. All EE students are required to take EE 296, EE 396, and EE 496, which are, respectively, sophomore, junior, and senior level project courses. The projects have design tasks that require accessing design documents, component and system specifications, technology articles, etc. Students use this to analyze and plan their design.
2) **All students who graduate with the major are proficient in the problem-solving and oral communication methods of the field**

All of the EE courses have problem-solving in engineering and mathematical homeworks, exams, laboratory experiments, and projects. As mentioned above, there are three project courses EE 296, EE 396, and EE 496, which have a wealth of problem solving tasks.

For oral communication methods, each project course requires a student to do 30 minutes of presentation of their project work.

Students are required to take SP 251 Principles of Effective Public Speaking, and they have an Oral Communication requirement that is part of the University’s General Education Requirement.

3) **All students who graduate with the major 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.**

EE lecture and laboratory courses provide training and experience in the modes of inquiry analysis through homeworks, experiments, and projects. Homeworks are primarily problems to solve. Laboratory experiments are typically building and testing a circuit or device. Often the experiments have some design task.

As mentioned above, there are three project courses which provide training and experience where the mode of inquiry and analysis is at a high level. In the senior design EE 496, students must do a significant design project, which often requires substantial design, testing, and analysis. These projects are done with a faculty advisor, who provides mentorship.
B. Graduate Assessment by Degree/Certificate Program

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

The Department of Electrical 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.”

Our department does not have additional SLOs at this time.

2. Where are these SLOs published?

The student outcomes can be found by going to the department web site at http://www-ee.eng.hawaii.edu

On the home page, it states “Our Department's Mission Statement and our Program Objectives and Outcomes can be found here.” By clicking “here”, you will find the graduate SLOs.

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 has three graduate degree programs: Master’s Degree Plan A, Master’s Degree Plan B, and PhD Degree.

Master of Science Plan A (Thesis)

A.1. Course Requirements. A minimum of 30-credit hours are required in courses numbered 400-498 and 600-790 with a grade of C, or better.

These minimal 30 credit hours must include:

- A minimum of 9 credits of EE 700
- A minimum of 12 credits in 600-695 credits in the student's Major track (Electrophysics, Systems, or Computers),
- A minimum of 6 credits in 400-695 courses outside the student's Major track
In addition, each student must complete one seminar course in Electrical Engineering and enroll for at least 1 credit in EE 700 in the final semester. The course work should constitute a coherent program in the student's major track; they are to be approved by the graduate advisor for his major area.

The Course Requirements help ensure students achieve SLO 1 by having students take a sufficient number of graduate courses in their specialty.

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 Electrical Engineering Graduate faculty. When the thesis topic has been approved by the committee, the candidate may then register for EE 700. The candidate should look to his committee chairman for primary direction, research methods, and preparation of 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. 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 defense is an oral examination where the student presents his/her thesis work to his/her thesis committee.

The Thesis Requirements help ensure students achieve SLO 1, 3 and 4 by having them apply their knowledge to conduct thesis research with some independence. It helps ensure SLO 2 and 4 because the thesis must be written and orally presented and defended at a professional level.

A.3. Seminar Requirements. Students must attend at least twelve seminars from the department seminar series, thesis defenses, and/or technical conferences. Students entering before Spring 1999 are also encouraged to attend seminars and conferences, and to give presentations of their work. Attendance should be taken by the track coordinator for the departmental seminars and by the student's advisor for thesis defenses. Documentation should be provided by the student's advisor for conference attendance.

The Seminar Requirements help ensure students achieve SLO 2 since they can observe others giving presentations. It helps to ensure SLO 4 because they practice attending technical talks.

Master of Science Plan B (Non-Thesis)

B.1. Course Requirements: The same as the Course Requirements for Master’s Plan A (A.1) except that a grade of B or better (not B-minus) is required. The Course Requirements help ensure students achieve SLO 1 by having students take sufficient number of graduate courses in their specialty.

B.2. Report Requirement: This is the same as a Thesis Requirement of Master’s Plan A (A.2) except that the report can be less pure research and more industry oriented. Note that a student must apply for and get approval prior to admission into the program. This is done through the Intern Plus Program of the department and requires industry sponsorship.
The Thesis Requirements help ensure students achieve SLO 1, 3 and 4 by having them apply their knowledge to conduct report research with some independence. It helps ensure SLO 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 Requirement of Master’s Plan A (A.3). The Seminar Requirements help ensure students achieve SLO 2 since they can observe others giving presentations, and they also have the option of presenting a seminar. It helps to ensure SLO 4 because they practice attending technical talks.

**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 comprehensive and final examinations and a dissertation. The dissertation must be a significant original contribution to knowledge in electrical engineering. There are six requirements: C.1 - C.6.

**C.1. Course Requirements.** A minimum of 9 credit hours in 600 level courses in the student's major track and a minimum of 3 credit hours in 600 level courses outside the student's major track are required. These courses must be approved by the graduate advisor for the student's major track. The Department also requires that all candidates participate in a teaching project; they must demonstrate this proficiency in the communication of ideas and concepts by successfully completing 3 credits in EE 790, Directed Instruction.

The Course Requirements help ensure students achieve SLO 1 by having students take sufficient number of graduate courses in their specialty.

**C.2. Qualifying Examination.** The purpose of this examination is to determine whether or not a student should be encouraged to proceed in a doctoral program, and if encouraged, to enable his advisers to assist him in planning a program that will familiarize him with the requisite knowledge and techniques.

The Ph.D. Qualifying Examination in EE consists of a test of the graduate background at the M.S. level and must be passed during the student's first three semesters in the Ph.D. program.

This test consists of 1 oral exam plus final exams in three 600 level courses in the student's Major track; the average of these 3 final exam scores must be greater than 3.66. Each major track of EE has designated courses acceptable for the background test. An oral exam in the major track tests broad background and understanding.

The Qualifying Examination help ensure students achieve SLO 1 by verifying that students have sufficient background knowledge and skills before continuing to pursue the PhD degree. Part of the examination is oral, so it also helps ensure SLO 2.
C.3. **Comprehensive Examination.** This examination covers the major field of study and work fundamental thereto and minor fields as may be required. Its purpose is to ascertain the student's comprehension of his field of study. The examination is given only after the student has had sufficient preparation in his field of study. The examination, which is oral, is conducted by the student's doctoral committee. The doctoral committee consists of at least five members: at least three members and the chairman must be on the graduate faculty of the Department of Electrical Engineering; at least one member must be from the graduate faculty outside of Electrical Engineering.

Similar to the Qualifying Examination, the Comprehensive Examination helps ensure SLOs 1, 2, as well as 3 since the students must also demonstrate the ability to perform research

C.4. **Final Examination.** 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. When the dissertation topic has been approved by the doctoral committee, the Graduate Division will be notified. A graduate student may undertake a research problem when the subject is primarily in one field but has a close relationship to other fields; in such an event, at the time the student submits his dissertation proposal, it must be ensured that: a) the student possesses sufficient knowledge of the related field of study to be able to deal competently with the research and dissertation, and b) a representative of the related field is placed on the student's doctoral committee. The candidate should look to the chairman of his doctoral committee for primary direction regarding research methods and the preparation of 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 both the research and dissertation. A majority of the members of the doctoral committee must approve both the dissertation and examination on the dissertation.

The dissertation helps ensure SLO 1 because it is the research project where the student applies his knowledge. It helps ensure SLO 2 because it is a major and often lengthy document to write, and so it must be organized and very well written. It must also be presented orally.

It helps to ensure SLO 3 because the work must be scholarly, original and suitable for publication. Finally, it helps to ensure SLO 4 because the work demands that the student applies his professional skills at the highest level.

C.5. **Teaching Project.** All candidates must participate in a teaching project; they must demonstrate this proficiency in the communication of ideas and concepts by successfully completing 3 credits in EE 790, Directed Instruction. This helps ensure SLO 2. It also helps ensure SLO 4 because many PhDs will have careers as instructors.

C.6. **Seminar Requirements:** This is the same Seminar Requirement of Master’s Plan A (A.3). The Seminar Requirements help ensure students achieve SLO 2 since they can observe others giving presentations. It helps to ensure SLO 4 because they practice attending technical talks.
4. **What population(s) is covered in your assessment(s)?**

Graduate students in the EE MS and PhD program.

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

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

**Master’s Degree**

*Entry Requirements:* If during the initial advising period, the Graduate Chairman determines that the student does not have the equivalent of the present B.S. degree in Electrical Engineering at the University of Hawaii, then the student will be required to take designated courses to fulfill these deficiencies; such courses are not applicable toward the 30 credits required for the M.S. degree.

In addition, an applying student often submits scores from the TOEFL and GRE examinations. They are used by the department to help evaluating whether the student has sufficient skills.

*Course Requirements:* There is a minimum GPA to maintain in course work via grades based on written exams.

**PhD Degree**

*Entry Requirements:* If the Advisor determines that the student does not have the equivalent of the present course work for the M.S. degree in Electrical Engineering at the University of Hawaii, the student will be required to take designated courses to fulfill these deficiencies; such courses are not applicable toward the Ph.D. course credit requirements.

In addition, an applying student often submits scores from the TOEFL and GRE examinations. They are used by the department to help evaluating whether the student has sufficient skills.

*Course Requirements:* There is a minimum GPA of 3.0 to maintain in course work via grades based on written exams.

*Qualifying Examination:* Part of the Qualifying Exam consists of final exams in three 600 level courses in the student’s Major track. The average of these 3 final exam scores must be greater than 3.66. Each major track of EE has designated courses acceptable for the background test.

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

For a Master’s degree, a thesis or report is required, depending on whether it is Plan A or B. The thesis or report work is judged and must be approved by a thesis or report committee, comprised of three faculty members.
For a PhD degree, there is a Qualifying Examination to evaluate whether the student should be encouraged to continue. It is administered by a committee of at least three graduate faculty members, chosen by the track coordinator and the student. The Comprehensive Exam consists of an oral defense of a research problem posed by the committee chairman. It shall be three credits of directed reading, or the equivalent. To pass, the student must clearly indicate the ability to perform research to the committee.

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, the thesis must be presented and defended during an oral presentation.

For the PhD degree, the Qualifying and Comprehensive Examinations are oral examinations. To assess the dissertation, the Final Examination is an oral presentation. There is also the Teaching Project EE 790 to assess the student’s teaching abilities.

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?

Case by case basis decided by the student’s advisor.

We surveyed our faculty to estimate the fraction of graduate students who present their work at professional conferences. We asked they consider their advisees who were graduate students at some time from Fall 2003 until Spring 2005. Of 19 faculty, 8 responded. Their advisees were 21 MS and 11 PhD students which includes students who recently entered our program. 5 MS and 9 PhD students presented their work at conferences.

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

Case by case basis decided by the student’s advisor. However, a PhD student should eventually publish work in his/her dissertation.

We surveyed our faculty to estimate the fraction of graduate students who published their research work. We asked they consider their advisees who were graduate students at some time from Fall 2003 until Spring 2005. Of 19 faculty, 8 responded. Their advisees were 21 MS and 11 PhD students which includes students who recently entered our program. 8 MS and 10 PhD students were either an author or co-author of conference papers. 1 MS and 8 PhD students were either an author or co-author of journal papers.
7. What attempts are made to monitor student post-graduate professional activities?

Case by case basis conducted by the student’s advisor or instructors. There is monitoring of alumni at the College level.