Learning Outcomes Data
for the
Senate Committee on
Instructional Program Priorities

Program: Graduate Program (M.S. in CPE)
Department: Electrical & Electronic Engineering (EEE)
Faculty member completing template: Preetham B. Kumar
Date: 02/01/2012
1. Please describe your program’s learning-outcomes trajectory since 2006-07: Has there been a transformation of organizational culture regarding the establishment of learning outcomes and the capacity to assess progress toward their achievement? If so, during which academic year would you say the transformation became noticeable? What lies ahead; what is the next likely step in developing a learning-outcomes organizational culture within the program?

The first assessment cycle was completed in January 2011, and the EEE graduate program was fully approved until the next review cycle. We are working on the suggestions of the reviewer in an effort to improve the assessment and review process.

2. Please list in prioritized order (or indicate no prioritization regarding) up to four desired learning outcomes (“takeaways” concerning such elements of curriculum as perspectives, specific content knowledge, skill sets, confidence levels) for students completing the program. For each stated outcome, please provide the reason that it was designated as desired by the faculty associated with the program.

**Desired Learning Outcomes**

The following four learning outcomes have been prioritized from our original ten outcomes

a) The ability to apply knowledge of mathematics, science and engineering to solve problems in CpE
b) A knowledge of core and advanced CpE topics

c) The ability to work with modern instrumentation, software and hardware, design and perform experiments, and analyze and interpret the results.

d) Recognition of the need for and an ability to engage in “life-long” learning.

3. *For undergraduate programs only*, in what ways are the set of desired learning outcomes described above aligned with the University’s Baccalaureate Learning Goals? Please be as specific as possible.

This is not applicable for the EEE graduate program.

4. For each desired outcome indicated in item 2 above, please:

   a) Describe the method(s) by which its ongoing pursuit is monitored and measured.

**Course based assessment**

Outcomes (a), (b) (c) and (d) were monitored and measured through assessment of some key core courses in the EEE curriculum. The following courses and course outcomes were monitored:

CPE 201 – Research Methodology (Required core class for all graduate students)
Course outcomes

- **CO-1**: Able to select a contemporary project topic in Electrical/Computer Engineering, and complete a clearly written Topic Form
- **CO-2**: Able to write a concise introduction and related bibliography for the selected project topic

EEE 285 Micro-Computer System Design I. (Required core class for Digital area)

Course outcomes

- **CO-1**: Students will design systems based on logic that includes PC system bus, architecture components.
- **CO-2**: Students will understand PC architecture/components technologies when using schematic design tool.
- **CO-3**: Students will acquire extensive hands-on laboratory skills (understanding technical specifications, design to industry specifications/protocols, generating schematic diagrams).
- **CO-4**: Students will design implementations of PCI based bus protocols, arbitration policies, CPU out of order execution contemporary cache and virtual memory architectures.
- **CO-5**: Students will practice writing a technical, grammatically correct report and technical papers. Students will also learn professional presentation skills.

Assessment of culminating experience (Thesis/project/comprehensive exam)

We assessed the course level assessment through the Culminating experience for graduating M.S. students. Students have the following options for their culminating experience:

Plan A : Thesis (5 units)
Plan B : Project (2 units)
Plan C : Comprehensive exam

The following Table 1 lists the statistics of the projects/thesis completed by M.S. students in the last 6 years, giving the total number of reports. Figure 2 illustrates the breakup of reports according to the three core areas in the CpE graduate programs.

Table 1. CPE M.S. Project/Thesis Statistics

<table>
<thead>
<tr>
<th>Year</th>
<th>Total reports(CpE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>2</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
</tr>
<tr>
<td>2007</td>
<td>2</td>
</tr>
</tbody>
</table>
The CPE comprehensive exam was introduced only in the Fall 2010 semester, and sufficient data is not available for assessment. However, future assessment reports will have a sufficient number to get significant data.

b) Include a description of the sample of students (e.g., random sample of transfer students declaring the major; graduating seniors) from whom data were/will be collected and the frequency and schedule with which the data in question were/will be collected.

**Student sample**

The data was collected from EEE graduate students, with equal distribution over the five areas of specialization: Power Systems, Communication systems, Control Systems, Microelectronic Design, and Computer Architecture & Digital Design.

c) Describe and append a sample (or samples) of the “instrument” (e.g., survey or test), “artifact” (e.g., writing sample and evaluative protocol, performance review sheet), or other device used to assess the status of the learning outcomes desired by the program.

d) Explain how the program faculty analyzed and evaluated (will analyze and evaluate) the data to reach conclusions about each desired student learning outcome.
Course based assessment

The course outcomes for the four key courses, EEE 201, EEE 244, EEE 285, EEE 230 and EEE 211 have been described in the previous section. These course outcomes are directly related to the SLOs, and are tested in proposed assessment tests in each of these courses.

Assessment of culminating experience (Thesis/project/comprehensive exam)

The assessment committee met in December 2010 and reviewed 15 EEE project reports that were completed in the years 2008-2009, 3 each from the five different areas of specialization. Reports were classified into 3 categories: Excellent, Good and Fair, based on extent of work done by the student, and also presentation of the report. The 15 reports, after review by the assessment committee were listed as follows:

Excellent: 3
Good: 10
Fair: 2

d) Explain how the program faculty analyzed and evaluated (will analyze and evaluate) the data to reach conclusions about each desired student learning outcome.

Course based assessment

The following reviews were obtained from the course based assessment:

EEE 201 Review: The assessment committee met in December 2010 and reviewed the effects of recommendations made in the earlier assessment. It was noticed that writing skills, as evinced from the projects, show improvement in quality, in both outcomes CO-1 and CO-2. Student awareness to proper acknowledgement of references and citations has also improved; however, this is one area, where we need to keep working on. Newer approaches planned include inviting speakers from industry and other departments, like the English department, to give students a more detailed view of plagiarism and work ethics.

EEE 285 Review: The assessment committee met to discuss the course in December 2010 and determined that the addition of new projects did improve student expertise in the area. Future steps are to increase student performance in projects through some additional in-class project reviews.

Assessment of culminating experience (Thesis/project/comprehensive exam)

Overall Review for projects/thesis and comprehensive exam

In the CpE graduate program, over the past 5 years, the number of students choosing the comprehensive exam option has increased and is comparable to the number of students
choosing the project or thesis as their culminating experience. This trend can be partially attributed to the fact that the number of students in the CpE M.S program has steadily increased over the years, and it is not possible for a limited number of faculty to provide M.S. project/thesis topics to more than a limited number of students. This results in students increasingly opting for the comprehensive exam option for their culminating experience.

5. Regarding each outcome and method discussed in items 2 and 4 above, please provide examples of how findings from the learning outcomes process have been utilized to address decisions to revise or maintain elements of the curriculum (including decisions to alter the program’s desired outcomes). If such decision-making has not yet occurred, please describe the plan by which it will occur.

**Examples of faculty actions to address assessment findings**

One such action was for the core class **EEE 285**, which is the key class in the CpE program

**EEE 285 Review & decisions:** The assessment committee met to discuss the course in May 2010 and introduced more complex design projects to challenge the students, keeping in tune with advancements in the Digital design industry.

**EEE 285 Review & decisions:** The assessment committee met to discuss the course in December 2010 and determined that the addition of new projects did improve student expertise in the area. Future steps are to increase student performance in projects through some additional in-class project reviews.

Another action was for the core class **CPE 201**, which is the key introductory class in the CpE program

**CPE 201 Review & decisions:** The assessment committee met in **December 2010** and reviewed the effects of recommendations made in the earlier assessment. It was noticed that writing skills, as evinced from the projects, show improvement in quality, in both outcomes CO-1 and CO-2. Student awareness to proper acknowledgement of references and citations has also improved; however, this is one area, where we need to keep working on. Newer approaches planned include inviting speakers from industry and other departments, like the English department, to give students a more detailed view of plagiarism and work ethics.

6. Has the program systematically sought data from alumni to measure the longer-term effects of accomplishment of the program’s learning outcomes? If so, please describe the approach to this information-gathering and the ways in which the information will be applied to the program’s curriculum. If such activity has not yet occurred, please describe the plan by which it will occur.

[Please limit your response to 300 words or less]

**Surveys from industry**
An EEE/CpE faculty team visited Intel Corporation, Folsom in May 2007, and talked informally with 7 former graduate students, who were also informed of the meeting earlier through e-mail. Topics discussed were based around the following questionnaire:

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

**Review**

The feedback we obtained from Intel engineers included suggestions for the following topics to be covered in our courses: Object oriented programming, databases, C, Perl, multiprocessor programming, GUI, wiMax, technology for mistake prevention, data management, communication skills, and globalization. In addition, tools like the Plan C exam, and a possible combined B.S. /M.S program were also welcomed.

Our faculty reviewed all the feedback carefully, and is steadily including some suggested topics in their courses. As an example, WiMax technology and some of the suggested digital topics are now included in elective classes. The Plan C exam is now very popular among graduate students, and serves as a convenient culminating experience to graduate students, who would like to enter industry quickly after graduation. The department will continue to incorporate such kind of industry feedback into our courses.

7. Does the program pursue learning outcomes identified by an accrediting or other professional discipline-related organization as important? Does the set of outcomes pursued by your program exceed those identified as important by your accrediting or other professional discipline-related organization?

This is not applicable for the graduate program, since the professional ABET accreditation is applicable for the undergraduate program only.

8. Finally, what additional information would you like to share with the Senate Committee on Instructional Program Priorities regarding the program’s desired learning outcomes and assessment of their accomplishment?

The first assessment cycle was completed in January 2011, and the EEE graduate program was fully approved until the next review cycle. We are working on the suggestions of the reviewer, in an effort to improve the assessment and review process.