**Electrical and Computer Engineering Department**

**Annual Report on Assessment**

**B.S. in Electrical Engineering (EE) Program**

**B.S. in Computer Engineering (CompE) Program**

**2015-2016 Academic Year**

The academic year 2015-2016 is the 4th year of the six-year full assessment cycle for the EE and CompE programs. The 2012 Accreditation Board of Engineering and Technology (ABET) visit resulted in a commendation to the Electrical and Computer Engineering (ECE) department. The accreditation criterion changes effective 2013-2014 resulted in changes to the Student Outcomes Assessment Plans (SOAP) for each program. This process started in spring ’13 and continued to fall ’13. Rubrics were altered and will continue to be refined throughout the accreditation cycle.

The following is a summary of the most recent assessment activities for both programs.

**Student Learning Outcome (SLO) Binders**

Binders reflecting the ABET a-k SLOs have been created and are in the common ECE faculty workroom ready for population since 2013. The assessment coordinator has populated the binders with embedded question rubrics of all SLOs evaluated since then, including AY2015-16.

These binders are available for instructor review as they continue to be living receptacles of SLO information throughout the six-year assessment cycle.

**Embedded Question Assessment Plan**

All student learning outcomes have been evaluated multiple times during each assessment period. The ECE faculty developed a structured plan during the 2015-2016 academic year with regards to embedded question. The plan ensures that all SLOs are evaluated at the same frequency during the six year assessment period. Additionally, the plan specifies the semesters in which instructors will be responsible for evaluating their course SLOs. It is the intention that by spreading out the assessment of SLOs in a pre-planned manner, one instructor will not be overwhelmed by SLO evaluation during one semester.

The characteristics of the plan are that every SLO is evaluated by embedded questions on a repeating four semester cycle. Approximately five courses are assessed for their SLOs using embedded questions per semester. This schedule ensures that all SLOs will be assessed minimum two times in a six year assessment period. A table including all courses in the ECE roadmap outlines the semesters in which they will be utilizing embedded questions as an SLO assessment tool. The table is in the SOAP.

1. **What learning outcomes did you assess?**

All ECE SLO’s were evaluated in AY2015-2016. A variety of assessment techniques were utilized. The SLOs for the Electrical and Computer Engineering Programs are the same as the ABET Student Learning Outcomes and are as follows.

Graduates of the Electrical/Computer Engineering program are expected to achieve the following student learning 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 economic, 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. **Instruments used and data received? (\* is to signify direct assessment)**

It must be noted that the published SOAPs for the EE and CompE programs include conducting an Employer Survey every third year. The department has decided not to attempt this survey any more due to the difficulty of collecting industry input about employees. Liability issues and confidentiality constraints have always made this survey hard to complete. This fact has been recognized by the ABET such that this particular assessment tool is not required any more. An informal way is now followed through the Industry Advisory Board Meeting where verbal input is given rather than completing a survey form. However, we could not have the Industry Advisory Board Meeting due to the unavailability of the board members in this academic year.

1. **Exit Surveys**

Exit surveys captured information from all SLOs. Surveys were conducted in December 2015 and in May 2016; 17 EE graduating seniors and 7 ComP graduating seniors completed the survey. A compilation of the data is included in the following bar charts.



Exit Survey – F’15-S’16 EE Program

*a b c d e f g h i j k*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SLO | *a* | *b* | *c* | *D* | *e* | *f* | *g* | *h* | *i* | *j* | *k* |
| Average | 4.58 | 4.47 | 4.29 | 4.70 | 4.47 | 4.47 | 4.47 | 3.94 | 4.52 | 3.94 | 4.35 |
| Std | 0.50 | 0.62 | 0.84 | 0.46 | 0.62 | 0.62 | 0.79 | 0.96 | 0.71 | 1.08 | 0.70 |

Exit Survey – F’15-S’16 ComP Program



*a b c d e f g h i j k*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SLO | *a* | *b* | *c* | *D* | *e* | *f* | *g* | *h* | *i* | *j* | *k* |
| Average | 3.71 | 4.28 | 3.85 | 4.33 | 4.00 | 4.28 | 4.33 | 3.85 | 4.28 | 3.42 | 3.85 |
| Std | 0.95 | 0.75 | 0.89 | 1.70 | 1.61 | 0.75 | 1.70 | 0.89 | 0.95 | 0.53 | 0.69 |

For EE, the average rating for all EE SLOs met the department’s standard of 3.75. On the other hand, for CompE, SLOs *a* and *j* could not satisfy the department standard. The SLO-*a* was 3.71, that is slightly below the standard, and SLO-*j* was 3.42, which is rated below the 3.75 standard. Faculty may need to pay attention to the two SLOs for ComP.

1. **Student-Faculty Forum**

In the annual student-faculty forum, a SLO survey was conducted as a follow-up of the discussions and identified issues; 30 EE students completed the survey. Unfortunately, we could not obtain data from CompE students. The following tables provide a data summary.

Student Faculty Forum – F’15-S’16 EE Program



*a b c d e f g h i j k*

The data shows that all SLOs meet the department’s standard of 3.75. However, SLO-*b,d,e* and *k* are very close to the standard so that the department should pay attention to monitor those SLOs not to go below the department’s standard and how to improve those outcomes.

1. **Embedded Questions\***

Embedded questions were used in multiple courses to assess relevant SLOs; according to the adopted SOAP for each program. All students in each course answered the questions in an exam or homework setting. Even though the SOAPs were revised to streamline this part of the assessment process covering the targeted SLOs on a two-year cycle, the department tries to obtain more data from each course. The assessment plan developed by the ECE faculty was followed for F’15 and S ’16. Based on SOAP, SLOs *a, c, d, e, g, k* for EE and CompE were assessed. The following table shows the AY15-16’s data as well as those of the past years for comparison purposes.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| EE | a | c | d | e | g | k |
| AY13-15 | 3.86 | 4.78 | 3.00 | 2.68 | 3.77 | 4.95 |
| AY15-16 | 3.60 | 4.19 | 4.45 | 4.04 | 4.37 | 4.57 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CompE | a | c | d | e | g | k |
| AY13-15 | 2.9 | 2.67 | 3.43 | N/A | 3.88 | 4.92 |
| AY15-16 | 2.81 | 4.38 | 4.49 | 3.90 | 4.49 | 4.42 |

For both EE and CompE, the data shows that all SLOs except SLO-*a* met the 3.75 standard for the department. The rating of SLO-*a* shows a need for improvement in applying knowledge in math, science and engineering skills.

Compared to the previous year, there is a significant improvement in SLOs-*d* and *e* for EE and in SLOs-*c* and *d* for CompE.

1. **Industry Advisory Council**

The ECE Industry Advisory Council meeting could not be held due to the unavailability of the members.

1. **Faculty Focus Group**

A weekly faculty meeting is held in the ECE department and assessment is a recurring agenda item. In AY2015-2016 the embedded question assessment plan has been a topic of multiple faculty meetings. Additionally, compiled assessment data is presented to faculty during the weekly faculty meetings and discussed how the SLOs that are under the department’s standard can be improved. In addition, minor errors and typos have been corrected in current SOAPs.

1. **Culminating Experience (Poster Session and Oral Presentations)\***

On 5/11/16, the electrical and computer engineering students presented their culminating experience projects at a technical poster session (LCOE Projects Day). Senior EE and CompE students form interdisciplinary teams to work on year-long design projects and they present their works together. Five faculty members performed 28 evaluations of projects. The summary of the data collected is as follows.

|  |  |  |
| --- | --- | --- |
| Oral and Written Communication  SLO g | Clarity | 4.74 |
| Eye Contact | 4.84 |
| Express Ideas | 4.62 |
| Answer Questions | 4.66 |
| Poster Quality | 4.18 |
|  |  |  |
| Technical Content  SLO e & k | Methodology | 4.14 |
| Engineering Tools | 4.39 |
| Creativity | 3.92 |
| Argument | 3.82 |
| Conclusions | 3.85 |
| Accomplishments | 4.05 |
| Engineering Skills | 4.21 |
|  |  |  |
| Overall | Excellent | 39.3% |
| Very Good | 32.2% |
| Good | 25% |
| Acceptable | 3.5% |
| Poor | 0% |

Communication skills (SLO g), were fulfilled at the benchmark rating of 3.75. Most of subcategories of SLOs e, k also showed that they satisfied the department standard of 3.75. The overall scores are acceptable and improved compared to last year’s scores. However, there should be efforts to enhance ability of argument in their design and to induce creativity of the project topic.

Overall quality of the culminating experience project rendered 96.5% of the projects to be good or above. None of the projects was considered poor.

1. **Alumni Survey**

Although the alumni survey was sent to more than 120 EE and CompE engineers graduates at Fresno State over the past five years, only 8 EE engineers have completed the survey. Unfortunately, none of the CompE graduates completed the survey. Based on this fact, we could not perform the alumni survey in this academic year. We plan to try the alumni survey every year from AY2016-2017.

1. **What did you discover from the findings?**

**EE Program:** Direct Assessment (Embedded Questions and Culminating Experience) indicated that most SLOs are met according to the department’s set standard, except for SLO-*a* (applying knowledge in math/science/engineering). Although, SLOs-*a* showed the need to enhance skills in applying knowledge in math/science/engineering in problem solving, the embedded questions assessment tool showed strength in most of SLOs. Also, compared to the previous year, there is a significant improvement in SLOs-*d* and *e* for EE.

Soft Assessment tools (Exit Survey, Student-Faculty Forum, Alumni Survey) show that all SLOs average ratings that meet the department’s standard of 3.75 for EE.

Based on the direct and soft assessments, there is sufficient evidence that the SLOs of the EE program are met in the most part, but SLO-*a* needs attention.

**CompE Program:** Direct Assessment (Embedded Questions and Culminating Experience) indicated that most SLOs are met according to the department’s set standard, except for SLO-a (applying knowledge in math/science/engineering). Also, compared to the previous year, there is a significant improvement in SLOs-*c* and *d* for CompE.

As for soft assessment, the soft assessment tools show that the ratings of SLOs-*a* and *j* (knowledge of contemporary issues) are below the department’s standard.

There is sufficient evidence that the SLOs of the CompE program are met for the most part, but SLO-*a* and *j* needs attention.

It should be noted that the CompE program has undergone a comprehensive review for several years and major changes were made to further strengthen the program and to keep it current with changes in technology.

1. **What changes did you make as a result of these findings?**

**EE Program:**

The faculty took a note of the need to emphasize how to apply knowledge in mathematics, science and engineering throughout the curriculum. In weekly faculty meetings, faculty members discussed how to improve skills of applying mathematics, science and engineering to problem solving. It was suggested that faculty members provide more examples of applying theory to real-world problems rather than focusing theory only in lectures. In addition, providing supplementary materials through blackboard and open sessions for extra problem solving has been proposed.

**CompE Program:**

Similar to EE program, assessment result showed that SLO-*a* should be improved for CompE students. The changes suggested are same as those of EE as mentioned above. Especially, CompE faculty would take attention on providing more examples of real world problems to apply theory in courses such as microcontroller, embedded system and data structure. Also, to address contemporary issue, the microcontroller platform has been upgraded. In ECE103, ECE174 and ECE178, more current trends in computer engineering will be address such as parallel processing, cloud computing, mobile platform and cyber securities.

The CompE program underwent a comprehensive program review by the faculty from two years ago. Courses were restructured and new topics were introduced. The main focus of the revisions was to further strengthen the curriculum and stay current with the advanced in the computer engineering technology.

In addition, we plan to evaluate ECE72 (Introduction to Engineering Tools) for the General Education (GE) –area C. We have included art and creativity components such as image and music processing in the course to satisfy the GE requirements.

1. **What assessment activities will you be conducting in the 2016-17 academic year?**

1. Exit Surveys
2. Embedded questions
3. Industry Advisory Council Meeting
4. Culminating Experience including Poster Sessions/Oral Presentations
5. Student-Faculty Forums
6. Faculty focus group
7. Alumni survey
8. **What progress have you made on items from your program review action plan?**

ECE action plans were drafted on 2/26/2010. Since then, every year the department made good progress towards each of the action items.

**Action 1**: hands-on experiences have been intensified and numerous equipment upgrades took place.

**Action 2**: To have a proper mix of faculty expertise, the department hired six new ECE faculty members since 2013 with expertise in areas that expand and complement the existing expertise. One more new hire is undergoing in AY2016-2017, which will further help the department achieve its goal in this area.

**Action 3**: Lab development is continuing to take place every year according to the adopted strategic plan and more faculty development activities are being supported. Control lab and embedded system lab have been improved significantly through funding from the college.

**Action 4**: The learning outcomes assessment plan is under continued review to stay in alignment with changes in the national accrediting agency. The department is following the SOAP as closely as possible.

**Action 5**: Collaboration with ME is always desirable. ECE and ME faculty are finding more opportunities for collaboration.

**Action 6**: A graduate program computer engineering option has already been established and started formally.