2016-2017
Annual Assessment Report Template

For instructions and guidelines visit our **website**
or **contact us** for more help.

Please begin by selecting your program name in the drop down. If the program name is not listed, please enter it below:

BS Computer Engineering

OR

Question 1: Program Learning Outcomes

Q1.1.
Which of the following Program Learning Outcomes (PLOs), Sac State Baccalaureate Learning Goals (BLGs), and emboldened Graduate Learning Goals (GLGs) **did you assess?** [**Check all that apply**]

- [ ] 1. **Critical Thinking**
- [ ] 2. **Information Literacy**
- [x] 3. **Written Communication**
- [x] 4. **Oral Communication**
- [ ] 5. Quantitative Literacy
- [ ] 6. **Inquiry and Analysis**
- [ ] 7. Creative Thinking
- [ ] 8. Reading
- [x] 9. Team Work
- [ ] 10. Problem Solving
- [ ] 11. Civic Knowledge and Engagement
- [ ] 12. **Intercultural Knowledge, Competency, and Perspectives**
- [ ] 13. Ethical Reasoning
- [ ] 14. Foundations and Skills for Lifelong Learning
- [ ] 15. **Global Learning and Perspectives**
- [ ] 16. Integrative and Applied Learning
- [ ] 17. Overall Competencies for GE Knowledge
- [ ] 18. **Overall Disciplinary Knowledge**
- [ ] 19. **Professionalism**
- [ ] 20. Other, specify any assessed PLOs not included above:

a.
b.
c.

Q1.2.
Please provide more detailed background information about **EACH PLO** you checked above and other information including how your specific PLOs are **explicitly** linked to the Sac State **BLGs**/**GLGs**:

The PLOs are a through k ABET specified PLOs for engineering. These are mapped to the university BLGs as shown in the attached document Table 4. Because CpE students also take Computer science (CSc) course and CSc uses a different set of PLOs, the CSC PLOs are also mapped to the CpE PLOs as shown in the attached document Table 5.

Teamwork and effective communication (oral and written) are assessed in introductory courses such as ENGR 1 but primarily in the senior project courses CpE 190 and 191. Please also refer to "Section III: Assessment: Teamwork and Effective Communication" in the attached document for more information.

Q1.2.1.
Do you have rubrics for your PLOs?

- ○ 1. Yes, for all PLOs
- ○ 2. Yes, but for some PLOs
- ○ 3. No rubrics for PLOs
- ○ 4. N/A
- ◉ 5. Other, specify: the program uses the exact list of PLOs provided by ABET, the accreditation body.

Q1.3.
Are your PLOs closely aligned with the mission of the university?

- ◉ 1. Yes
- ○ 2. No
- ○ 3. Don't know

Q1.4.
Is your program externally accredited (other than through WASC Senior College and University Commission (WSCUC))?

- ◉ 1. Yes
- ○ 2. No (skip to **Q1.5**)
- ○ 3. Don't know (skip to **Q1.5**)

Q1.4.1.
If the answer to Q1.4 is **yes**, are your PLOs closely aligned with the mission/goals/outcomes of the accreditation agency?

- ◉ 1. Yes
- ○ 2. No
- ○ 3. Don't know

Q1.5.
Did your program use the *Degree Qualification Profile* ("DQP", see http://degreeprofile.org) to develop your PLO(s)?

- ○ 1. Yes
- ◉ 2. No, but I know what the DQP is
- ○ 3. No, I don't know what the DQP is
- ○ 4. Don't know

Q1.6.
Did you use action verbs to make each PLO measurable?

- ◉ 1. Yes
- ○ 2. No
- ○ 3. Don't know

(Remember: Save your progress)

Question 2: Standard of Performance for the Selected PLO

Q2.1.
Select **OR** type in **ONE(1)** PLO here as an example to illustrate how you conducted assessment (be sure you *checked the correct box* for this PLO in Q1.1):

Team Work

If your PLO is **not listed, please enter it here**:

Q2.1.1.
Please provide more background information about the **specific PLO** you've chosen in Q2.1.

The senior design courses CpE 190 and CpE 191 and co-scheduled with the EEE senior design courses EEE 193A and EEE 193B, respectively and encouraged students to make up interdisciplinary teams comprised of both CpE and EEE students. Students in each team apply the knowledge acquired in earlier course work to address a societal problem to satisfy also PLO c (an ability to design a system ...with realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability." Also, refer to "Section III: Assessment: Teamwork and Effective Communication" in the attached document for additional information.

Q2.2.
Has the program developed or adopted **explicit** standards of performance for this PLO?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know
- ( ) 4. N/A

Q2.3.
Please **provide the rubric(s)** and **standards of performance** that you have developed for this PLO here or in the appendix.

Please refer to the attached Rubrics:

1. Senior Design I (CpE 190) Rubric
2. Senior Design II (CpE 191) Rubric
3. Written/Oral Communication Rubric
4. Team member evaluation Rubric

No file attached No file attached

Q2.4. PLO	Q2.5. Stdrd	Q2.6. Rubric	Please indicate where you have published the **PLO**, the **standard** of performance, and the **rubric** that was used to measure the PLO:
☐	☐	☐	1. In **SOME** course syllabi/assignments in the program that address the PLO
☑	☐	☐	2. In **ALL** course syllabi/assignments in the program that address the PLO
☐	☐	☐	3. In the student handbook/advising handbook
☐	☐	☐	4. In the university catalogue
☐	☐	☐	5. On the academic unit website or in newsletters

☑	☐	☐	6. In the assessment or program review reports, plans, resources, or activities
☐	☐	☐	7. In new course proposal forms in the department/college/university
☐	☐	☐	8. In the department/college/university's strategic plans and other planning documents
☐	☐	☐	9. In the department/college/university's budget plans and other resource allocation documents
☐	☑	☑	10. Other, specify: Classroom Handouts

Question 3: Data Collection Methods and Evaluation of Data Quality for the Selected PLO

Q3.1.
Was assessment data/evidence **collected** for the selected PLO?

- (●) 1. Yes
- ( ) 2. No (skip to **Q6**)
- ( ) 3. Don't know (skip to **Q6**)
- ( ) 4. N/A (skip to **Q6**)

Q3.1.1.
How many assessment tools/methods/measures **in total** did you use to assess this PLO?

2

Q3.2.
Was the data **scored/evaluated** for this PLO?

- (●) 1. Yes
- ( ) 2. No (skip to **Q6**)
- ( ) 3. Don't know (skip to **Q6**)
- ( ) 4. N/A (skip to **Q6**)

Q3.2.1.
Please describe how you collected the assessment data for the selected PLO. For example, in what course(s) or by what means were data collected:

In Both CpE 190 and 191.

1. **Teamwork evaluation rubric completed by students**
2. **Instructor's teamwork observations**

Others not used for the teamwork PLO are:

1. **Work Breakdown Structure (WBS) report approved by instructor. The report defines the scope and deliverables of each project.**
2. **Gantt Chart**
3. **Weekly progress meetings**
4. **Students provide several reports and present their work on various occasions during each semester**
5. **A formal presentation and report at the end of each semester.**

(Remember: Save your progress)

Question 3A: Direct Measures (key assignments, projects, portfolios, etc.)

Q3.3.
Were direct measures (key assignments, projects, portfolios, course work, student tests, etc.) used to assess this PLO?

(●) 1. Yes
( ) 2. No (skip to **Q3.7**)
( ) 3. Don't know (skip to **Q3.7**)

Q3.3.1.
Which of the following direct measures (key assignments, projects, portfolios, course work, student tests, etc.) were used? [**Check all that apply**]

☑ 1. Capstone project (e.g. theses, senior theses), courses, or experiences
☐ 2. Key assignments from required classes in the program
☐ 3. Key assignments from elective classes
☐ 4. Classroom based performance assessment such as simulations, comprehensive exams, or critiques
☐ 5. External performance assessments such as internships or other community-based projects
☐ 6. E-Portfolios
☐ 7. Other Portfolios
☐ 8. Other, specify:

Q3.3.2.
Please **provide** the direct measure (key assignments, projects, portfolios, course work, student tests, etc.) you used to collect data, THEN **explain** how it assesses the PLO:

The level of synergy among each team members was assessed based on the Teamwork Evaluation Rubric attcahed) completed by all the students in each team.

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Q3.4.
What tool was used to evaluate the data?

( ) 1. **No** rubric is used to interpret the evidence (skip to **Q3.4.4.**)
( ) 2. Used rubric developed/modified by the faculty who teaches the class (skip to **Q3.4.2.**)
(●) 3. Used rubric developed/modified by a group of faculty (skip to **Q3.4.2.**)
( ) 4. Used rubric pilot-tested and refined by a group of faculty (skip to **Q3.4.2.**)
( ) 5. The VALUE rubric(s) (skip to **Q3.4.2.**)
( ) 6. Modified VALUE rubric(s) (skip to **Q3.4.2.**)
( ) 7. Used other means (Answer **Q3.4.1.**)

Q3.4.1.
If you used other means, which of the following measures was used? [**Check all that apply**]

☐ 1. National disciplinary exams or state/professional licensure exams (skip to **Q3.4.4.**)
☐ 2. General knowledge and skills measures (e.g. CLA, ETS PP, etc.) (skip to **Q3.4.4.**)
☐ 3. Other standardized knowledge and skill exams (e.g. ETC, GRE, etc.) (skip to **Q3.4.4.**)
☐ 4. Other, specify: (skip to **Q3.4.4.**)

Q3.4.2.
Was the **rubric** aligned directly and explicitly **with the PLO**?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know
- ( ) 4. N/A

Q3.4.3.
Was the **direct measure** (e.g. assignment, thesis, etc.) aligned directly and explicitly **with the rubric**?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know
- ( ) 4. N/A

Q3.4.4.
Was the **direct measure** (e.g. assignment, thesis, etc.) aligned directly and explicitly **with the PLO**?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know
- ( ) 4. N/A

Q3.5.
How many faculty members participated in planning the assessment data **collection** of the selected PLO?

Two EEE and one CpE faculty members

Q3.5.1.
How many faculty members participated in the **evaluation** of the assessment data for the selected PLO?

two

Q3.5.2.
If the data was evaluated by multiple scorers, was there a norming process (a procedure to make sure everyone was scoring similarly)?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know
- ( ) 4. N/A

Q3.6.
How did you **select** the sample of student work (papers, projects, portfolios, etc.)?

The work of all the students who took CpE 190 in the fall and CpE 191 in the spring were assessed.

Q3.6.1.
How did you **decide** how many samples of student work to review?

Assessed all the students' work.

Q3.6.2.
How many students were in the class or program?

20 in CpE 190 and 20 in CpE 191

Q3.6.3.
How many samples of student work did you evaluated?

All the students in the selected courses.

Q3.6.4.
Was the sample size of student work for the direct measure adequate?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know

(Remember: Save your progress)

Question 3B: Indirect Measures (surveys, focus groups, interviews, etc.)

Q3.7.
Were indirect measures used to assess the PLO?

- ( ) 1. Yes
- (●) 2. No (skip to **Q3.8**)
- ( ) 3. Don't Know (skip to **Q3.8**)

Q3.7.1.
Which of the following indirect measures were used? [**Check all that apply**]

- [ ] 1. National student surveys (e.g. NSSE)
- [ ] 2. University conducted student surveys (e.g. OIR)

- [ ] 3. College/department/program student surveys or focus groups
- [ ] 4. Alumni surveys, focus groups, or interviews
- [ ] 5. Employer surveys, focus groups, or interviews
- [ ] 6. Advisory board surveys, focus groups, or interviews
- [ ] 7. Other, specify:

Q3.7.1.1.
Please explain and attach the indirect measure you used to collect data:

No file attached **No file attached**

Q3.7.2.
If surveys were used, how was the sample size **decided**?

Q3.7.3.
If surveys were used, how did you **select** your sample:

Q3.7.4.
If surveys were used, what was the response rate?

Question 3C: Other Measures (external benchmarking, licensing exams, standardized tests, etc.)

Q3.8.
Were external benchmarking data, such as licensing exams or standardized tests, used to assess the PLO?

- ○ 1. Yes
- ◉ 2. No (skip to **Q3.8.2**)
- ○ 3. Don't Know (skip to **Q3.8.2**)

Q3.8.1.
Which of the following measures was used? [**Check all that apply**]

- ☐ 1. National disciplinary exams or state/professional licensure exams
- ☐ 2. General knowledge and skills measures (e.g. CLA, ETS PP, etc.)
- ☐ 3. Other standardized knowledge and skill exams (e.g. ETC, GRE, etc.)
- ☐ 4. Other, specify:

Q3.8.2.
Were other measures used to assess the PLO?

- ○ 1. Yes
- ◉ 2. No (skip to **Q4.1**)
- ○ 3. Don't know (skip to **Q4.1**)

Q3.8.3.
If other measures were used, please specify:

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(Remember: Save your progress)

Question 4: Data, Findings, and Conclusions

Q4.1.
Please provide simple tables and/or graphs to summarize the assessment data, findings, and conclusions for the selected PLO in **Q2.1**:

CpE 190 is the first senior design course where students form their teams and select their senior projects. CpE 191 is the second course where students with one semester experience working as a team and generating progress reports continue to better the project prototype they created in CpE 190.

While the assessment results for PLO d indicate 80% of students in CpE 190 and 82% of students in CpE 191 meet or exceed expectations on interdisciplinary teamwork abilities, there is no a significant improvements between their teamwork abilities in the first course (CpE 190) vs. the second course (CpE 191). The reason could be that perhaps it takes more time and more effort to build a better team synergy when at the same time these students are taking other and sometimes different classes.

The assessment results also indicate, as expected, the students' effective communication skills (both oral and written) was improved significantly over time when the assessment results in CpE 190 and in CpE 191 are compared. During the second senior design course (CpE 191), students start the new semester with already having an extended experience in CpE 190 with presentations both orally and written reports. The result indicates that 85% of the students meet or exceed the criteria after completing the second senior design course (CpE 191).

Also, refer to "Section III: Assessment: Teamwork and Effective Communication" in the attached "Related Documents" for more information including assessment results for teamwork and effective communication (Table 10) as well as partial results for other PLOs (Table 9).

Attachments included with CpE report 2016-2017.zip
739 KB

No file attached

Q4.2.
Are students doing well and meeting the program standard? If not, how will the program work to improve student performance of the selected PLO?

As shown in Table 10, the assessment results for PLO d (teamwork) indicate 80% of students in CpE 190 and 82% of students in CpE 191 meet or exceed expectations on interdisciplinary teamwork abilities. However, there is no a significant improvements between their teamwork abilities in the first course (CpE 190) vs. the second course (CpE 191). The reason could be that perhaps it takes more time and more effort to build a better team synergy within a relatively such a short time while also at the same time students are taking other and sometimes different classes during their last semester.

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Q4.3.
For the selected PLO, the student performance:

- (●) 1. **Exceeded** expectation/standard
- ( ) 2. **Met** expectation/standard
- ( ) 3. **Partially** met expectation/standard
- ( ) 4. Did not meet expectation/standard
- ( ) 5. No expectation/standard has been specified
- ( ) 6. Don't know

Question 4A: Alignment and Quality

Q4.4.

Did the data, including the direct measures, from all the different assessment tools/measures/methods directly align with the PLO?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know

Q4.5.
Were **all** the assessment tools/measures/methods that were used good measures of the PLO?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know

Question 5: Use of Assessment Data (Closing the Loop)

Q5.1.
As a result of the assessment effort and based on prior feedback from OAPA, do you anticipate *making any changes* for your program (e.g. course structure, course content, or modification of PLOs)?

- (●) 1. Yes
- ( ) 2. No (skip to **Q5.2**)
- ( ) 3. Don't know (skip to **Q5.2**)

Q5.1.1.
Please describe *what changes* you plan to make in your program as a result of your assessment of this PLO. Include a description of how you plan to assess the impact of these changes.

1. **No specific changes will be made for assessing PLO d.**
2. **It is noticed that the ABET/CpE PLO g (an ability to communicate effectively) combines both oral and written communication abilities as "effective communication" abilities. While the assessment data for the PLO g in Table 10 is shown for both oral and written communications combined, in the future these assessment data will be reported and analyzed separately for "oral communication" and "written communication."**
3. **We have reported the CpE curriculum mapping to PLO with each entry contributing to a PLO marked with an X. In the future we will try to mark the entries with letters I for "subject introduced", D for "subject developed and practiced with feedback", and M for "demonstrated as mastery level appropriate for graduation for the subject."**

Q5.1.2.
Do you have a plan to assess the *impact of the changes* that you anticipate making?

- ( ) 1. Yes
- ( ) 2. No
- (●) 3. Don't know

Q5.2.

Since your last assessment report, **how have the assessment data from then been used** so far?	1. Very Much	2. Quite a Bit	3. Some	4. Not at All	5. N/A
1. Improving specific courses	○	○	●	○	○
2. Modifying curriculum	○	○	○	○	○
3. Improving advising and mentoring	○	○	○	○	○
4. Revising learning outcomes/goals	○	○	○	○	○
5. Revising rubrics and/or expectations					

	○	○	○	○	○
6. Developing/updating assessment plan	○	○	○	○	○
7. Annual assessment reports	○	○	○	○	○
8. Program review	○	○	○	○	○
9. Prospective student and family information	○	○	○	○	○
10. Alumni communication	○	○	○	○	○
11. WSCUC accreditation (regional accreditation)	○	○	○	○	○
12. Program accreditation	○	○	○	○	○
13. External accountability reporting requirement	○	○	○	○	○
14. Trustee/Governing Board deliberations	○	○	○	○	○
15. Strategic planning	○	○	○	○	○
16. Institutional benchmarking	○	○	○	○	○
17. Academic policy development or modifications	○	○	○	○	○
18. Institutional improvement	○	○	○	○	○
19. Resource allocation and budgeting	○	○	○	○	○
20. New faculty hiring	○	○	○	○	○
21. Professional development for faculty and staff	○	○	○	○	○
22. Recruitment of new students	○	○	○	○	○

23. Other, specify:

Q5.2.1.
Please provide a detailed example of how you used the assessment data above:

Based on the last assessment results, the delivery method for CpE 138 was changed to improve students' understanding of the detailed computer network layers. The re-assessment result indicate improvements where 79% of students met or exceeded the expectations. Also, refer to Section III in the attached file

"CpE related document - assessment 2016-2017 – BS Program - plus teamwork and communication.pdf" for more information.

Q5.3.
To what extent did you apply **last year's feedback** from the Office of Academic Program Assessment in the following areas?

	1. Very Much	2. Quite a bit	3. Some	4. Not at All	5. N/A
1. Program Learning Outcomes	○	○	○	○	○
2. Standards of Performance	○	○	◉	○	○
3. Measures	○	○	○	○	○
4. Rubrics	○	○	○	○	○
5. Alignment	○	○	○	○	○
6. Data Collection	○	○	○	○	○
7. Data Analysis and Presentation	○	○	○	○	○
8. Use of Assessment Data					

	○	○	○	○	○
9. Other, please specify:	○	○	○	○	○

Q5.3.1.
Please share with us an example of how you applied **last year's feedback** from the Office of Academic Program Assessment in any of the areas above:

While we use the average to determine the overall students' performance on each of the PLOs, we do indeed address problems (if any) in any of the courses that we assess. Case in point was CpE 138 where the assessment results indicated less than satisfactory in the Performance Indicator a (Application of fundamental knowledge), which was re-assessed after some changes were implemented. If this understanding is correct, perhaps the explanation was not very clear in the earlier report.

(Remember: Save your progress)

Additional Assessment Activities

Q6.
Many academic units have collected assessment data on aspect of their program *that are not related to the PLOs* (i.e. impacts of an advising center, etc.). **If** your program/academic unit has collected data on program *elements*, please briefly report your results here:

In the interest of improving the CpE curriculum and assess student readiness for Senior Project, the program conducted a survey of graduating students in Spring 2017 Graduation Ceremony. The survey was designed to 1) determine how satisfied students were in their contributions to senior project; and 2) which specific courses were more useful in their senior project courses CpE 190 and CpE 191. We also collected their GPA data to see how the responses correlated with GPA. The plan is to analyze the survey data next year and make changes to the curriculum 4-year plan and/or senior project courses if necessary.

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Q7.
What PLO(s) do you plan to assess next year? [**Check all that apply**]

- ☐ 1. **Critical Thinking**
- ☐ 2. **Information Literacy**
- ☑ 3. **Written Communication**
- ☑ 4. **Oral Communication**
- ☐ 5. Quantitative Literacy
- ☑ 6. **Inquiry and Analysis**
- ☐ 7. Creative Thinking
- ☐ 8. Reading
- ☐ 9. Team Work
- ☐ 10. Problem Solving
- ☐ 11. Civic Knowledge and Engagement
- ☐ 12. **Intercultural Knowledge, Competency, and Perspectives**
- ☐ 13. Ethical Reasoning
- ☐ 14. Foundations and Skills for Lifelong Learning
- ☐ 15. **Global Learning and Perspectives**

☐ 16. Integrative and Applied Learning

☐ 17. Overall Competencies for GE Knowledge

☐ 18. **Overall Disciplinary Knowledge**

☐ 19. **Professionalism**

☐ 20. Other, specify any PLOs not included above:

a.

b.

c.

Q8. Please attach any additional files here:

No file attached | No file attached | No file attached | No file attached

Q8.1.
Have you attached any files to this form? If yes, please list every attached file here:

1. **CpE BS Related Document - assessment 2016-2017 - plus teamwork and communication.pdf**
2. **CPE 190 Course Outline.pdf**
3. **CPE 190 Rubric.pdf**
4. **CPE 191 Course Outline.pdf**
5. **CPE 191 Rubric.pdf**
6. **Written report rubric.pdf**
7. **Oral+Presentation+Rubric.pdf**
8. **Team_Member_Evaluations_Form.pdf**
9. **Student Learning Outcomes by Course matrix-curriculum Map.pdf**

Program Information (**Required**)

Program:

(If you typed your program name at the beginning, please skip to Q10)

Q9.
Program/Concentration Name: [skip if program name appears above]
BS Computer Engineering

Q10.
Report Author(s):
Nikrouz Faroughi

Q10.1.
Department Chair/Program Director:
Nikrouz Faroughi, Program Coordinator

Q10.2.
Assessment Coordinator:
Nikrouz Faroughi

Q11.
Department/Division/Program of Academic Unit
Computer Engineering

Q12.
College:
College of Engineering and Computer Science

Q13.
Total enrollment for Academic Unit during assessment semester (see Departmental Fact Book):

433

Q14.
Program Type:

- (●) 1. Undergraduate baccalaureate major
- ( ) 2. Credential
- ( ) 3. Master's Degree
- ( ) 4. Doctorate (Ph.D./Ed.D./Ed.S./D.P.T./etc.)
- ( ) 5. Other, specify:

Q15. Number of **undergraduate degree programs** the academic unit has?
1

Q15.1. List all the names:
Computer Engineering

Q15.2. How many concentrations appear on the diploma for this undergraduate program?
0

Q16. Number of **master's degree programs** the academic unit has?
1

Q16.1. List all the names:
Computer Engineering

Q16.2. How many concentrations appear on the diploma for this master's program?
0

Q17. Number of **credential programs** the academic unit has?
Don't know

Q17.1. List all the names:

Q18. Number of **doctorate degree programs** the academic unit has?
0

Q18.1. List all the names:

When was your **assessment plan**...	1. Before 2011-12	2. 2012-13	3. 2013-14	4. 2014-15	5. 2015-16	6. 2016-17	7. No Plan	8. Don't know
Q19. developed?	○	○	○	◉	○	○	○	○
Q19.1. last updated?	○	○	○	○	○	○	○	○

Q19.2. (REQUIRED)
Please **obtain** and **attach** your latest **assessment plan**:

CpE Assessment Plans Spring 2015 Final.pdf
314.59 KB

Q20.
Has your program developed a **curriculum map?**

◉ 1. Yes
○ 2. No
○ 3. Don't know

Q20.1.
Please **obtain** and **attach** your latest **curriculum map**:

Student Learning Outcomes by Course matrix-curriculum Map.pdf
43.09 KB

Q21.
Has your program indicated in the curriculum map where assessment **of student learning** occurs?

○ 1. Yes
◉ 2. No
○ 3. Don't know

Q22.
Does your program have a capstone class?

- (●) 1. Yes, indicate: CpE 190 and CpE 191
- ( ) 2. No
- ( ) 3. Don't know

Q22.1.
Does your program have **any** capstone project?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know

(**Remember**: **Save your progress**)

ver. 5.15/17

Section I: CpE PLOs and Mapping Tables

Computer Engineering (CpE) PLOs: Also referred to as Student Outcomes (SOs)

The CpE SOs are as follows, the same as those listed in EAC ABET:

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

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

c) 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.

d) An ability to function on multidisciplinary teams.

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 global, economic, environmental, and societal context.

i) A recognition of the need for, and an ability 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.

Table 1 Sacramento State Baccalaureate Learning Goals for the 21st Century

Competence in the Disciplines: The ability to demonstrate the competencies and values listed below in at least one major field of study and to demonstrate informed understandings of other fields, drawing on the knowledge and skills of disciplines outside the major.
Knowledge of Human Cultures and the Physical and Natural World through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts. Focused by engagement with big questions, contemporary and enduring.
Intellectual and Practical Skills, Including: inquiry and analysis, critical, philosophical, and creative thinking, written and oral communication, quantitative literacy, information literacy, teamwork and problem solving, practiced extensively, across the curriculum, in the context of progressively more challenging problems, projects, and standards for performance.
Personal and Social Responsibility, Including: civic knowledge and engagement—local and global, intercultural knowledge and competence*, ethical reasoning and action, foundations and skills for lifelong learning anchored through active involvement with diverse communities and real-world challenges.
Integrative Learning, Including:** synthesis and advanced accomplishment across general and specialized studies. **All of the above are demonstrated through the**

application of knowledge, skills, and responsibilities to new settings and complex problems.

*Understanding of and respect for those who are different from oneself and the ability to work collaboratively with those who come from diverse cultural backgrounds.

** Interdisciplinary learning, learning communities, capstone or senior studies in the General Education program and/or in the major connecting learning goals with the content and practices of the educational programs including GE, departmental majors, the curriculum and assessments.

Table 2 Mapping of CpE Program Educational Objectives (PEOs) and the University Baccalaureate Leaning Goals (BLGs).

	University Baccalaureate Learning Goals				
CpE PEOs	A Competence in the Disciplines	Knowledge of Human Cultures and the Physical and Natural World	Intellectual and Practical Skills	Personal and Social Responsibility	Integrative Learning
Core Knowledge	X	X			
Application of Knowledge	X		X		X
Life-long Learning	X	X			X
Professionalism				X	

Table 3 Mapping of CpE Program Educational Objectives (PEOs) and Student Outcomes (SOs)

Program educational objectives	**Student Outcomes**										
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
1. Core Knowledge:…	X	X			X						X
2. Application of Knowledge:…	X	X	X		X			X		X	X
3. Life-long Learning:…								X	X	X	X

4. Professionalism:…				X		X	X				

Table 4 Mapping of CpE SOs and the University Baccalaureate Leaning Goals (BLGs).

	University Baccalaureate Learning Goals				
CpE SOs	A Competence in the Disciplines	Knowledge of Human Cultures and the Physical and Natural World	Intellectual and Practical Skills	Personal and Social Responsibility	Integrative Learning
a)	X	X	X		X
b)	X	X	X		X
c)	X		X		X
d)				X	
e)	X	X	X		X
f)				X	
g)				X	
h)	X	X	X		X
i)	X	X			X
j)	X	X	X		X
k)	X	X	X		X

Computer Science SOs vs. Computer Engineering SOs

The CSc program uses a different set of student outcomes that are mapped to the CpE program SOs before the CSc assessment results are combined to generate the assessment results for the CpE program. Below is the list of SOs used to assess the Computer Science program, and **Error! Reference source not found.** is the mapping between the CSc SOs and the CpE SOs.

CSc SOs:

(a) Apply fundamental knowledge of mathematics, algorithmic principles, computer theory, and principles of computing systems in the modeling and design of computer-based systems that demonstrate an understanding of tradeoffs involved in design choices.

(b) Analyze a problem, specify the requirements, design, implement, and evaluate a computer-based system, process, component, or program that satisfies the requirements.

(c) Apply design and development principles in the construction of software systems of varying complexity.

(d) Use current skills, techniques, and tools necessary for computing practice.

(e) Function effectively as a member of a team to accomplish a common goal.

(f) Understand professional, ethical, and security issues and responsibilities.

(g) Write effectively.

(h) Give effective oral presentations.

(i) Recognize the need for, and have the ability to learn new technologies in computer science or related areas.

Table 5 Mapping of CSc SOs and CpE SOs.

a) Apply fundamental knowledge of mathematics, …	X										
b) Analyze a problem, specify the requirements, design, …		X									
c) Apply design and development principles, …			X								
d) Use current skills, techniques, and tools...											X
e) Function effectively as a member of a team …				X							
f) Understand professional, ethical, …						X					
g) Write effectively							X				
h) Give effective oral presentations …							X				
i) Recognize t need for, a have the …									X	X	

Section II: Assessment Data Collection

Computer Science (CSc) Courses: Re-assessment and closing the loop

CSc/CpE 138 re-assessment and closing the loop:

Outcome a), Application of fundamental knowledge

Computer Engineering (CpE) Courses: Data collection and Assessment

Assessment data was collected in CpE 142 and CpE 151, 190, and 191. For courses CpE 151, 190, and 191 that are taught by the EEE department, Course Outcomes (COs) are collected, which are then mapped to PLOs. Tables illustrating the mapping between the COs and PLOs are also given below.

CpE 142:

PLO-a Apply knowledge of math., science and engineering (Exam problems)
PLO-b Design, analyze, and interpret data (Exam Problem)
PLO-e Ability to identify, formulate, and solve engineering problem (term project)

CpE 151:

Course outcome (COs): After successfully completing this course, students will be able to:

CO_1 Students will be able to apply basic semiconductor device physics that dictate the operation of CMOS circuits

CO_2 Students will be able to analyze and design CMOS logic gates at the transistor level, including memory

CO_3 Students will be able to make tradeoffs between performance, power, and area for CMOS digital circuits

CO_4 Students will be able to use a professional style physical design tool to layout CMOS logic circuits

CO_5 Students will be able to describe issues and make tradeoffs associated with large “system on a chip” designs

Table 6. CpE 151 Mapping of Course Outcomes (COs) to Student Outcomes (PLOs)

		ABET Student Outcomes										
		(a)	(b)	I	(d)	I	(f)	(g)	(h)	(i)	(j)	(k)
Course Outcomes	1.	X								X	X	
	2.	X		X								
	3.	X		X								
	4.			X								X

	5.											X

CpE 190:

Course outcome (COs): After successfully completing this course, students will be able to:

1. Identify and evaluate a societal problem that needs an engineering solution.
2. Use basic project management methods and software tools such as Microsoft project for planning and management.
3. Design a working laboratory prototype of a system/device/process that addresses a societal problem under realistic constraints such as cost and safety requirements.
4. Communicate effectively in written and oral forms
5. Work effectively in a team.

Table 7. CpE 190 Mapping of Course Outcomes (COs) to Student Outcomes (PLOs)

		ABET Student Outcomes										
		(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
Course Outcomes	1.					X			X		X	
	2.								X			X
	3.	X		X		X						X
	4.							X				
	5.				X							

CpE 191:

Course outcome (COs): After successfully completing this course, students will be able to:

1. Address the limitations and improve the prototype designed in CPE 190 (Senior De-sign Project I).
2. Develop a testing plan and use contemporary tools to test the prototype.
3. Perform market analysis.
4. Show an understanding of ethical and professional issues.
5. Communicate effectively in written and oral forms
6. Work effectively in a team

Table 8. CpE 191 Mapping of Course Outcomes (COs) to Student Outcomes (PLOs)

Course Outcomes	ABET Student Outcomes										
	(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**
CO 1	x		x		x				x		x
CO 2		x									x

CO 3								x		x	x
CO 4						x					
CO 5							x				
CO 6				x							

Table 9 shows the re-assessment data for CSc/CpE 138 to close the loop as well as assessment data for several CpE courses.

Student Outcome	Courses Taught by CSc		Courses Taught by EEE		
	CpE 138	CpE 142	CpE 151	CpE 190	CpE 191
a)	81.8	72.41	98.81	90	100.00
b)		96.55			90.91
c)			96.43	90	100.00
d)				80	81.82
e)		93.10		90	100.00
f)					85.00
g)				70	100.00
h)				95	100.00
i)			100		100.00
j)			100	90	100.00
k)			89.29	95	96.97

The earlier assessment result CpE 138 was lower than satisfactory (65%) – minimum is 70% -- in the area of "Application of fundamental knowledge." A set of modification as follows was made by the instructor and the re-assessed result improved from 65% in Spring 2016 to 81.8% in Spring 2017.

Instructor's modification in CpE 138 to improve student performance:

"For each [network] layer, in addition to talking about the individual layer, I also related and compared the layer with other layers, such as what protocols may be used in other layers corresponding to the protocol in this specific layer. At the end of the semester, I summarized the entire network architecture by providing a concrete scenario to show activities and protocols at each layer." In conclusion, "Students may easily get lost and become overwhelmed by the tons of details inside a specific layer if the layer is not related with other layers. Frequently going over and compare related knowledge from other layers is very useful to help understand the entire network architecture and the protocol stack. The scenarios of a web request improved students capability of integrating involved protocols and activities from all layers in a comprehensive way."

Section III: Assessment: Teamwork and Effective Communication

CpE senior design courses 190 and 191 form a two-semester sequence that consists of a one unit lecture and a one unit laboratory. In these courses, students apply the knowledge acquired in earlier

course work to address a societal problem. The following is a sample list of subject areas of senior projects:

Environment (including wild fire detection)
Health and physical activity
Safety and security
Power and energy
Surveillance, search and rescue

Because of the nature of the problems addressed, senior design constitutes a broad design experience, where students use the knowledge from mathematics and science subjects as well as knowledge and skills from computer science, computer engineering, and electrical engineering subjects to design a system, device, or process to solve problems in hand. Specifically, the first semester of the senior design (CpE 190) begins with an overview on the engineering design process. The first assignment is the identification of the societal problem, and the second assignment is the design idea. This is where teams propose a design solution to address the problem, identify design constraints, and define requirements. Once the design solution is approved, students develop and follow a work breakdown structure (WBS) and begin implementing the proposed solution. The breadboard proof takes place around the middle of the semester. In this assignment, the students need to show that all major components of the projects have been implemented according to the design requirements. The laboratory prototype presentation and demonstration takes place in the last week of the semester. The presentations are open to general public.

In the first assignment of the second semester (CpE 191), teams are asked to revise their designs, if necessary, based on the experience and results they obtained during the previous semester. Students implement their final designs, which includes keeping testing records and market review (discussed below), during the second semester. Students are required to perform testing in conjunction with implementation. However, in the second semester, students formally test and validate their designs against the initial requirements. The test results are documented.

For the market review, students are required to assess the economic/market potential of the system or device being developed. They usually perform design strengths, weaknesses, opportunities and threats (SWOT) analysis and compare it with recent patents and products already in the market that address a similar societal problem. This assignment allows the students to have a broader knowledge about existing opportunities and the limitations of their design in terms of market potential. Students are also required to prepare a project documentation and final presentation/demonstration. However, unlike CpE 190, the final presentation/demonstration in CpE 191 has the form of an open trade show where the students make a poster presentation.

In addition to the design experience, senior design emphasizes professional development activities such as project management, technical communications, and teamwork that are essential skills for engineers. Specifically, students by identifying an engineering solution to solve a societal problem, they gain knowledge about current problems and needs of society that contributes to their broader thinking. They also identify and learn about design constraints including safety, environmental, and economic constraints. The choice of the societal problem also affects students' level of engagement and knowledge of contemporary issues.

Likewise, while students work on many projects prior to senior design, the scope and the nature of the senior design projects require the use of formal project management tools. In the first weeks of senior design I (CpE 190), project management tools such as WBS, program evaluation and review techniques (PERT) and Gantt chart are discussed in the lecture. Students are required to develop a WBS for their

project in the first few weeks of the semester. The WBS should be approved by the instructor for the students to continue working on the project. The WBS should clearly define the scope and the deliverables of the project and allow dividing work and assigning responsibilities to team members. Each team also develops a Gantt chart and keeps it up to date for the duration of the project. Students submit brief progress reports every week and discuss progress in the weekly meetings with the instructor(s).

In addition, teamwork and effective communication are important components of the senior design. Teams of four are preferable, but teams of three and five are also acceptable. Once, the team is formed, the members elect a leader. The role of team leader is rotated so that each team member serves as a leader once in the two semester sequence. In both senior design courses (CpE 190, 191), the students typically remain in the same teams. Oral and written communications play an important role in senior design where students perform several formal and non-formal presentations. Students write several reports and present their work on various occasions. At the end of each semester, the students deliver a formal presentation and submit a report documenting their work.

All the senior design projects typically include both hardware and software components. Teams of mixed computer and electrical engineering students have complementary skills in terms of their background as well as their hardware and software knowledge and capabilities. Computer engineering students have strong background in programming and software design, operating systems, networks, computer interfacing, digital circuit design, and microprocessors. Electrical engineering students have strong background in analog circuit design, sensors, and communications. Furthermore, both groups of students are skilled working with microcontrollers. These interdisciplinary teams with complementary skills prove advantageous in tackling broad problems such as those addressed in the senior design. While students choose their own team members, a greater emphasis is placed on the importance of working successfully in an interdisciplinary teams and as a result the majority of teams are made of both CpE and EEE students.

The assessment results in CpE 190 and CpE 191 (Senior Project courses) for all the PLOs except the PLOs d (teamwork) and g (effective communication) will be merged with the other assessment data (including Table 9) in the future. Table 10 shows the assessment result for PLOs d and g.

Table 10. CpE BS Assessment 2016-2017: Teamwork and Effective Communication

Student Outcome	Courses Taught by EEE		**Average (percent)**	**PLO Description**
	CpE 190	**CpE 191**		
d)	80	81.82	**80.91**	An ability to function on multidisciplinary teams
g)	70	100.00	**85.00**	An ability to communicate effectively

CpE 190 is the first senior design course where students form their teams and select their senior projects. CpE 191 is the second course where students with one semester experience working as a team and generating progress reports continue to better the project prototype they created in CpE 190.

While the assessment results for PLO d indicate 80% of students in CpE 190 and 82% of students in CpE 191 meet or exceed expectations on interdisciplinary teamwork abilities, there is no a significant improvements between their teamwork abilities in the first course (CpE 190) vs. the second course (CpE 191). The reason could be that perhaps it takes more time and more efforts to build a better team synergy while at the same time they are taking other and sometimes different classes.

The assessment results also indicate, as expected, the students' effective communication skills (both oral and written) was improved significantly over time when the assessment results in CpE 190 and in CpE 191 are compared. During the second senior design course (CpE 191), students start the new semester with already having an extended experience in CpE 190 with presentations both orally and written reports.

Senior Design
Written Report Rubric

	1 = Below expectation	2 = Meets expectation	3 = Exceeds expectation
Abstract	The abstract does not reflect the paper and fails to provide an adequate summary of the problem statement, the motivation, the approach used in the paper and the results.	The abstract concisely and clearly summarizes the problem statement, the motivation, the approach used in the paper and the results.	The abstract gives a clear, complete and concise summary of the problem statement, the motivation, the approach used in the paper and the results.
Formatting	Formatting standards are not followed. Font is illegible or inconsistent; formatting is poor and detracts from the paper. The reader has difficulties navigating the paper.	Formatting standards are carefully followed. For most part, the document is visually appealing and easily navigated.	The document is formatted in a professional fashion, visually appealing and easily navigated. Formatting aspects enhance the repot.
Organization	The paper lacks the logical sequence, the connection between ideas is not clear and transitions are inadequate. There is no apparent ordering of paragraphs and sections.	The report is well structured with proper paragraphing and sections. The report follows a logical sequence with clear introduction, development and conclusion.	Report is well structured and flows very well. Sections and paragraph structure are effective with clear introduction, development and conclusion. The overall organization helps the reader grasp the information quickly.
Content	The report does not adequately respond to the assignment. The purpose and motivation are not clear. The primary ideas are unclear and the assertions are not supported.	The report clearly and adequately covers the assignment. The purpose and motivation are addressed. The primary ideas are clear and supported by evidence.	The report clearly and thoroughly covers the assignment. The purpose and motivation are clear and persuasive, and the main points are addressed. The primary ideas are clear, fully developed and effectively supported by evidence.
Grammar, spelling, punctuation	There are significant errors in spelling, grammar and punctuation. Errors affect the readability of the paper.	May have a small number of spelling, grammatical, or punctuation errors.	Almost entirely free of spelling, grammatical, and punctuation errors.
Use of figures, graphs and tables	Figures, graphs, charts, and tables are of poor quality or nonexistent. Titles and labels are missing or inaccurate. No explanation or discussion of the figures, graphs, charts, or tables is given in the text.	Most figures, graphs, chart, and tables are of good quality and used in an effective way. They are correctly labeled and referred to in the text.	All figures, graphs, chart, and tables are of good quality and used in an effective way. They are correctly labeled and referred to in the text.
Language	There are errors in sentence structure, words and sentences are repeated multiple times. Numerous errors in using Engineering terms For most part, sentences are complete and focused and words are chosen carefully.	Engineering terms are correctly used and defined when necessary.	Sentences are complete and concise, and words are chosen for their precise meaning. Engineering terms are correctly used and defined when necessary.
Conclusion	The conclusion fails to recap the main ideas; there is no clear take home message.	The conclusion stresses the importance and effectively recaps the most important main ideas in a clear and concise manner. The take home message is clear and leaves a final impression on the reader but a few elements may be missing The conclusion stresses the importance and effectively recaps the main ideas in a clear and concise manner.	The take home message is clear and leaves a final impression on the reader.
References	Fail to cite sources or acknowledge prior work.	References are inaccurate or incorrect Prior work is acknowledged by referring to sources and citing them in text. Almost all references are adequate and correct.	Prior work is acknowledged by referring to sources and citing them in text. All references are adequate and correct.
Appendix (if required)	Appendix lacks organization and is difficult to navigate. Important information is missing.	Appendix is well organized and easily navigated, and contains the necessary information.	Appendix is complete, well organized, and easily navigated.
Total			
Overall			

Team Member Evaluations - Submit this form for each team member including yourself.

Evaluated Person: Evaluator:

Team: Date:

Category	0	1	2	3	4	5
Planning						
Decision Making						
Communication						
Organizational Skill including Time Management						
Ability to meet deadlines and punctuality.						
Flexibility to discuss ideas and form alternate approaches						
Responsiveness to shifting project priorities						
Problem solving, willingness to brain storm and form a range of possible solutions						
Teamwork including working team priorities, ability to integrate personal goals into the project's requirements to enhance the project.						
Leadership including the ability to bring out the best in team mates, willingness to search to pathways to keep the project on track and using initiative to self-start and help others to stay focused on appropriate tasks.						
Professionalism – ability to complete the project despite the normal daily buzz of competing schedules and priorities.						
Technical knowledge as defined by the needs of your senior design project.						
Contribution of this person – Hardware aspects						
Contribution of this person – Software aspects						
Contribution of this person – Mechanical aspects						

Rating Scale

0	The person either did not contribute any useful effort or the category does not apply to this person (must be justified in the comments section).
1	The person is perceived as supplying the absolute minimum in effort in this category to complete the project at the lowest acceptable level.
2	The person is perceived as supplying minimal effort in this category as long as other conflicts such as their academic schedule are not impacting the person.
3	The person is perceived as striving complete the project but, in this category, needs frequent orientation or other direction to stay on track and be a successful contributor.
4	The person is perceived as capable, and able to work independently in this category. The team members can rely on this person to stay on track, be focused, and coordinate all aspects necessary of this category.
5	The person is perceived as being the role model of an engineer with unmatchable skills, endless enthusiasm, limitless energy and capable of completing any relevant task required by the project.

Please comment on quality of support you receive from this person.

What are his/her greatest strengths?

What areas need attention?

Table. Courses Contributing to CpE Student Learning Outcomes

ABET Learning Outcome	Engr 1*	Eng 17	Engr 120	CSc 15	CSc 20	CSc 28	CSc 60	CSc 35	CSc 130	CpE 138	CSc 139	EEE 117	EEE 117L	EEE 108	EEE 108L	EEE 180	CpE 64	CpE 142	CpE 151	CpE 159	CpE 166	CpE 185	CpE 186	CpE 190	CpE 191	Elective
a			X	X	X	X	X	X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	
b			X	X	X	X	X	X		X	X				X		X	X		X	X	X	X		X	
c			X	X	X	X	X	X	X	X					X				X	X	X	X	X	X	X	
d	X																			X				X	X	
e			X											X		X	X	X			X	X		X	X	
f	X									X	X												X		X	
g	X					X									X	X		X			X		X	X	X	
h	X																							X	X	
i																			X				X		X	
j	X																		X				X	X	X	
k			X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	

* ENGR 96A is substituted for ENGR 1

Oral Presentation Rubric

	1	2	3	4	5	6	7	Score
1. Organization	Poor sequence or illogical presentation of information. Some relevant information not presented. Presentation not well timed.		Some information presented out of sequence. Had some pacing and timing problems.		Information presented nearly complete and relevant and presented in logical sequence. Pacing and timing appropriate.		Information presented was completed and in logical order. Easy to follow. Very well-timed and well-paced.	
2. Originality	Problem/purpose limited in originality and creativity. Design/approach only marginally appropriate or innovative.		Problem/purpose moderately original or creative. Design/approach moderately appropriate or innovative.		Problem/purpose fairly original or creative. Design/approach appropriate or innovative.		Problem/purpose very creative or original with new and innovative ideas. Explored original topic and discovered new outcomes. Design/approach introduced new or expanded on established ideas.	
3. Significance	Project has little relevance or significance to field and will make little contribution.		Project has only moderate relevance or significance to field and will make a nominal contribution		Project has fair relevance or significance to field and will make good contribution.		Project extremely relevant or has significant importance to field and will make an important contribution.	
4. Discussion and Summary	Major topics or concepts inaccurately described. Considerable relevant discussion missing. Conclusions/summary not entirely supported by findings/outcomes.		Few inaccuracies and omissions. Conclusions/summary generally supported by findings/outcomes.		Discussion sufficient and with few errors. Greater foundation needed from past work in area. Conclusions/summary based on outcomes and were appropriate.		Discussion was superior, accurate, and thought-provoking. Conclusions/summaries appropriate and clearly based on outcomes.	
5. Delivery	Presenter unenthused, monotonous and relied extensively on notes. Voice mannerisms, body language, and communication skills sometimes inappropriate. Poor quality of slides/presentation/performance.		Displayed interest and enthusiasm. Limited engagement with audience. Occasionaly struggled to find words. Generally appropriate voice mannerisms, body language, and communication skills. Moderate quality of slides/presentation materials.		Engaged audience. Displayed interest and enthusiasm. Good voice mannerisms, body language, and communication skills. Good quality of slides/presentation materials; enhanced presentation/performance.		Very engaging. Expressed ideas fluently in own words. Genuinely interested and enthusiastic. Exceptional voice mannerisms, body language, and communication skills. Exceptional slides/presentation quality materials; greatly enhanced presentation/performance.	

Comments

Rubric provided by San Diego State University

Assessment Plans

for

Computer Engineering Programs

Spring 2015

Introduction

The CpE B.S and M.S. degree programs at California State University, Sacramento are joint programs supported by both the Computer Science (CSc) and Electrical and Electronics Engineering (EEE) departments. The Computer Engineering (CpE) faculty members (including the CpE coordinator) are appointed in either the CSc or EEE department.

This report describes the processes used by the CpE faculty to monitor and assess the Program Educational Objectives (PEOs) and Student Outcomes (SOs) for the B.S. degree program – both of which have been established according to due process and the guidelines of ABET, the accrediting agency. This report also describes the processes used by the CpE faculty to assess the PEOs and SOs of the CpE M.S. degree program.

The SOs are defined as the knowledge and those skills that students should be able to demonstrate at the time of their graduation, and the PEOs are those professional characteristics that students should be able to demonstrate approximately five years after graduation. The processes to periodically review the PEOs and assess the SOs are also described.

B.S. Program Educational Objectives (PEOs)

The list of PEOs for the Computer Engineering B.S. degree is as follows:

1. *Core Knowledge*: Our graduates will have careers in computer engineering, or be engaged in a related career path.
2. *Application of Knowledge*: Our graduates will apply their knowledge and skills to solve practical engineering problems.
3. *Life-long Learning*: Our graduates will continue to develop their skills and seek knowledge after graduation in order to adapt to advancing technology and the needs of society. This may be indicated by the graduate's pursuit of an advanced degree or other formal instruction, and/or that the graduate has developed a professional specialty.
4. *Professionalism*: Our graduates will have the necessary professional skills, such as high ethical standards, effective oral and written communications, and teamwork, to be productive engineers and to advance in their careers.

B.S. Student Outcomes (SOs)

Excerpted from ABET General Criteria 3 for Accreditation of Engineering Programs, 2015-2016

"The program must have documented student outcomes that prepare graduates to attain the program educational objectives. Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program."

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

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) 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

(d) an ability to function on multidisciplinary teams

(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 global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability 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.

Constituencies of CpE Programs

The students, Alumni, employers, and faculty as a whole are the four major constituencies of the CpE programs.

Students and Alumni

The mission of the CpE Program at CSUS is to provide our students with high quality education with the necessary knowledge, skills, and abilities at the time of graduation to transform our graduates into professionals who are prepared to meet the needs of society and adapt to rapidly changing technology. CSUS has a diverse student body from a wide range of cultures and socioeconomic backgrounds and our current students as well as our graduates are the primary constituents of our program.

Employers

Computer related industries are the primary employers of graduates from the CpE Program. Our graduates enter a competitive market wherein such employers seek candidates with strong technical and communication skills as well as an ability to thrive within current industry standards and to address the challenges of the future. Our employers are in a unique position to reflect on the talents, abilities and skills that are necessary for our graduates to succeed in the workplace. Experienced employees from the local industries are invited to form the CpE Industry Advisory Council (IAC).

Faculty

Faculty at-large represent one of the important constituents of the program and they are directly responsible for the education of our students and ensuring that they are prepared to meet the educational objectives of our program. The Office of Academic Program Assessment defines undergraduate leaning goals and provides university-wide assessment guidelines and requirements and the College of Engineering and Computer Science

Assessment Committee provides additional guidelines for the Engineering programs in the College. The CpE faculty is involved directly by providing course outlines, creating course goals and objectives, assessing student outcomes, and closing the loop. Individual faculty members make minor changes within individual courses, while the entire CpE faculty acts upon major curriculum changes resulting from evaluation of the outcomes assessments.

B.S. PEOs Review Process

Figure 1 illustrates the process to periodically review and update the B.S. degree PEOs. The CpE faculty members receive inputs from various on campus committees, the program constituents, and ABET accrediting body to continuously review and assess the relevance of the PEOs. The Office of Academic Program Assessment defines the University Educational Goals and provides the campus wide assessment guidelines. The goals of the College Assessment Committee is for each Engineering program to exchange and share sound assessment practices and develop college-wide assessment standards and guidelines. The inputs from the CpE Industrial Advisory Council (IAC) meetings, site visits with local industries, student and Alumni, and ABET are used to periodically evaluate the relevance of the PEOs with respect to university and college mission, the needs of the industry, and requirements of the accreditation.

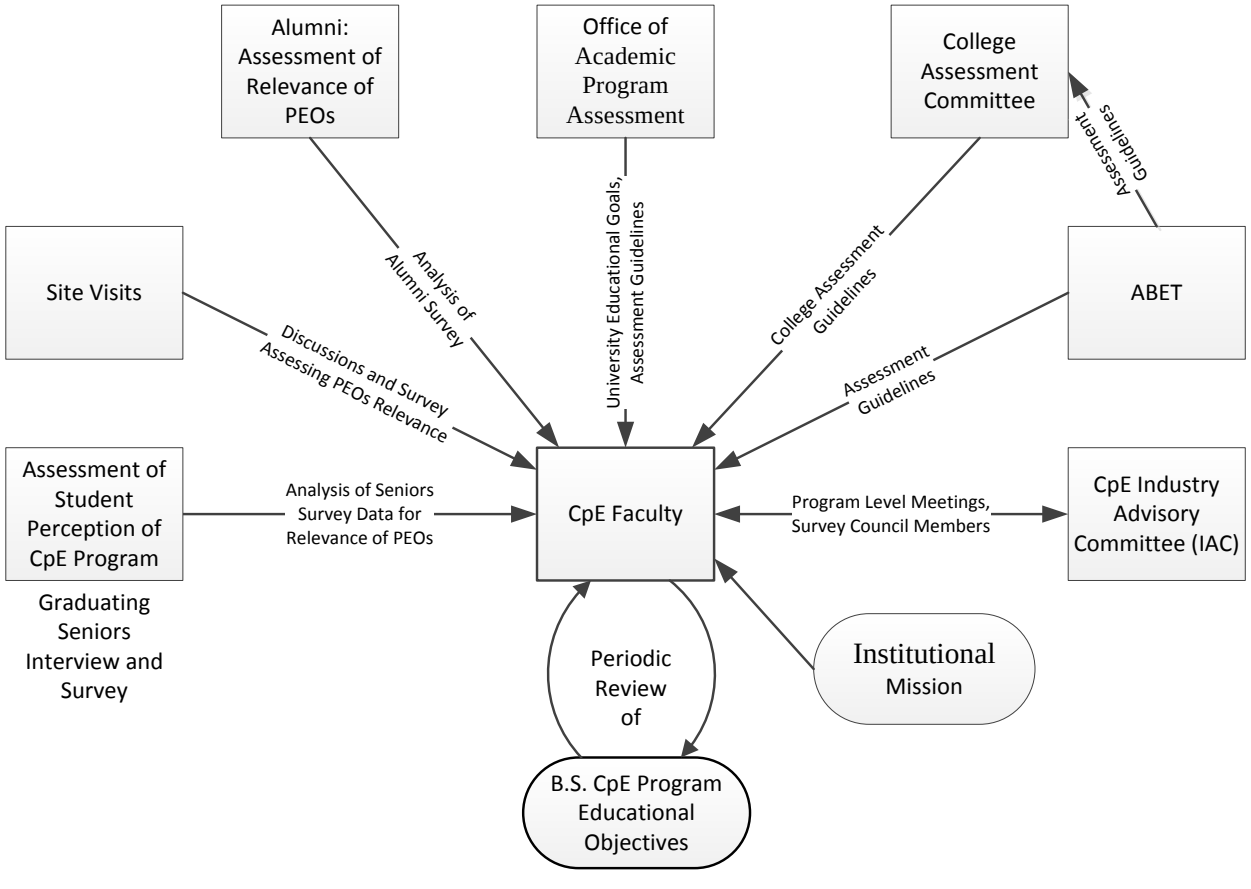

Figure 1 Flowchart of B.S. Program Educational Objectives Assessment

Table 1 outlines the methodologies used to periodically review the PEOs using the various inputs CpE faculty receive as shown in Figure 1.

Table 1 Process to Periodically Review B.S. Degree Program Educational Objectives

Constituent	Methodology	Inputs
Students	Graduating Senior Exit Interview and Survey (Sample list of graduating seniors interviewed every semester)	Verbal student recommendations; Seniors shall be asked to rate their perception of the CpE program in terms of the knowledge, skills, and abilities relating to the PEOs.
Alumni	Alumni survey, once every 3-5 years.	Survey collected by the Office of Institutional Research (OIS). The Alumni shall be asked to rate the relative importance of the PEOs as Essential, Important, Desirable, or Not Relevant.
Employers	The Industry Advisory Council (IAC) meetings, once every year; Site visits, one per year.	IAC meeting discussions and survey: The industry members of the Council shall rate the relevant importance of the PEOs as Essential, Important, Desirable, or Not Relevant. Members shall add additional objectives (if any) and also rate their relative importance. Company site visits and survey: The managers and Alumni/employees attending shall be asked to rate the relative importance of the PEOs, add and rate new objectives (if any), and provide recommendations to improve the program.
University/ College	Office of Academic Program Assessment; College Assessment Committee	University educational goals updates, University assessment guideline updates, College assessment guidelines updates
CpE Faculty	Faculty meetings to review PEOs based on the data and inputs received over the past three years	Analysis of Alumni, IAC, and site visits survey results, Evaluation of University, College, and/or ABET assessment guidelines updates

B.S. Degree SOs Assessment Process

The CpE B.S. degree curriculum includes math and science courses as well as CpE, CSc, EEE, and Engineering (ENGR) prefixed courses that are taught by faculty members from the CSc and EEE departments. The assessment of the CpE program relies on the assessment data received from the two departments where each department uses a different assessment methodology as outline below.

The EEE department uses a set of performance indicators, called Course Outcomes (COs), to assess (when applicable) all or a set of SOs in each course, and the CSc department uses a set of performance indicators from all the courses to assess the SOs for the entire program. The CSc department does not assess SOs in each course. In both cases the assessment instruments are direct and include exam questions, assignments, and/or projects.

For each course where COs are assessed the assessment data is first mapped to SOs using the template shown in Table 2 (Course SOs), where an "X" in any cell would indicate how an SO is assessed in each course. Two or more X's in a single column would indicate the SO is assessed using multiple COs. The data from all such maps is mapped to all the SOs, as illustrated in Table 3, to assess the CpE Program SOs, as required by ABET.

Table 2 Course SOs: Example Mapping Course Outcomes to Student Outcomes (for Courses Taught By EEE Department)

Course Outcome (CO)	Student Outcome (SO)										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
1											
2											
3											
4											
. . .											

Place an X in each cell where the Course Outcome assesses the Student Outcome.

For courses that performance indicators are used to assess the SOs for the entire program, the assessment instruments (exam questions, assignments, and/or projects) directly measure the performance of each student on each of the indicators. Multiple indicators from multiple courses are used to assess all the SOs, as also illustrated in Table 3. The quantitative assessment results in Table 3 as well as the inputs from the College Assessment Committee and ABET are used for continuous improvement of the SOs as illustrated by the flowchart shown in Figure 2.

Table 3 CpE Program SOs: Example Mapping of CSc Performance Indicators (PIs) and EEE Course Outcomes (COs) to CpE Student Outcomes (SOs)

Student Outcome (SO)	Courses Taught by CSc Faculty				Courses Taught by EEE Faculty			
	Course 1 PIs	Course 2 PIs	Course 3 PIs	…	Course A COs	Course B COs	Course C COs	…
a								
b								
c								
d								
e								
f								
g								
h								
i								
k								

Place an X in each cell where a set of performance indicators CSc department or Course Outcomes from EEE department assesses a Student Outcome (SO).

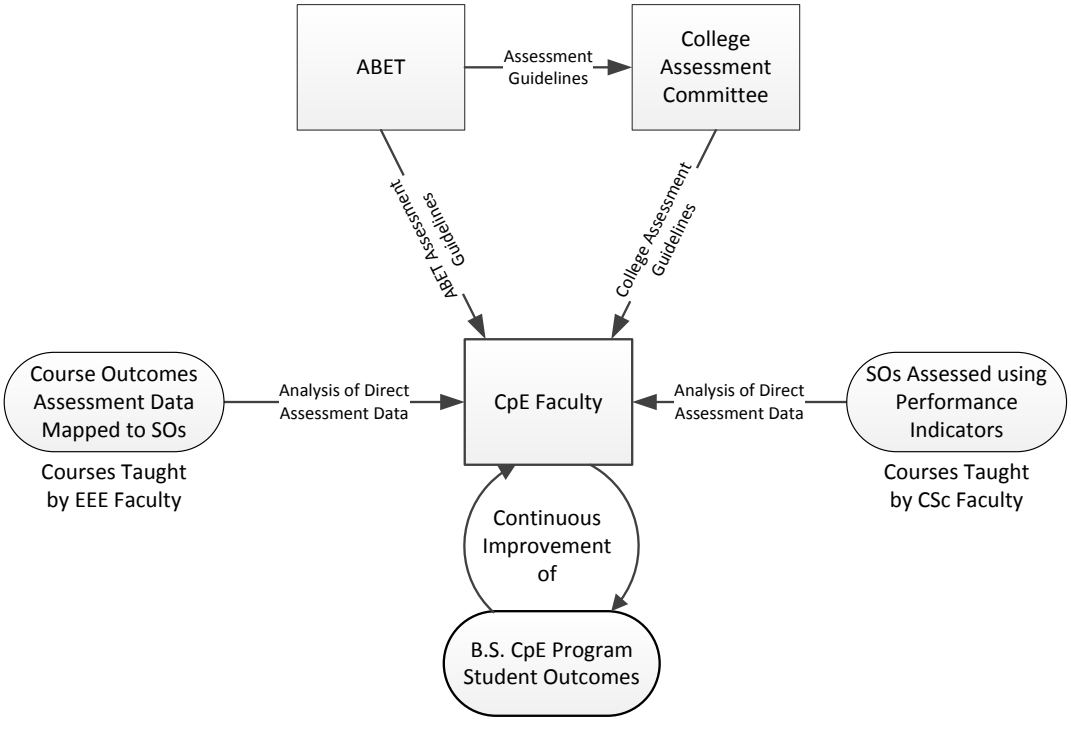

Figure 2 Flowchart of B.S. Student Outcomes Assessment

Assessment of CpE Graduate Programs

The CpE M.S. degree requirements includes Plan A (Masters Project), Plan B (Thesis), or Plan C (Comprehensive Exam).

M.S. Program Educational Objectives

1. Graduates will be capable of integrating undergraduate fundamentals and advanced knowledge to solve complex Computer Engineering related problems
2. Graduates will be prepared for professional advancement in computer engineering. They will have the ability to pursue continuous learning and identify, understand, and apply new knowledge within the field.
3. Graduates will have the ability to undertake a research and development project and to document the work in clear and effective manner, appropriate to the standards in the field.
4. Graduates will have the ethics and the communication skills to be an effective team member.

The process used to periodically review the M.S. PEOs is shown in Figure 3.

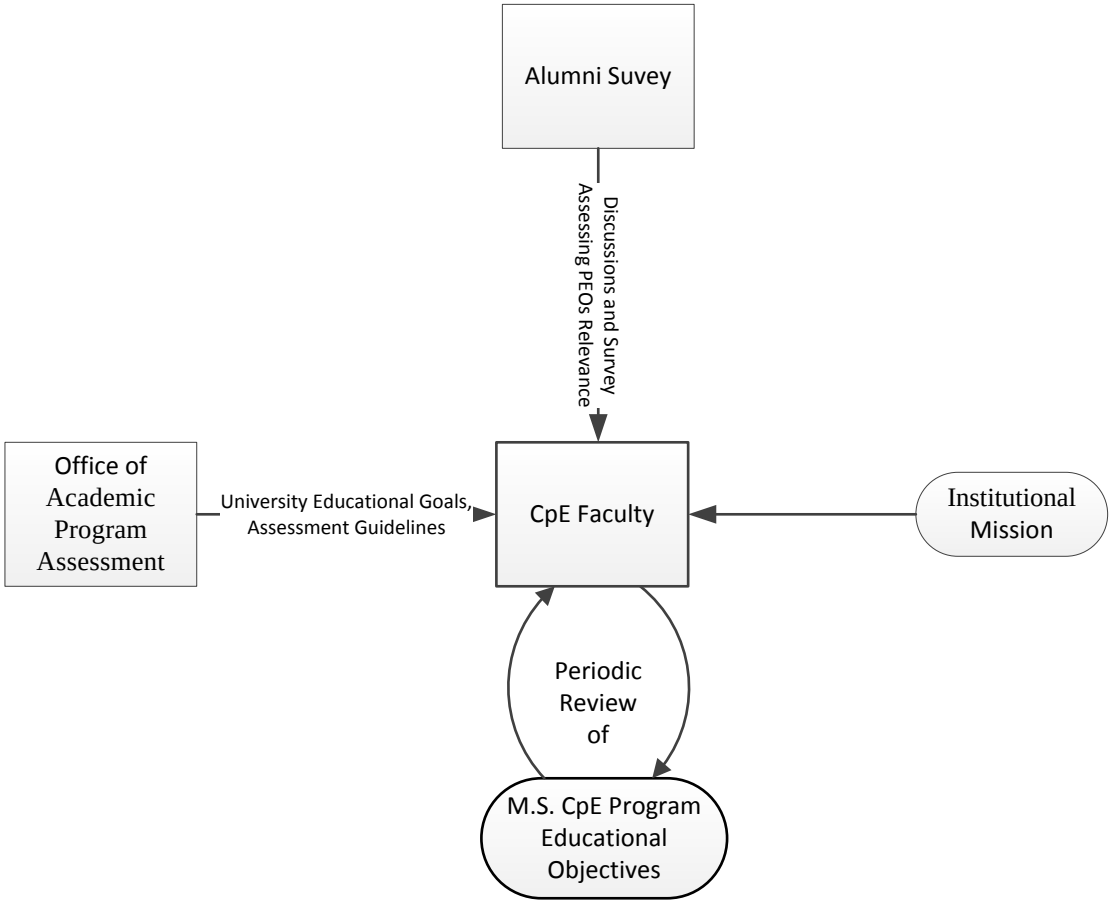

Figure 3 Flowchart of M.S. Program Educational Objectives Assessment

M.S. Student Outcomes

a. Problem Solving: Graduates apply knowledge from their undergraduate and graduate computer engineering studies and related disciplines to solve complex computer engineering problems that require advanced knowledge within the field.

b. Critical thinking: Graduates understand and integrate new knowledge within the field.

c. Creative thinking: Graduates can plan and conduct projects on advanced topics within the field.

d. Written communication: Graduates can report on advanced topics within the field.

e. Integrative and applied learning: Graduates can work as a team in a diverse changing world.

f. Civic knowledge and engagement: Gradates recognize the ethical standards, and possess skills for effective communication.

Figure 4 illustrates the process used to assess the M.S. degree SOs.

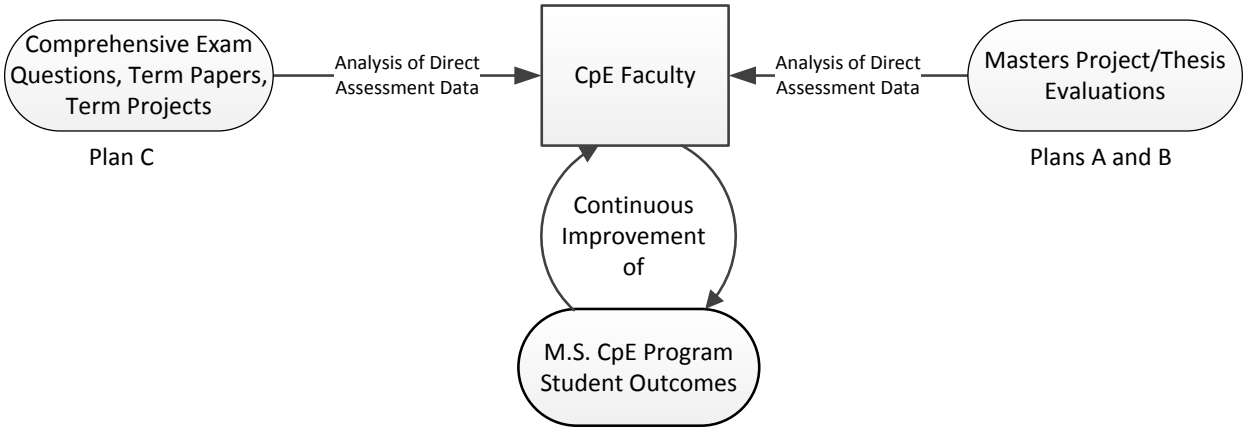

Figure 4 Flowchart of M.S. Student Outcomes Assessment

CPE 190: Senior Design Project I

1. **Course number and name:** CPE 190- Senior Design Project I
2. **Credits and contact hours:** 2-4
3. **Instructor's or course coordinator's name:** Fethi Belkhouche
4. **Text book:** Textbook not required
   a. Additional reading:
      - Design for Electrical and Computer Engineers, R. Ford and C. Coulston, McGraw-Hill Science/Engineering/Math; 1st edition, 2007.
      - Practical Engineering Design, M. Bystrom and B. Eisenstein, CRC Press; 1st edition, 2005.
5. **Specific course information**
   a. **Catalog description:** Centers on developing hardware and software project planning and engineering design skills. Emphasis is placed on design philosophies, problem definition, project planning and budgeting, written and oral communication skills, working with others in a team arrangement, development of specifications and effective utilization of available resources. Lecture one hour per week, laboratory three hours per week.
   b. Prerequisites or co-requisites: CPE 142, CPE 166, CPE 186, CPE 187, EEE 102, and (GWAR Certification before Fall 09, or WPJ score of 70+, or at least a C- in ENGL 109M/W).
   c. Required course
6. **Specific goals for the course**
   a. Course outcomes
      After successfully completing this course, students will be able to
      1. Identify and evaluate a societal problem that needs an engineering solution.
      2. Use basic project management methods and software tools such as Microsoft project for planning and management.
      3. Design a working laboratory prototype of a system/device/process that addresses a societal problem under realistic constraints such as cost and safety requirements.
      4. Communicate effectively in written and oral forms
      5. Work effectively in a team.

b. Relationship of the student outcomes with the course outcomes:

Course Outcomes	Student Outcomes										
	a)	b)	c)	d)	e)	f)	g)	h)	i)	j)	k)
1.					x			x		x	
2.								x			x
3.	x		x		x						x
4.							x				
5.				x							

- Student outcome (a): students apply knowledge of mathematics, science and engineering in the design process during the development of their project, (related to course outcome 3).
- Student outcome (c): students design a working prototype of a system that addresses a societal problem under realistic constraints such as cost and safety requirements, (related to course outcome 3).
- Student outcome (d): students work in groups ranging from 3 to 5 team members, (related to course outcome 5).
- Student outcome (e): students identify a societal problem that needs an engineering solution, perform research and formulate a solution with desired specification requirements to solve the problem, (related to course outcomes 1 and 3).
- Student outcome (g): students perform presentations and write reports to describe and document their work, (related to course outcome 4).
- Student outcome (h): students use project and risk management tools to plan their project and predict project impact, students develop a system that solves a societal problem and assess its impact on society, (related to course outcomes 1, 2).
- Student outcome (j): students gain knowledge of contemporary issues through research, identification and evaluation of a current societal problem that needs an engineering solution, (related to course outcome 1).
- Student outcome (k): students use project management techniques and engineering tools and techniques to plan and solve the societal problem (related to course outcomes 2 and 3).

7. **Brief list of topics to be covered**

- The engineering design process
- Work breakdown structure.
- Project evaluation and review technique (PERT) and Gantt chart.
- Risk assessment and risk mitigation, decision making.
- Teams and team work.
- Technical writing and oral communication.

Assessment Rubric: Senior Design I

Learning Objectives	Senior Design assignment to assess outcome	1 = Below expectation	2 = Meets expectation	3 = Exceeds expectation
Use basic project management methods and software tools such as Microsoft project for planning and management.	Work breakdown structure PERT and Gantt chart Continuous update of Gantt chart	The work breakdown structure, PERT or Gantt chart does not reflect the project, some components of the project, or the relationship between components.	The work breakdown structure, PERT and Gantt chart reflect the deliverables, tasks and the time line adequately, and project management software tools are used effectively.	Effectively use other management tools in addition to those discussed in classroom/assignment.
Design a working laboratory prototype of a system/device/process that addresses a societal problem.	Final demonstration	The device/ system does not satisfy the requirements specifications, major features or components are not working properly	All major components of the device/ system are working properly according to the requirements specifications	The design satisfies all specifications, student began working on optimizing the design and moving it towards a deployable prototype.
Design under constraints such as cost, safety, and environmental requirements.	Design idea Final report	Student is not aware/does not mention constraints in the design idea or final report	Student is aware of some constraints and discuss them briefly in the design idea or final report	Student discusses designing under various constraints in the design idea/final report in some details, and shows good understanding of the importance of the real world constraints.
Communicate effectively in written and oral forms	Written assignments Oral presentations. Weekly reports End of term documentation/presentation	Unable to document or present work effectively.	Reports are effectively written, clear, concise and complete, and the author is able to convene the essential ideas to the reader. Presentations are effective based on audience feedback.	Reports may be accepted for a peer reviewed publication, and presentation is comparable to professional conference presentations
Work effectively in a team.	Course integrates EEE and CpE students Each student is a team leader for at least 6 weeks. Team leader evaluation Team members evaluation	Teammates have problems working together. Team is not effective.	Team members may face some issues but surmount them and are able to work effectively on the project.	The team is highly effective, teamwork goes smoothly, issues and problems are unnoticed by the instructor.

CPE 191: Senior Design Project II

1. **Course number and name:** CPE 191- Senior Design Project II
2. **Credits and contact hours:** 2-4
3. **Instructor's or course coordinator's name:** Fethi Belkhouche
4. **Text book:** Textbook not required
   a. Additional reading:
      - Design for Electrical and Computer Engineers, R. Ford and C. Coulston, McGraw-Hill Science/Engineering/Math; 1st edition, 2007.
      - Practical Engineering Design, M. Bystrom and B. Eisenstein, CRC Press; 1st edition, 2005.
5. **Specific course information**
   a. **Catalog description:** Continuation of CPE 190. Students are expected to continue the project started by design teams in CPE 190. The hardware will be completed, tested and redesigned if necessary. At the same time, software for the project will be finished and debugged. The final results of the team project will be presented to the CPE faculty and students at a prearranged seminar. Lecture one hour, laboratory three hours.
   b. Prerequisites or co-requisites: CPE 190, and (GWAR Certification before Fall 09, or WPJ score of 70+, or at least a C- in ENGL 109M/W).
   c. Required course
6. **Specific goals for the course**
   a. Course outcomes
      After successfully completing this course, students will be able to
      1. Address the limitations and improve the prototype designed in CPE 190 (Senior Design Project I).
      2. Develop a testing plan and use contemporary tools to test the prototype.
      3. Perform market analysis.
      4. Show an understanding of ethical and professional issues.
      5. Communicate effectively in written and oral forms
      6. Work effectively in a team

b. Relationship of the student outcomes with the course outcomes:

Course Outcomes	Student Outcomes										
	a)	b)	c)	d)	e)	f)	g)	h)	i)	j)	k)
1.	x		x		x				x		x
2.		x									x
3.								x		x	x
4.						x					
5.							x				
6.				x							

- Student outcome (a): students apply knowledge of mathematics, science and engineering in the design and improvement of their system (related to course outcome 1).
- Student outcome (b): students develop a testing plan, perform experiments and interpret results to validate the design (related to course outcome 2).
- Student outcome (c): students design a working prototype of a system that addresses a societal problem under realistic constraints such as cost, safety and environmental requirements (related to course outcome 1).
- Student outcome (d): students work in groups ranging from 3 to 5 team members (related to course outcome 6).
- Student outcome (e): students continue working on the initial design, identify potential problems and address them, (related to course outcome 1).
- Student outcome (f): lectures on ethics (related to course outcome 4).
- Student outcome (g): students perform presentations and write reports to describe and document their work (related to course outcome 5.)
- Student outcome (h): students perform market analysis to study the market potential and the economic impact of the project (related to course outcome 3).
- Student outcome (i): continuous improvement of the system/device (related to course outcome 1).
- Student outcome (j): students study the current market and the state of the industry related to their senior design product/system through market analysis, (related to course outcome 3).
- Student outcome (k): students use skills, tools and techniques to solve the societal problem, validate and test the device/system and assess its market potential (related to course outcomes 1, 2 and 3).

7. **Brief list of topics to be covered**

- System testing and validation
- Market review
- Life-long learning
- Engineering ethics
- Intellectual property

Assessment Rubric: Senior Design II

Outcomes	Senior Design assignment to assess outcome	1 = Below expectation	2 = Meets expectation	3 = Exceeds expectation
Address the limitations of the initial design and improve it	Design idea revision report Midterm review Final demonstration	Student fails to see the limitations of the initial design or improve it	Student shows a better understanding of the problem requirements and the design and performs effective revisions and improvements of the initial design	Student is able to perform effective revision and improvement of the design resulting in a deployable prototype
Develop a testing plan and use contemporary tools to test the prototype.	Device test plan Midterm review	Fail to develop a testing plan for the major features of the system or fail to execute the plan effectively.	Develop a clear functionality and integration testing plan and execute it effectively	Develop a clear and complete functionality, integration, and acceptance testing plan and execute it effectively
Perform market review and analysis.	Market review	Fail to develop an accurate market review	Perform market review and analysis using SWOT (strengths, weaknesses, opportunities, threats) method.	Perform a complete market review and analysis using SWOT and other methods
Show an understanding of ethical and professional issues.	Lecture on Ethics (quiz/questionnaire) Student team member evaluations Outgoing team leader report	There are issues such as cheating, plagiarism, or unprofessional conduct. Student fails to describe the basics of engineering ethics.	Student is able to describe the general principles of ethics and ethical professional standards and the engineer's obligation to society and to clients.	Student is able to use formal methods such as line drawing and flow charting to analyze more complex ethical issues.
Communicate effectively in written and oral forms	Written assignments Oral presentations. Feature presentation and report Weekly reports End of term/end of project documentation/presentation	Student is unable to document or present work effectively.	Reports are effectively written, clear, concise and complete, and the author is able to convene the essential ideas to the reader. Presentations are effective based on audience feedback.	Report may be accepted for a peer reviewed publication, and presentation is comparable to professional conference presentations
Work effectively in a team	Course integrates EEE and CpE students Each student is a team leader for at least 6 weeks. Team leader evaluation Team members evaluation	Teammates have problems working together. Team is not effective.	Team members may face some issues but surmount them and are able to work effectively on the project.	The team is highly effective, teamwork goes smoothly, issues and problems are unnoticed by the instructor.
Engage in lifelong learning to solve engineering problems.	Semester long based on instructor observations.	Student lacks initiative and independence and needs substantial guidance from the instructor	Student shows a great deal of independence and is able to transfer previous knowledge and use various resources such as the internet and peer reviewed articles effectively.	Student takes the initiative to investigate/research solutions independently and is able to transfer knowledge and use various resources such as the internet and peer reviewed articles effectively.