Washington State University
School of EECS
Electrical Engineering Course Assessment Report

Course Number: EE 416
Course Title: Electrical Engineering Design
Semester Offered: Fall 2005
Instructor: Scott S. Campbell
10th Day Enrollment: 24
Number Completing Successfully (C grade or better): 20

I. Assessment Outcomes from the Course Syllabus

☐ (A) Ability to apply knowledge of mathematics, science and engineering.
☐ (B) Ability to design and conduct experiments as well as analyze and interpret data.
☐ (C) Ability to design a system, component, or process to meet desired needs.
☒ (D) Ability to function on multidisciplinary teams.
☒ (E) Ability to identify, formulate, and solve engineering problems.
☒ (F) An understanding of professional and ethical responsibility.
☒ (G) Ability to communicate effectively in written and oral formats.
☒ (H) A broad education necessary to understand the impact of engineering solutions in global, economic, and societal context.
☐ (I) Recognize the need for, and have the ability to engage in lifelong learning.
☐ (J) Have a broad education and knowledge of contemporary issues.
☒ (K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.

II. List of Course Topics

1. Project management.
2. Teamwork – individual responsibilities for communication and progress.
3. Assessing team and individual progress.
4. Handling changes to design from mentors or from experience.
5. Team communication with mentors.
### III. Course Assessment Summary Table: one row of the table should be devoted to each of the checked outcomes in part I.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Description</th>
<th>Specific Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>(D) Ability to function on multidisciplinary teams.</td>
<td>The teams were, by their very nature multi-disciplinary. Each student arrived in EE416 with a previously assigned project team from EE415 with typical complement of 3 or 4 students. These teams included students with diverse interests (e.g. digital circuits, analog circuits, power, hardware, electrophysics, computer engineering, etc.)</td>
<td>1) Each team participated in weekly meetings with the instructor for face-to-face assessment of their progress, challenges, and development plans. 2) Each student was required to prepare a self-evaluation and peer evaluations of their team members at the end of the semester.</td>
</tr>
<tr>
<td>(E) Ability to identify, formulate, and solve engineering problems.</td>
<td>Each team of students was required to complete an engineering design project. This project required the team to be the primary problem-solving entity for a specific engineering problem as assigned in EE415.</td>
<td>1) Each team was required to participate in oral and written (individual) progress reports on a weekly basis. 2) As part of the project, a presentation before a panel with working demonstration prototype and a written final report was required.</td>
</tr>
<tr>
<td>(F) An understanding of professional and ethical responsibility.</td>
<td>Students arrive in EE416 with experience in ethics and responsibility from EE415. Each team was counseled on a weekly basis regarding various issues of teamwork including ethics and professionalism.</td>
<td>1) Each team makes a formal presentation before a panel of mentors and WSU faculty where each team is evaluated on their solution to the problem. This includes not just whether they solved the problem, but also their methodology including professionalism and ethics.</td>
</tr>
</tbody>
</table>
## IV. Using the table as a guide, for each outcome summarize your evaluation of the students’ achievement of that outcome; cite student performance on the identified measures as evidence to support your conclusions.

### (D) Ability to function on multidisciplinary teams.

Each student arrived in EE416 with a previously assigned project team from EE415 with typical complement of 3 or 4 students. These teams included students with diverse interests (e.g. digital circuits, analog circuits, power, hardware, electro-physics, computer engineering, etc.)

For the most part, the students functioned well in their teams. Most found that there were one or two members that they might not have selected on their own with which to work. However, many of these people realized the valuable learning experience in finding ways to work cooperatively under this challenge.

There were a couple of instances where it was clear that certain individuals did not get along well with their teams. During the weekly team meetings, these teams were able to keep the difficulty under cover through approximately half of the semester. Eventually, the friction became so high that the problem became obvious. In two of these cases, multiple intensive meetings with the team were required to resolve the differences and return the teams to action. Both teams were able to successfully complete their project.

These experiences are reflected in the relative responses to the peer evaluations.
(E) Ability to identify, formulate, and solve engineering problems.
Each team of students was required to complete an engineering design project. This project required the team to be the primary problem-solving entity for a specific engineering problem as assigned in EE415. Based on the weekly evaluations, some students clearly did not invest the required 9 hours per week on their design project. Even though they could see the detriment to falling behind with the time/activities schedule, some teams did not perform consistently. Teams needed to make more effective use of project management tools such as frequently updated Gantt charts. One team in particular fell so far behind that they needed to pare back the features and functionality of their project. That team did not receive the required passing grade of C for their project.

(F) An understanding of professional and ethical responsibility.
Students arrive in EE416 with experience in ethics and responsibility from presentations in EE415. Presentations such as intellectual property rights and various references to quality and reliability give students a grounding in this matter. Each team was counseled on a weekly basis regarding various issues of teamwork including ethics and professionalism. This was relevant in a couple of groups where individuals were found to not be carrying their weight.

(G) Ability to communicate effectively in written and oral formats.
Each team attended weekly meetings with the instructor to discuss the progress of the project and to deal with any issues that might be impairing the team’s progress. At these meetings, each student was required to deliver a written progress report indicating their personal advances during the week along with the team’s overall progress. Some students tried to cover lack of work during a given week with a sweepingly generalized discussion of the work that they had accomplished. This was easily overcome by oral questioning during the team meeting. This often led to a discussion of responsibility to team as described in criteria F above.
Finally, each team made a formal presentation and demonstration of their project before a panel of evaluators. This involved oral presentation skills, as well as written with the panel reviewing their documents at the presentation.

(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.
Mentors and faculty resources directed the teams to modern engineering tools such as RF modeling software, printed circuit board design software, ZigBee development kits, Matlab and digital design software.
Several teams established direct communications with developers and manufacturers of various products and resources used in their projects. This proved to be challenging for one team in particular whose industry contact was in Scandinavia.
V. Qualitative Assessment of Student Performance: using the arguments above and other data support the claim that students who completed this course with a grade of C or better have achieved each of the intended outcomes of this course.

Those students who received a grade of C or better have demonstrated competence in their field of study through practical application of skills. Dealing with the competing daily challenges of the undergraduate university experience, they were placed in a simulated industry environment with a real project and a real deadline. All but one of the teams rose to the occasion.

On the whole, mentors were very pleased with the work performed by their assigned project teams. Mentor evaluation scores ranged from 87% to 100% for all but the weakest team who was scored at 73%.

The teams’ presentations were very well received by a very critical panel of mentors and WSU faculty members. This panel commented on the generally high quality of the presentations and awarded scores of 82% to 88% for all but the weakest team which was scored at 51%.

The teams’ weekly meetings with the instructor were not intended to be solely critical, but were to be supportive and encouraging to the teams whenever possible. This is probably what led to the fairly narrow scoring range of the students at between 70% and 85%.

The peer evaluations were typically beneficial for the students. However, this was an appropriate opportunity for team members to return poor evaluations for individuals who ultimately impeded the team’s progress during the semester. As expected there was a wide range of scoring in this category from 47% to 100%. Those with high scores had worked very hard within the team structure and were respected by their teammates.

Considering the wide array of grading information sources, the final scoring for this class is done via statistical measurement. Hence, the center of the C range was the class mean, with a grade width of 1/3 standard deviation. Each grade segment above and below consisted of an additional 1/3 standard deviation such that the center of the B range was 1 standard deviation above the center of the C range and the center of the A range is 1 standard deviation above the center of the B range.

In a class where the grade range is contracted within the perimeter of 2 standard deviations, I choose to raise the base scores for the entire class until the top score reaches an A+. I then reflect on the grade shift and make certain that this proposed final grade is reasonable and appropriate for all class members. That was indeed the case for this class.

VI. Concerns: state any concerns you may hold about this class – were the students adequately prepared coming into it? Are there topics or outcomes where (some) students were weak after completing the course? Other concerns? Were there any comments on students’ course evaluations that should be addressed in future instances of the course? This section is very important for improving our program: it provides critical input to the curriculum committee for identifying areas requiring attention.

There are 4 basic concerns for EE416 in the future:

1) There is concern that some of the students are not adequately prepared for the range of tasks that will be required of them in EE416. Most, but not all, of the electrical engineering projects require some level of programming in order to come up with a completed operational demonstration prototype. Several students expressed concern that they didn’t have the programming background they needed to launch right into their work – for example, programming a micro-controller. This is a concern, as many of the projects involve programming components, however, it seems few students come into the class with more than one introductory programming course under their belts. In discussions with a few
people in industry, it appears that many will need more programming skills in their work than they realize at this point in time. Even if additional programming isn’t strictly required, but strongly suggested, this could help alleviate this situation.

2) There seems to be a collegiate mentality of some students that is difficult to shape or modify. It was difficult for them to view the project as anything more than another hoop that they were required to do within the framework of the University. While being technically true, it seems that some of the experience of this class is lost on the students who cannot (or will not) view this as an opportunity for (off-the-job) on-the-job training. It seems that those who were able to make the cognitive leap and approach this more like a job than just another college class, showed more respect for their work, their teammates, and ultimately themselves.

3) In review of student’s other responsibilities, it became clear that a few were taking 3rd year courses during the EE415 and EE416 sequence in order to “catch-up” on what they needed to know for their “senior” projects. This seems counterproductive, in general, as now they have even greater pressure on them to learn material for their project – the same learning with twice the workload. Is it the case that these students believe that they have to take a class in order to learn a subject? Or is it the case that they find it easier to have it all laid out for them by an instructor in a formal setting? Perhaps this is not limited to this college, but, rather is a wide-spread phenomenon across the campus. If so, perhaps the University should consider a 1 hour class on learning new skills on your own. Although that seems a bit like an oxymoron, perhaps that’s the only way the skill may be learned – and ultimately, the initiative taken.

4) It is extremely difficult for an instructor to be pulled into this class at the last minute – or later. This class requires preparation in advance of the semester start to have all of the laboratory space identified and assigned, grading criteria fully formulated, and team meeting times scheduled so that they may begin the very first week of class – if not sooner. The confusion experienced this semester was mentioned by several students on their class evaluation forms.

Signature

Date:

Please email a copy of the completed form to Patricia Arnold, patricia@eecs.wsu.edu and deliver a signed hardcopy to her mailbox.