Washington State University
School of EECS
Electrical Engineering Course Assessment Report

Course Number  EE 261
Course Title    Electrical Circuits I
Semester Offered Fall 2006
Instructor      John B. Schneider
10th Day Enrollment 48 Number Completing Successfully (C grade or better) 31

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 life long 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 from the Course Syllabus
1. Definitions and units; resistors; Ohm's Law; Kirchhoff's Laws; dependent sources; operational amplifiers.
2. Nodal analysis; mesh analysis; Thevenin and Norton equivalent circuits; maximum power transfer; superposition.
3. Capacitors and inductors; integro-differential circuit equations.
4. First order circuits; step functions; second order circuits.
5. Sinusoidal steady state analysis; single- and three-phase circuits.
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>Topics</th>
<th>Specific Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Ability to apply knowledge of mathematics, science and engineering.</td>
<td>1</td>
<td>HW 1, HW 2, HW3, HW5, HW 5, HW 7 Test 1, Test 2, Test 4</td>
</tr>
<tr>
<td>(A) Ability to apply knowledge of mathematics, science and engineering.</td>
<td>2</td>
<td>HW 3, HW 4, HW 5, HW 6, HW 7, HW 8 Test 1, Test 2, Test 4</td>
</tr>
<tr>
<td>(A) Ability to apply knowledge of mathematics, science and engineering.</td>
<td>3</td>
<td>HW 8 Test 2, Test 4</td>
</tr>
<tr>
<td>(A) Ability to apply knowledge of mathematics, science and engineering.</td>
<td>4</td>
<td>HW 8, HW 9, HW 10, HW 11, HW 12 Test 2, Test 3, Test 4</td>
</tr>
<tr>
<td>(A) Ability to apply knowledge of mathematics, science and engineering.</td>
<td>5</td>
<td>HW 11, HW 12, HW 13, HW 14 Test 3, Test 4</td>
</tr>
<tr>
<td>(E) Ability to identify, formulate, and solve engineering problems.</td>
<td>1 (op-amps)</td>
<td>HW 5, HW 6, HW 7 Test 2</td>
</tr>
<tr>
<td>(E) Ability to identify, formulate, and solve engineering problems.</td>
<td>4</td>
<td>HW 8, HW 9, HW 10, HW 11 Test 2, Test 3, Test 4</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.

(A) Ability to apply knowledge of mathematics, science and engineering.

As the first true course in the electrical engineering curriculum, there was a broad mix of abilities among the students. Of the 48 students who started the course, 31 ultimately completed it with a grade of C or better. This represents an attrition rate of approximately 35 percent. The students who ultimately did complete the course generally showed a good ability to apply math, science and engineering knowledge. The students were permitted, although not encouraged, to collaborate on the homework and hence the homework was not as precise a gauge of the students' abilities as were the tests. For the students completing the course with a grade of C or better, the average on the first test was 81, for the second test it was 78, for the third test it was 76, and for the fourth test (which was a comprehensive final) it was 72. These tests were by no means trivial and these scores could not be obtained without having a sound overall ability to apply math, science and engineering skills to these problems.

(E) Ability to identify, formulate, and solve engineering problems.
The discussion for (A) also pertains here. However, it was observed that although the students could generally solve problems on the tests which were similar to ones that they had seen on the homework or could solve problems on the homework that were closely aligned to material covered in lecture, when problems were slightly out of the ordinary or required the student to incorporate multiple techniques, their performance would drop. Nevertheless, the students typically did well with the op-amp problems on the test. Coming into the class the students did show some weakness with differential equations (i.e., they either had not been adequately prepared or had forgotten a large amount of what they had supposedly learned). However, they typically could solve the relatively simple first- and second-order circuits in this class. Where they struggled the most was in obtaining initial conditions from the circuit itself and recognizing which circuit quantities could and could not change instantaneously. Pulsed sources, such as considered in problem 2 of test 3 and problem 4 of test 4, were difficult for the students. In any case, considering that this was the first course in the major, the students who completed the course did demonstrate an ability to solve a fairly broad range of engineering problems but, as one would expect, the students were more likely to stumble as the problems became more and more open-ended.

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.

The discussion above about the students' performance on the tests is relevant to this point. The test scores of those completing the course with a grade of C or better was generally quite good. The lowest test average of 72 was on the comprehensive final (which had a slight emphasis on complex power and sinusoidal steady state). It should be noted that I am not generally a lenient grader when it comes to the exams. The tests certainly probed the students' understanding of nearly all the material covered in lecture. Students who completed the course with a C would typically get on the wrong track in their solution of a problem or two on the test and not be able to get back on the right track in the time allotted for the test. Nevertheless, these students would generally recognize that they had taken a wrong turn somewhere and would, I believe, be able to obtain the right answer given more time or a slight nudge in the right direction.

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.

Clearly, around a third of the students starting the class were either not properly prepared or were not properly motivated to complete the course. I am not aware if this rate of attrition is typical for this course. I also am not aware of the backgrounds of the students who dropped or failed the course (e.g., having transferred or taken course WSU). On the other hand, the students who did complete the course with a grade of C or better were typically adequately prepared (or were sufficiently motivated to overcome any shortcoming in their preparation). There was not one area which stood out in terms of student weakness. The students' ability to solve somewhat open-ended or seemingly new problems was occasionally not ideal, but that is to be expected at this level. After completing the course I believe the students were better able to solve open-ended problems but still have a long way to go. In this particular offering of the course we did not cover three-phase power. Given that they cover this in EE 361, it was felt it was more important to
spend more time on other topics that to rush through three-phase power. So, obviously, the students completing the course were “weak” in terms of three-phase power.

It seems with this course there isn't enough time to cover a sufficient number of example problems in lecture. Thus, were I to teach the course again, I would probably try to implement a weekly, optional problem solving/answer session. I believe many students would benefit from this.

I might suggest that we consider permanently removing three-phase power from this course. There is plenty of material here to fill the semester without that. Given that the students cover that in detail in EE 361 and, at best, only cover it tersely in EE 261, such a change would not likely compromise the students' ultimate understanding of three-phase and would help to put them on a more sound foundation in terms of electrical engineering and circuit fundamentals.

I have not yet obtained the student evaluation forms, so I cannot comment on that feedback.

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.