Washington State University
School of EECS
Electrical Engineering Course Assessment Report

Course Number   EE 362
Course Title   Power Systems Laboratory I
Semester Offered  Spring 2007
Instructor   Hudson
10th Day Enrollment 10  Number Completing Successfully (C grade or better) 10

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. Nonlinear magnetic circuits.
2. Single phase transformers.
3. Three phase transformer connections.
4. DC machines.
5. Synchronous machines.
7. Three phase induction motors.
8. Project.
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 - 8</td>
<td>Lab 8</td>
</tr>
<tr>
<td>(B) Ability to design and conduct experiments as well as analyze and interpret data.</td>
<td>1 - 8</td>
<td>Lab 8</td>
</tr>
<tr>
<td>(G) Ability to communicate effectively in written and oral formats.</td>
<td>1 - 8</td>
<td>Lab 11 write up</td>
</tr>
<tr>
<td>(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.</td>
<td>1 - 8</td>
<td>Lab 9</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.

All labs required application of engineering knowledge – in particular the theory developed in EE 361. I chose Lab 8 as a specific example. In this lab the students were given single-phase and three-phase induction motors. They were told to set up and perform DC, no-load and blocked-rotor tests with only rough guidelines for the applied voltages and currents (e.g., not to exceed the rated values). From the measured data they were then to derive electrical models for the two motors. Finally they were to predict the maximum power each could deliver at rated voltage and the corresponding slip and torque.

This lab required application of knowledge of the electrical model of an induction motor, how to use circuit theory to derive the parameters from measurements and how to use circuit theory and mechanics to use that model to predict power and torque as a function of spin rate. Scores on this assignment ranged from 82% to 100%. Students performed calculations and modeling individually.

(B) Ability to design and conduct experiments as well as analyze and interpret data.

I also chose Lab 8 to serve as a measure for Outcome (B). This lab required students to figure out and set up test configurations for performing DC, no-load and blocked-rotor measurements. Students worked in teams of two or three to set up and run the experiments, so there was a potential “free-rider” problem. To avoid this the teams were instructed to break up the wiring and configuration into discrete tasks which were assigned in turn to team members. Scores on this assignment ranged from 82% to 100%.
(G) Ability to communicate effectively in written and oral formats.

All labs required a lab write up. I chose the Lab 11 write up as a specific measure. This lab tasked students to measure the torque vs. speed characteristics of a three-phase induction motor, to compare this to theory and to present their findings with appropriate calculations and graphs. Scores ranged from 75% to 100%. Obviously the lower scoring write ups could have been improved, but I consider that even the lowest scoring write up demonstrated an adequate ability to communicate effectively.

(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.

Outcome (K) applied more or less to all the labs. I chose Lab 9 as a specific measure for this. In this lab students explored the behavior of compact fluorescent lights. In particular they observed how for a non-linear load such as this the interpretation of power factor, as measured by a power meter, is not straight-forward. Students used power meters and sampling oscilloscopes to study the detailed I-vs-V and power characteristics of CFLs. They then developed spreadsheets to calculate the effects on required power plant capacity and carbon emissions in the U.S. that would result from widespread adoption of CFLs for household use. They also ran a cost-benefit for consumers. Based on their work on this lab, I felt that the students achieved this outcome.

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.

As I have argued above, all students achieved each of the listed outcomes. This being a lab course, outcome (B) was particularly important. All labs required some elements of all the outcomes, so the overall course grades are also a strong measure of outcome achievement. There were three (3) “A,” four (4) “A-,” two (2) “B,” and one (1) “B-” given.

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.

Student enjoy the hands-on aspect of lab courses and this group of ten was highly motivated. With lab courses where the students work in teams I am always concerned about one student dominating the experiment while the others fail to gain the types of experience the lab is intended to convey. Mandating rotating responsibilities for tasks such as wiring, controls and data logging helped somewhat. However, I believe that having students work individually on experiments will be the only way force all students to develop the full range of lab experiences and competencies that I would like to see them all acquire.

Signature: Scott Hudson Date: 2007-05-11

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