Washington State University  
School of EECS  
Electrical Engineering Course Assessment Report

Course Number  EE 494  
Course Title  Protective Relay Laboratory  
Semester Offered Fall 2007  
Instructor  Aleksandar Dimitrovski  
10th Day Enrollment 13  Number Completing Successfully (C grade or better) 13

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 from the Course Syllabus

EE 494 is a 2 credit, senior level, laboratory course in the department of Electrical Engineering at WSU. This course was usually offered every Fall semester, concurrently with the companion theory class, EE 493, but last year both courses were rescheduled for the following semester, Spring 2007. The optimal number of students given the lab resources is 9, but frequently more students are allowed to take the course due to the increased interest. Last semester the number of students was 14, with one student auditing.

This course includes 10 different experiments designed to implement theoretical concepts and augment the material taught in EE 494. The students perform experiments with commercial relays under various simulated conditions to demonstrate their protective capabilities, test them, and to verify theoretical findings. They also get introduced to the use of protection related software. The students work in groups of 3 or less to perform the following assignments, on which they prepare 9 written reports. One combined written report is required for experiments 2 and 3.
1. Introduction. Wire heating and fuse elements
2. DOBLE relay test equipment
3. Auxiliary relays
4. ASPEN OneLiner fault simulation
5. Fault computations in looped systems
6. Electromechanical time overcurrent relays
7. ASPEN OneLiner relay coordination
8. Directional electromechanical overcurrent relays
9. Digital overcurrent relays
10. O/C relay coordination in looped systems

The first experiment introduces students to the protection fundamentals: wire heating, damage curves and fuses. Four of the other nine experiments are about specific types of relays: auxiliary, electromechanical overcurrent, digital overcurrent, and directional electromechanical relays. In three of the experiments students use the academic version of Aspen software to simulate faults in power systems, calculate settings for the relays and check the results. Aspen software in its full version is commonly used by industry and utilities for protection purposes. Finally, one of the experiments is dedicated to the use of the Doble relay testing equipment, a device also commonly used in professional world.

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>(B) Ability to design and conduct experiments as well as analyze and interpret data.</td>
<td>1-10</td>
<td>Lab reports, Quizzes</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.

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

The students who take this class are interested in power and they generally perform quite well. This was the case this last semester as well. Students find the protection aspect of power systems an important practical issue and they try to understand and conduct the experiments thoroughly. After completion of all assignments it appeared that the students are quite able to design experiments learned in the course and apply them in practical circumstances.
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 evidenced in their lab reports, students were quite successful in the analysis of the data and interpretation of the results. Their overall performance in the lab was also very good. At the end, they all got grade A- or better.

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.

1. The electromechanical relays used in the lab are quite worn out and need replacement. It seems that some of the relays that were left from the protective system retrofit on the WSU campus can be used for this purpose.
2. Two important topics are missing in the EE 493/494 syllabi. An introduction to distance relays and grounding principles.
3. The capacity of the lab is 12 students, 4 workstations with 3 students each. If more students are allowed to take the course, it should be acknowledged by opening another section and allocating time, and not left to the instructor to deal with the scheduling problems.

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.