Course Number: EE 331  
Course Title: Electromagnetic Fields and Waves  
Semester Offered: Fall 2006  
Instructor: Shira L. Broschat  
10th Day Enrollment: 39  
Number Completing Successfully (C grade or better): 32

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.  
- (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

1. Introduction to electromagnetics.  
2. Transmission lines.  
3. Vector analysis.  
4. Electrostatics.  
5. Magnetostatics.  

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>
</table>
| (A) Ability to apply knowledge of mathematics, science, and engineering. | 1-6 | Exams #1-#3  
Final, Part 1  
Homework #1-#14 |
| (E) Ability to identify, formulate, | 1-6 | Exams #1-#3 |
and solve engineering problems.

Final, Part 1
Homework #1-#14

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
(E) Ability to identify, formulate, and solve engineering problems

The three exams given during the semester, the fourteen homework assignments, and part 1 of the final exam all served as measures of outcomes (A) and (E). Exams were written with a target average of between 70% and 75%. On the first exam, the average was 85.35%; on the second it was 79.13%; on the third it was 69.41%; and on part 1 of the final (which is really just a fourth exam on the material covered following the third exam) it was 76.79%. I do not think these exams were easier than the exams I have written in previous years. I think rather that the quality of the students was somewhat higher than in previous years. The relatively low score on the third exam was probably a result of the number of projects due and the number of other exams administered during the same week, which was the week before Thanksgiving break. In addition to the average exam scores being higher, the standard deviation was smaller than usual on two of the four exams.

In contrast to the exam scores, the average homework scores (70.41%) were lower than in previous years (typically 75-80% and sometimes even higher). I think the reason is, in part, because I asked the teaching assistant to deduct points for incorrect vector notation, absence of units, and omitted primes. I hoped this would encourage students to be more careful. Judging from the difference between their first exam and last exam, this seems to have been the case. Also, when homework scores of those who failed the course are omitted, the average increases to 74.94%. Homework assignments were comprised of a mixture of problems from the book and problems written by me. Problems written by me were meant to offset the possibility that the solutions manual was available to students.

A basic competency test (BCT) was administered five times, once each week during the second through sixth weeks. This test requires students to review (or learn!) the basic math skills covered from middle school through the first two years of college. In addition, the ability to convert to and from phasor form is tested. The test is comprised of twenty questions, and students must answer all twenty questions correctly to pass. If they do not pass by the sixth week, they must withdraw from the course. The BCT is not included in the course grade.

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.

On the first day of class 41 students were registered for EE 331. Ten of these were students repeating the course for the first or second time. Two of the students did not have the required prerequisite courses and had to withdraw. Of the 39 remaining students, 34 students took the final exam. Two of these students failed the course. Thus, of the original 39 students who qualified to take the course, 32 passed. These 32 students all passed the BCT as required. None
of them had below 50% on an exam. Finally, on the comprehensive final exam (described below), their average score was 64.12%. The previous time I taught this course, the average was 55.47%.

The comprehensive assessment exam is a quasi-standardized test designed to assess the students’ overall knowledge and understanding of the material presented in EE 331. The assessment exam was given as half of a two-part final, each half weighted equally. The assessment exam counted toward 12.5% of the course grade. It was closed book, and only pencils, erasers, and a straight-edge were allowed. The exam was composed of 75 questions each worth 1 point. The questions consisted of fill-in-the-blank, mix-and-match, multiple choice, true/false, identification, and conversion from phasors to instantaneous form and vice versa. Students were given up to one hour to complete the exam.

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.

Consistent with every other time I have taught this course, the mathematical ability of the students was, on average, lower than desirable. My belief is that students depend far too much on calculators, and the increasing sophistication of calculators seems to correlate with the increasing lack of mathematical ability. For example, I recall being surprised when students did not immediately recognize that the sine of 0 is 0. Now I find that students are having an increasingly difficult time integrating. They do not even try. Instead they type the integrand into their calculators and write down the answer displayed. Some students even seem to have difficulty understanding the meaning of integration limits. To pass this course, students had to achieve a minimum proficiency with advanced mathematical skills, but I am not sure these skills will be retained.

Several years ago, we reorganized the material covered in EE 331 and the second-semester EM course, EE 351. At that time we moved the topic of transmission lines from EE 351 to EE 331 and decided not to cover the part of plane wave propagation that we had previously covered in EE 331. Instead we moved the topic of plane waves to EE 351. However, I have found it necessary to use 12 lectures to cover transmission lines. In contrast, plane waves were covered in 4-6 lectures. As a result, we try to cover too much material in EE 331. I believe it would be better for our students if we reorganized the material in EE 331 and EE 351 once again. I realize this will not be possible for the spring term, but we should probably try to do so by the fall 2007 term.

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.