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

1. Maxwell’s equations and the wave equation.
2. Plane wave propagation, transmission, and reflection, polarization.
3. Waveguides, fiber optics, resonators.
4. Antennas, antenna arrays.
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 - 5</td>
<td>Midterm and final exams</td>
</tr>
<tr>
<td>(C) Ability to design a system, component, or process to meet desired needs.</td>
<td>3, 4</td>
<td>HW#7, problem 11.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HW#12, problem 13.42</td>
</tr>
<tr>
<td>(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.</td>
<td>5</td>
<td>HW#11, problems 13.12 &amp; 13.26</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.

Essentially all homework and exam problems require students to apply knowledge of mathematics, science and engineering. Due to the control the instructor has over the environment in which they are completed, exams form a more rigorous assessment tool than homeworks. I have therefore chosen the two exams as the specific measures for outcome A. Midterm scores were: 87, 92, 94, 76, 65. Final scores were: 90, 97, 91, 84, 92. Based on these scores I conclude that all five students achieved this outcome.

(C) Ability to design a system, component, or process to meet desired needs.

Design in 351 is essentially at the component level and typically involves determining the optimal value(s) of one or more free parameters. It is a relatively small part of the course. I have chosen two homework problems to serve as an assessment for this outcome. In problem 11.54 students designed a microstrip line to have a specified impedance. In problem 13.42 students designed a radar transmitter to achieve a desired received signal power. All five students were able to arrive at correct solutions for both problems. Based on this I conclude that all five students achieved this outcome.
As part of problem 13.12 students used Matlab/Scilab to plot the radiation pattern of a dipole. In 13.26 they used Matlab/Scilab to investigate a two-element antenna array. They plotted the antenna pattern and numerically determined the angles of maximum and minimum radiation. All five student were able to use the math tools to obtain graphical and numerical results. Based on this I conclude that all five 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.

All students performed achieved acceptable measures for the three outcomes A, C and K. This course is mostly concerned with outcome A which was measured using exam scores. Midterm exam scores ranged from 65 to 94 while final exam scores ranged from 84 to 97. The student who scored 65 on the midterm was not fully achieving this objective during the first part of the course. He took his midterm score as a wake-up call, devoted more time to study and scored 92 on the final. Based on these results, students completing this course with a grade of C or better achieved the intended outcomes.

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.

EE 351 requires students to use multi-variable calculus and complex numbers to a great extent. They use complex numbers in several other courses, but EM is the only subject in which they use gradient, divergence, curl and so on. In light of that it might not be surprising that this area of math is their biggest weakness in this course. More math review during the first weeks might be necessary.

To the extent that 351 involves design it is at the component level and typically involves determining the optimal value(s) of one or more free parameters. It might be advisable to remove this from the list of course outcomes.

Signature Todd Garlick
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.