Washington State University
School of EECS
Electrical Engineering Course Assessment Report

Course Number        EE 351
Course Title         Distributed Parameter Systems
Semester Offered     Spring 2006
Instructor           M. Osman
10th Day Enrollment: 37    Number Completing Successfully (C grade or better) 36

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. Maxwell’s equations and wave equation.
2. Plane wave propagation in free space and lossy media.
3. Normal and oblique incidence of plane waves
4. Rectangular waveguides
5. Resonators
6. Cylindrical waveguides: Fiber optics
7. Antennas: Dipole and antenna arrays
8. Numerical methods: Finite difference, finite element, moment and/or Monte Carlo methods.
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>all</td>
<td>Exam 1, Exam. 2, Exam 3</td>
</tr>
<tr>
<td>(C) Ability to design a system, component, or process to meet desired needs.</td>
<td>4,5,6,7</td>
<td>Exam 3</td>
</tr>
<tr>
<td>(E) Ability to identify, formulate, and solve engineering problems.</td>
<td>4,5,6,7</td>
<td>Exam 3 and homework assignments on numerical methods.</td>
</tr>
<tr>
<td>(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.</td>
<td>7,8</td>
<td>Exam 3</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.

Mathematics, science, and engineering permeate nearly all topics in EE351. All topics listed in the table are especially pertinent with respect to the students’ ability to apply knowledge of mathematics, science, and engineering. Students studied Maxwell’s equations and solutions of the wave equations under different boundary conditions. The class also studied engineering devices closely related to these science topics including the waveguides and antennas, both important to optical and wireless communication. Exam 1 measured student performance on Topics 1, 2, and 3. Subjects listed on the study sheet for Exam 1 that are pertinent to Outcome “A” include: Wave equation, wave propagation in free space and lossy media, and normal and oblique incidence of waves on an interface. Figure 1 shows a histogram of Exam 1 scores.

![Figure 1: Grade Distribution](image)
The four lowest scores in Figure 1 are 50, 50, and 54 and 55%. It is difficult to argue that these three students had acceptable ability to apply knowledge of mathematics, science, and engineering. This exam exposed a weakness in their ability to solve wave equation, the use of phasor notation and the concept of waves. As these concepts were repeatedly emphasized during the course only one student dropped out of the class. From the Exam 1 results, all students completing EE321 with C or better grade appear to have suitable ability to apply knowledge of mathematics, science, and engineering.

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

During the study of waveguides and antennas, as part of home work assignments and exams students designed waveguides to meet desired cutoff frequencies. Students determined the appropriate dimensions of the waveguide and whether the waveguide supports TE or TM modes. They also determined the required input power to account for losses in the waveguide in order to meet the power needed at the output antenna. The understanding of these concepts was measured by their performance in homework and exam 3.

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

This assessment report interprets “engineering problems” as those related to engineering devices or systems. Typical engineering devices analyzed in this course are antireflection coatings, waveguides, antennas, optical fibers, resonators. These are essential components of communication and radar systems. The coverage of engineering devices is spread throughout EE351; however, Exams 2 and 3 focused on waveguides and antennas. Thus Exam 3 covers essential topics related to communications systems. It appears logical to claim that a student passing Exam 3 has shown an ability to identify, formulate, and solve engineering problems. Figure 2 shows a histogram of Exam 3 scores.
(K) Ability to use techniques, skills and modern engineering tools necessary for engineering practices.

Many homework problems required students to use the modern software packages such as MATLAB, Excel, and programming languages. The topic on numerical methods required students to write codes using MATLAB or a programming language. Students receiving C or better in the course showed good performance in homework assignments and relevant problems in the exams which demonstrates that they were capable of using techniques, skills and modern engineering tools necessary for engineering practices.

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.

Exam scores have supported the hypothesis that students completing EE351 with C or better are suitably equipped to 1) apply knowledge of mathematics, science and engineering; 2) design a system, component, or process to meet desired needs; 3) identify, formulate, and solve engineering problems; 4) use techniques, skills and modern engineering tools necessary for engineering practices.

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.

Many students starting EE351 had marginal knowledge of Numerical methods and MATLAB. Many also had weak skills in programming languages such as C and how to apply them for solving engineering problems. Programming classes should do a more thorough job of integrating MATLAB and programming languages into the EECS curriculum. Course evaluations showed notable comments on 1) programming component contained in homework problems made the homework sets too long and 2) The EE351 instructor should cover examples of MATLAB programming, 3) text book should have more examples.

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.