Department of Electrical and Computer Engineering
New Jersey Institute of Technology

ECE 362: Electromagnetic Fields II (3 credits, 3 contact hours, required course)

Instructor: Gerald Whitman; email: whitman@njit.edu; Tel.: 973-596-3232

Text books:

Course Description:
Maxwell’s equations solutions in terms of plane waves, reflection and refraction of plane waves in
dielectric and conducting media, total internal reflection and total transmission of plane waves at the
dielectric interface, transmission lines; transients and frequency domain solutions in lossy and lossless
lines, Smith chart and its applications, impedance matching; parallel plate and rectangular waveguides
and introduction to optical fibers.

Prerequisite: ECE students - ECE 361   Co-requisite: none

Specific course learning outcomes (CLO): The student will be able to

1. understand fundamentals of Faraday’s Law and Maxwell’s equations and their general
   solutions in time varying fields;
2. formulation of plane waves as simplest solutions to Maxwell’s equations, reflection of plane
   waves at conducting boundaries, reflection and refraction of plane waves at dielectric
   interfaces for normal and oblique incidence as well as concepts of total internal reflection and
   total transmission for horizontal and parallel polarizations;
3. formulation of telegrapher’s equations and their general solutions in time and frequency
   domains;
4. Transient solutions of transmission lines in time domain for resistive terminations utilizing
   lattice diagrams;
5. Frequency domain solutions at steady state for time harmonic excitations with complex
   terminations, Smith Chart and its applications to transmission lines and impedance matching
   using parallel and serial stubs;
6. Parallel plate and rectangular waveguides and introduction to optical fibers utilizing modal
   solutions if sufficient time is available.

Relevant student outcomes (ABET criterion 3):

(1) an ability to identify, formulate, and solve complex engineering problems by
   applying principles of engineering, science, and mathematics (CLO 1, 2, 3, 5)
(4) an ability to recognize ethical and professional responsibilities in engineering situations
   and make informed judgments, which must consider the impact of engineering solutions in
   global, economic, environmental, and societal contexts (CLO 1, 4)
(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data,
   and use engineering judgment to draw conclusions (CLO 1, 2, 3)
(7) an ability to acquire and apply new knowledge as needed, using appropriate
   learning strategies (CLO 1, 3, 4)
Computer assisted design and course specific software: None

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<tr>
<th>Tentative Course Schedule</th>
<th>Weeks</th>
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<tr>
<td>Faraday’s Law, Maxwell’s Equations, Boundary Conditions, Wave Equation for Time Harmonic Fields</td>
<td>1-2</td>
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<td>Plane Waves in Lossless and Lossy Media, Group Velocity, Dispersion, Poynting Vector</td>
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<td>Normal Incidence at a Plane PEC Oblique Incidence at a Plane PEC Normal Incidence at Single and Multiple Plane Dielectric Boundaries Oblique Incidence at Plane Dielectric Boundaries, Total Internal Reflection and Total Transmission</td>
<td>5-6</td>
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<tr>
<td>Review and Examination I</td>
<td>7</td>
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<td>Transmission Line (TL) Equations Lossless TL, Low-loss TL and Distortionless TL Transients on Resistive Terminated Lines</td>
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<td>Smith Chart Impedance</td>
<td>10</td>
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<td>Matching Review and</td>
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<td>Examination II</td>
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<tr>
<td>Parallel plate and rectangular waveguides and introduction to optical fibers utilizing modal solutions if time permits</td>
<td>13-14</td>
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**Formula Sheets:** Two for exam I, four for exam II, six for final.
In own handwriting, no derivations, no worked out examples, no calculations, no illustrative examples.
Permitted: definitions, units, formulas, geometry that define parameters in formulas; equivalent circuits.

**Homework Policy:** The problems will be assigned and checked. Students are expected to solve all assigned problems. Solutions will be provided and discussed in class. The text contains numerous examples. Students are required to study these examples for practice.

**Attendance:** Required at class lectures and problem solving sessions.
Lateness to class: Unacceptable.
Cellular phones and Beepers: Shut off or in quiet mode.

**Updates and Assignments** to be distributed via e-mail.

**Office Hours:** to be announced as well as by appointment.

**Grading policy:** Two class examinations: 30%, 30%; Final examination: 40%. Homework, quizzes class, participation: 0-10% (add or subtract);

**Honor Code:** The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students.

**Office:** MIC Bldg., Room 405
**Prepared by:** G. Whitman