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ECE 362 - Electromagnetic Fields II

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Department of Electrical and Computer Engineering

New Jersey Institute of Technology

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

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

Text books:

D. K. Cheng, *Fields and Wave Electromagnetics*, 2nd ed., Addison-Wesley, 1989. ISBN: 0-210-12819-5

J. Edminister and M. Nahvi-Dehordi, *Electromagnetics*, 3rd ed., Schaum's Outlines, McGraw Hill,2010. ISBN: 978-0-07-163235-5

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):

(a) an ability to apply knowledge of mathematics, science, and engineering (CLO 1, 2, 3)

(b) an ability to design and conduct experiments, as well as to analyze and interpret data (CLO 1, 2, 3)

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (CLO 1, 4)

(i) a recognition of the need for, and an ability to engage in life-long learning (CLO 1, 3, 4)

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (CLO 5)

Computer assisted design and course specific software: None

Tentative Course Schedule	**Weeks**
Faraday's Law, Maxwell's Equations, Boundary Conditions, Wave Equation for Time Harmonic Fields	1-2
Plane Waves in Lossless and Lossy Media, Group Velocity, Dispersion, Poynting Vector	3-4
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	5-6
Review and Examination 1	7
Transmission Line (TL) Equations Lossless TL, Low-loss TL and Distortionless TL Transients on Resistive Terminated Lines	8-9
Smith Chart Impedance	10
Matching Review and	11
Examination II	12
Parallel plate and rectangular waveguides and introduction to optical fibers utilizing modal solutions if time permits	13-14

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