ABET COURSE OUTLINE

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Department of Electrical and Computer Engineering
New Jersey Institute of Technology

Academic Year: **2023-2024**
Term: **Fall 2023**

Course Instructor: ***Oksana Manzhura***

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office hours/open classroom workshop:

office hours and extra sessions schedule provided separately by email and posted on class CANVAS page 24/7 by e-mail. *Extra WEBEX online office meetings available upon request.*

Course Number and Title: *ECE 362: Electomagnetic Fields II – Waves Propagation*

(3 credits, 3 contact hours, required course)

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 Catalog Description (including prerequisites and co-requisites):

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 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)

Course Outline:

Week	Chapter/ Sections	Topics	Problems*
	Review Chapter 4	Review of Static Electro-Magnetic Fields	**TBA**
1	**-6**	**Select problems from chapters 5 and 6 to be assigned.**	
2	**Ch 7/pp307-310,**	Faraday's Law, Motional EMF with examples , Ampere's Current Law correction,	**7-2, 4a, 5, 7**
3	**Ch 7/ pp314-338**	Maxwell's Equations, Vector and Scalar Potentials, Boundary Conditions	**7-10,11,1,18, 19**
4	**Ch. 7/pp338-347**	Wave Equation for Time Harmonic Fields Plane Waves. Transverse Waves.	**7-23, 25, 27, 30**
5	**Ch. 8/pp354-373**	Plane Waves in Lossless and Lossy Media, Polarization	**8-4, 5b, 6** *(assume permittivity of air)*,
	Ch. 8/pp375-379	Group Velocity, Dispersion,	**10a**
	Ch8/pp379-386	Poynting Vector	**8-11,16,17,20**
6	**Ch. 8/pp379-390**	Normal Incidence at a Plane PEC	**8-21,22**
	Ch. 8/pp.390-397	Oblique Incidence at a Plane PEC	**8-24**
	Ch. 8/pp397-406	Normal Incidence at a Single and Multiple Plane Dielectric Boundaries	**8-27,30,32,33**
	Ch. 8/pp.406-419	Oblique Incidence at Plane Dielectric Boundaries	**8-35,36,39,40,41,46**
7		Midterm I	
8	**Ch.9/pp.437-441**	Transmission Line (TL) Equations	**9-5**
	Ch.9/pp.441-444	Lossless TL, LowLoss T L and Distortionless TL	**9-9- 11,12,14,15**
	Ch.9/pp.449-471	Waves on Tenninated Lines *In 9-14 assume ZL=RL* *In.9-30 do not use 9-153(a) and (b) other than to check your result; assume β=90° with β known)*	**(Z_L=Zo), 18, 21, 27, 30, 31.**
9	**Ch.9/pp.471-485**	Transients on lossless TL *In 9-38 replace Ro by R in 2nd sentence and in Fig.9-46 add terminal resistor R after the switch*	**9-36, 38**
10	**Ch.9/pp. 485-497**	Smith Chart *Additional Smith Chart Problems Handed out.*	**9-43,45**
11	**Ch.9/pp.497-505**	Impedance Matching	**9-48,49**
12		Midterm II	
13	**Ch.10/pp. 520-534**	Waveguides	**10-1, 2**
	Ch.10/pp. 534-543	Parallel Plate Waveguides••	**10-3,5,7,11**
	Ch.10/pp. 547-555	Rectangular Waveguides••	**10-14,16,17**

Grading Policy:

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Two class examinations:	30%, 30%
Final examination:	35%
Homework, Pop quizzes, class participation:	5%
Extra Credit Project	10%

Attendance is mandatory

Recorded videos will be uploaded to CANVAS with corresponding PDF notes.

Occasional and optional Problem Solving sessions may be offered in addition. Records (if available) and notes will be uploaded.

All students are required to complete all assigned homework. Pop quizzes may be provided based on homework problems.

Tests and final exams are closed notes and books, formula sheets will be provided for tests and final.

Tests will be carried out in person while proctored by instructor or/and TA. No late submission will be accepted.

Honor Code: The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students. All solutions of test problems must be carried out in FULL form, no intermediate formula solutions will be accepted. All solutions must be carried out in the given class/test/problem notation. No change in notation or formulations will be accepted. Cases of similar modifications for multiple students in the same test will be reason for instantaneous failure of the course.

NJIT Honors Code may be reviewed at this link:

https://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf