PHYS 3515 ENGINEERING ELECTROMAGNETICS (3 credit hours)

Elmira College

SUMMER 2024

Required Text:
Aziz Inan, Ryan SaidUmran, S Inan, ***Engineering Electromagnetics and Waves***, Wesley, 2nd ed., 2012.
Supplemental readings will be included to illustrate or expand on textbook readings.

Pre-requisites: MATH 3375 Differential Equations for Engineers; MATH 3009 Introduction to Calculus III; PHYS 2400 Principles of Electricity and Magnetism

Course Description

Engineering Electromagnetics is designed to provide students with a comprehensive understanding of electromagnetic theory and its applications in engineering. This course covers fundamental principles of vector analysis, time-harmonic fields, electromagnetic wave propagation, transmission lines, waveguides, antennas, circuits, and impedance matching. Through theoretical concepts and practical applications, students will gain proficiency in analyzing and designing electromagnetic systems used in communication and radar systems.

Course Objectives and Goals

- Understand the principles of vector analysis and its application in electromagnetic theory.
- Analyze time-harmonic fields and their behavior in various mediums.
- Investigate electromagnetic wave propagation phenomena and its application in communication systems.
- Evaluate transmission lines characteristics, including signal temporal and spatial dependencies, line parameters, input impedance, transient behavior, and reflection coefficients.
- Apply impedance matching techniques using transformers, stubs, and Smith charts analysis.
- Comprehend Maxwell's equations and wave equations in electromagnetics.
- Explore different modes of electromagnetic wave propagation (TEM, TE, TM).

Evaluation of Performance

Your grade will be based upon your performance on exams, assignments, and participation.

Class Participation	10%
4 Labs	40%
2 Quizzes	10%
Midterm Exam	20%

Final Exam	20%
Total	100%

Grades will be assigned as follows:

A	93% and above	B-	80 - 82%	D+	67 - 69%
A-	90 - 92%	C+	77 - 79%	D	63 - 66%
B+	87 - 89%	C	73 - 76%	D-	60 - 62%
B	83 - 86%	C-	70 - 72%	F	59% or below

Withdrawal Policy: Please see Elmira College Bulletin for information on this policy.

Academic Honesty: Please read the section on Academic Honesty in the **Code of Conduct**. Briefly, academic dishonesty includes: cheating, fabrication, facilitating academic dishonesty, and plagiarism. Ask if you have any questions on whether something constitutes as academic dishonesty. All work must be original and new. Past assignments from current or other courses will not be accepted. Academic dishonesty will not be tolerated. It will result in zero on the assignment, and a report will be filed with the school. Continued practice will result in failure of the class. Institutional penalties may also apply with repeated acts of academic honesty.

Student Responsibility:

- It is your responsibility to keep track of assignments and due dates.
- You should ask questions concerning assignments and lectures, if you need any clarifications.
- If you are struggling in class, have concerns, and/or unsure about expectations, please stop by during office hours or make an appointment for another time.

Tentative Schedule of Topics

Topic	Materials	Tasks & Evaluations
Vector Analysis in Electromagnetics	Chapter 1	
Time-Harmonic Fields	Chapter 2	
Electromagnetic Wave Propagation Principles	Chapter 3	Lab 1: Investigating Electromagnetic Wave Propagation in Free Space and Different Media
Transmission Line Theory	Chapter 4	
Gauss law, Voltage, Laplace's Equation, Capacitance	Chapter 5	Quiz 1
Divergence, Gradient, Integral Forms, Green's Formula	Chapter 6	
Transmission Line Cascades, Tees, Reactive Loads	Chapter 7	Lab2: Characterizing Transmission Line Cascades and Impedance Matching Techniques

Input Impedance Analysis	Chapter 8	
Reflection Coefficients and Standing Wave Ratio	Chapter 9	
Impedance Matching Techniques	Chapter 10	Midterm Exam
Transformers in Impedance Matching	Chapter 11	Lab 3: Application of Transformers for Impedance Matching in Transmission Lines
Stub Matching Analysis	Chapter 12	
Smith Chart Applications	Chapter 13	
Maxwell's Equations	Chapter 14	Quiz 2
Wave Equations in Electromagnetics	Chapter 15	
Faraday's Law, Maxwell Equations, Planar Waves	Chapter 16	
Poynting Vector, Medium Bondary, Guided Propagation	Chapter 17	Lab 4: Measurement of Poynting Vector and Electromagnetic Field Interaction with Boundaries
Stoke's Theorem, Flux Linkage, Inductance and Magnetic Coupling	Chapter 18	
TEM Wave Propagation, TE and TM Wave Modes	Chapter 19	
Rectangular Waveguide Characteristics	Chapter 20	Final Exam