WEST VIRGINIA UNIVERSITY
College of Engineering & Mineral Resources
Lane Department of Computer Science & Electrical Engineering

EE 345   Engineering Electromagnetics
Fall 2014

Instructor: Dr. M. A .Jerabek   Phone: 293-9695
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Office Hours: MWF 10-11am, TTh 3:30-4pm
Class Time: 2-3:15 pm Tue. and Thurs.   Class   location   ESB   801
:   **Prerequisites:**   Physics 112, Math 261

Text: Elements of Electromagnetics, Matthew N.O. Sadiku, 6th Ed.,Oxford,2015.

Description: PR: MATH 261, PHYS 112. Introduction to electromagnetic theory and applications. Transmission line transient and steady state analysis, Maxwell's equations, plane waves, wave interaction with materials and boundaries, electrostatics and magnetostatics.

Objectives: To provide students with the physical and engineering fundamentals of electromagnetic waves in transmission lines, bounded, and unbounded media, and static electric and magnetic fields.

Outcomes: Students will be able to successfully engage in problem solving and understand at a basic level TEM transmission lines, plane waves propagation in unbounded and bounded media, behavior in lossy materials, and basic electric and magnetic fields necessary for EM wave understanding in the above contexts. In addition, the student will become aware of the broad technological/application impact of electromagnetics, and the environmental implications of electromagnetics design (e.g. interference, radiation safety, etc).

Tentative Lecture Schedule:

Lecture (approx)	Subject Topic
	Background and Motivation
1.	Central role of electromagnetics in EE,
2.	Electromagnetic Waves , Lumped & Distributed Circuits, Maxwell's Eqns.
	Waves on Transmission Lines
	Transient Excitation of Transmission Lines
3.	Heuristic Discussion of Transmission Line Behavior and Circuit Models, Transmission Line Equations & Wave Solution
4.	Reflections at Discontinuities, Transient Response of Lossless Line with Resistive Termination
5.	Transient Response of Reactive Terminations
6.	Time Domain Reflectometry, Transmission Line Parameters
	Steady State Waves on Transmission Lines
7.	Current and Voltage Wave Solutions, Open and Short Circuited Lines
8.	Lines Terminated with Arbitrary Impedance, Power Flow on Transmission Lines
9.	Impedance Matching and the Smith Chart
10.	----------------------- EXAM 1 --------------------------
	Fields and Currents
	Electrostatics
11.	Electric Charge Concepts, Coulomb's Law and the Electric Field, Electrostatic Scalar Potential
12.	Flux Density and Gauss' Law
13.	Metallic Conductors

| 14. | Laplace and Poisson Equations, Dielectrics and Capacitance |
| 15. | Boundary Conditions and Energy Density |

Steady Electric Currents

| 16. | Current Density and Conduction, Current Flow, Ohms Law, and Resistance |
| 17. | EMF and Kirchoff's Voltage Law, Continuity Equation and Kirchoff's Current Law, Joule's Law, Dielectric Relaxation |

Magnetostatics

18.	Lorentz Equation and B, Biot-Savart Law and Applications
19.	Ampere's Circuital Law, Divergence of B, Magnetic Flux
20.	Magnetic Forces and Torques , Magnetic Dipoles, Magnetic field in Materials, B, H, and M - Boundary Conditions

Electromagnetic Waves

Time Varying Fields and Maxwell's Equations

21.	Faraday's Law, Motional EMF, Inductance and Energy in Magnetic Fields
22.	Displacement Current and Maxwell's Equations in point and Integral Form
23.	----------------------- EXAM 2 -------------------------

Plane Waves in Unbounded and Bounded Media

24.	General plane EM waves, time harmonic TEM waves
25.	Plane Waves in Lossy Mediums
26.	Power Flow in general media
27.	Reflection of Plane Waves at Normal Incidence
28.	Multiple Reflections – antireflection & matching
Final Exam Week	----------------------- FINAL EXAM ---------------------------

RULES OF OPERATION FOR EE 345

General: Attendance will be taken intermittently by sign-in sheet and used in grading. The lectures will explain, expand upon, and supplement the assigned reading material and will in many instances provide background information for assignments from Sadiku and other sources, therefore, attendance is strongly recommended. Handouts, verbal instructions and demonstrations cannot always be scheduled in advance but will occur when appropriate for the topic. Students missing a class are responsible for all material covered.

Grading: Semester grades will be computed roughly as follows:

| Homework and quizzes: | 15% (approx. 7 to 9 assignments) |
| Examinations: | 25% + 25% + 35% (final) |

Tests will seek to determine your level of mastery of fundamental principles and methods developed in the lectures, text, and reinforced/expanded upon through homework assignments. Grades will generally be 90-100%=A, 80-89% = B, 70-79% = C, etc. The approximate dates of in-class exams are the 7-8th and 11-12th weeks. Actual dates will be chosen in class.

Homework sets: All graded homework sets will be given 10 points per set. Unexcused late homework will loose 10 points per day late. Students are encouraged to discuss homework problem methodologies but must submit their own assignments completed individually. Plagiarized assignments will be severely penalized if detected, and if not, punishment is always self-inflicted during exams. If you do not fully understand any material, see me promptly.

Academic Honesty: Students are expected to exhibit the same level of professionalism and integrity that will distinguish them in their future careers. Your signature on homework and examination papers attests to your completion of the work in an ethical and professional manner. A statement to this effect will be placed as a reminder on all examinations and is implicit when you place your signature on homework assignments. Cases of academic dishonesty will be handled promptly pursuant to Department and University policies.

West Virginia University is committed to social justice. I concur with that commitment and expect to foster a nurturing learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with Disability Services (293-6700).