ESE 319: Electromagnetics and Transmission Lines
Fall 2017

2016-2017 Catalog Description:

Fundamental aspects of electromagnetic wave propagation and radiation, with application to the design of high speed digital circuits and communication systems. Topics include: solutions of Maxwell's equations for characterization of EM wave propagation in unbounded and lossy media; radiation of EM energy; guided wave propagation with emphasis on transmission line theory.

Course Designation: Required

Text Books:
Fundamentals of Applied Electromagnetics (7th ed), Fawwaz T. Ulaby, Eric Michielssen, Umberto Ravaioli, Prentice Hall (2015), ISBN-13: 9780132139311

Prerequisites: ESE271

Students should have a good understanding of complex algebra, vector calculus and, basic circuit analysis techniques.

Coordinator: **Harbans Dhadwal**

Goals:

The goal is to establish a fundamental understanding of electromagnetic wave propagation and its importance in the design of electronic circuits and communication systems.

Course learning outcomes:

- Transmission line fundamentals
- Application to high speed digital circuits and communication systems
- Electromagnetic wave propagation
- Radiation and antennas

Topics Covered:

Week 1	Introduction, EM spectrum, EM puzzles, complex numbers RLC circuits, speed of signal transmission,
Week 2	Current flow in conductors, space and time Transmission lines, Telegrapher's equations
Week 3	Terminations, reflection coefficient, Smith Chart
Week 4	Lossy and dispersive line. Vectors and co-ordinate systems
Week 5	Electrostatics – Coulomb, Gauss's

Week 6	Dielectric materials, capacitance Magnetostatics, magnetic fields, Ampere's law
Week 7	Magnetic forces, emf, inductance, Boundary conditions and Laplace Equation
Week 8	Time varying fields
Week 9	Maxwell's equations, time harmonic EM wave
Week 10	EM wave propagation - plane wave solution , polarization
Week 11	EM wave propagation in lossy medium, Reflection and transmission
Week 12	Radiation fields: Short dipole antenna – antenna characteristics, Radiation power and resistance
Exams	Two tests and Final

* More detail can be added as needed.

Class/laboratory Schedule: Lecture: 1hr 20min/2 days per week

PROGRAM OUTCOMES AND ASSESSMENT	% contribution*
On the following "3 a-k" list, please check those topics which are covered within the course:	
✓ (a) ability to apply knowledge of math, engineering, and science	75
❑ (b1) ability to design and conduct experiments	
✓ (b2) ability to analyze and interpret data	5
❑ (c) ability to design system, component or process to meet needs	
❑ (d) ability to function on multi-disciplinary teams	10
✓ (e) ability to identify, formulate, and solve engineering problems	
❑ (f) understanding of professional and ethical responsibility	
✓ (g) ability to communicate effectively	5
❑ (h) broad education	
❑ (i) recognition of need an ability to engage in life-long learning	
❑ (j) knowledge of contemporary issues	
✓ (k) ability to use techniques, skills, and tools in engineering practice	5
❑ Any other outcomes and assessments?	

* Assume that the total contribution of any course will be 100%. Use the right hand column to indicate the approximate percent that the left hand columns contribute to the overall course.

Document Prepared by: Harbans Dhadwal
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