ECE 303 Syllabus

Course: ECE 303
Credit Hours: 3
Course Title: Electromagnetic Fields
Course Description:

This course prepares you to formulate and solve electromagnetic problems relevant to all fields of Electrical and Computer Engineering and that will find application in subsequent courses in RF circuits, photonics, microwaves, wireless, computers, bioengineering, and nanoelectronics. Primary topics include static electric and magnetic fields, Maxwell's equations and force laws, wave propagation, reflection and refraction of plane waves, transient and steady-state behavior of waves on transmission lines.

Prerequisite(s): A grade of C- or better in ECE 211 and ECE 220

Textbook(s) and/or other required material:

Engineering Electromagnetics, by Umran Inan and Aziz Inan, 1999, Prentice Hall

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1. Distinguish between distributed and lumped element circuits (Transmission lines).
2. Explain the concepts of wavelength, characteristic impedance, and space dependence of voltage and current.
3. Write transient solution equations and analyze transients in transmission line circuits by using the bounce diagram.
4. Write steady state solution equations and analyze transmission line circuits operating in steady state mode by using the bounce diagram.
5. Match a transmission line operating in sinusoidal steady state mode using the concepts of reflection and transmission coefficients.
6. Apply Coulomb's law to the solution of the electrostatic field generated by one or more isolated charges.
7. Apply Gauss's law to a certain class of electrostatic problems (line charges, cylindirical charge, spherical charge distributions) and define capacitance and conduction currents.
8. Apply Faraday's and Ampere's laws in magnetostatic problems.
9. Discuss Maxwell's equations and recognize the difference between electrodynamics and statics. Write plane wave solutions of wave equations and describe the concepts of polarization.
10. Analyze the reflection and transmission of plane waves due to multilayered dielectric structures by using transmission line equivalent circuits.
11. Discuss the principles of radiation and applications of plane waves to model real-life wave-interaction problems (hyperthermia, antenna radiation, wireless electromagnetics)

Topics covered:

Overview: Transmission lines, circuit theory equations (1);Reflections on transmission lines (2);Transient response of transmission lines and wave propagation (3);Impedance matching and lossy lines (3);Power flow on transmission lines (2);Introduction to electrostatics (2);Vector analysis, Potential, Gauss's law (3);Gauss's law and applications (3);Poisson and Laplace equations (2);Capacitance, conduction current (2);Magnetostatic, Ampere's law, Faraday's law, inductance (3);Electrodynamics, Maxwell's equations, boundary conditions (2);Wave propagation, power flow, lossless and lossy dielectric media (3);Plane waves reflections and transmission (2);Total reflection, standing wave, propagating wave, analogy with T.L. (2);Principles of radiation and antennas, novel and exciting applications of electromagnetics (2)

Class/laboratory schedule (sessions per week and duration of each session):

Two, 75-minutes lectures per week

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

1 hour

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

2 hours

Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Students learn how to use vector calculus as well as the application of linear, surface and volume integrations to solve electromagnetic problems and learn the fundamentals of complex electrodynamic systems.
Outcome B	Basic	Students observe videos of lab experiments and using concepts learned during virtual labs and data collected, they complete some

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
		homework assignments.
Outcome C	N/A	
Outcome D	N/A	
Outcome E	Major	Students learn how to solve practical static and electrodynamic problems in engineering.
Outcome F	Basic	IEEE safety standards are discussed.
Outcome G	N/A	
Outcome H	Basic	Applications such as MRI, cellphones, antennas and radar are presented to the students.
Outcome I	Basic	Students are informed about benefits of using/keeping up-to-date with modern design tools.
Outcome J	Basic	Safety of cell phones as devices generating electromagnetic radiation are discussed.
Outcome K	Basic	Students are introduced to multimedia tools to further advance their learning.

Person who last prepared this description and date of preparation:

- Ozturk, Hatice Orun (hoo) - Apr 1st, 2010 (09:42pm)