

ENG EC456 Electromagnetic Systems II

2008-2009 Catalog Data:

Prereq: ENG EC 455. Electric field, energy, and force. Dielectric materials. Steady electric currents. Magnetic field, energy, and force. Magnetic materials. Applications of electrostatics, magnetostatics, and electrodynamics. Time carrying fields and Maxwell's equations. Electromagnetic waves in dielectric and conducting materials. Numerical methods in electromagnetic fields and waves. 4 cr.

Status in the Curriculum: Elective

Class/Lab Schedule:

LEC: 4 hrs/wk (TR 2-4), DIS: 1.5 hr/wk (W 4-5:30)

Textbooks and other required materials:

Shen and Kong, *Applied Electromagnetism*, 3rd Ed., PWS Publishing Co., 1995

Coordinator:

Mark N. Horenstein, Professor, ECE Department

Prerequisites by topic:

ENGEC455: Electromagnetic Systems I:

- Electric and magnetic fields
- Electromagnetic waves
- Propagation, reflection, and transmission of E&M waves
- Transmission lines
- Waveguides
- Optical fibers
- Antennas and radiation.

Goals:

To provide students with:

- Thorough understanding of the theoretical foundations of electrostatic, magnetostatic, and quasistatic field analysis.
- Application of fundamentals of electrostatics and magnetostatics to industrial processes, consumer devices, scientific research.
- Detailed knowledge of the mathematical methods used to solve for electric and magnetic fields, charge, current, capacitance and/or inductance for devices in various geometries.

Course Outcomes:

As an outcome of completing this course, students should be able to:

- 1) *Understand* how electric and magnetic fields are related to Maxwell's Equations in the low frequency domain.

- 2) *Understand* the origins of the mathematical solutions to field equations.
- 3) *Understand* how circuit theory laws such as KVL and KCL derive from Maxwell's Equations
- 4) *Understand* the relationships between charge, E-field, potential, voltage, and capacitance in an EQS system.
- 5) *Understand* the relationships between H-field, current, flux density, flux linkage, and inductance in an MQS system.
- 6) *Understand* the properties of dielectrics and magnetic materials.
- 7) *Understand* various applications of electrostatics such as xerography, electrostatic paint spraying, electrostatic precipitation, MEMS devices.
- 8) *Understand* various applications of magnetostatics such as transformers, actuators, relays, rotating machines.
- 9) *Explore* the issues of industrial safety in the context of electric and magnetic fields.
- 10) *Explore* experiments in electrostatic fields

Understand the various numerical solutions methods for finding fields and potential.

Course Outcomes mapped to Program Outcomes:

Program:	A	B	C	D	E	F	G	H	I	J	K	
Course:	i	ii-iv	ii-iv		ii-iv		iv			i	iv	
Emphasis:	1	3	2	1	4	1	1	0	0	1	3	

Contribution of Course to Meeting the Professional Component:

Engineering topics: 80%

Math & Basic Science: 20%

General Education: 0%

Prepared by: M. Horenstein, Professor.

Date: June 3, 2009