**ELEN 3110: Electromagnetic Fields 1**

**Credit hours:** 3

**Course Coordinator:** James E. Richie

**Course Materials:**

**Required:** M. N. O. Sadiku, Elements of Electromagnetics, 5th Edition, New York, NY: Oxford Univeristy Press, 2015.

**Course Description:** Development and use of the point and integral forms of Maxwell’s equations for static and quasi-static electric and magnetic fields with emphasis placed on the vector nature for these fields. Includes analytic and computational solutions to field problems. The wave equation for E. M. fields is derived and discussed.

**Prerequisites:** ELEN 2020, MATH 2450 and PHYS 1004.

**Required** for the Electrical Engineering program.

**Contribution to Professional Component:** Engineering Science 90%

Engineering Design 10%

**Course Goals:**

To enable the students to understand and use vector calculus to find the electric and magnetic fields, and to be able to use Maxwell’s equations for time varying fields. Be able to use both mathematical and physical reasoning to look at electromagnetic problems, and to understand the nature of resistance, capacitance, and inductance.

**Course Objectives:**

*By the end of this course, you should be able to ....*

1. Compute and understand the meaning of the curl, divergence, gradient and Laplacian of fields.
2. Set up and solve electrostatic problems using integral equation techniques.
3. Set up and solve magnetostatic problems using integral equation techniques.
4. Qualitatively estimate the direction of the magnetic field and/or electric field from their sources.
5. Identify sources of capacitance, resistance, and inductance.
6. Compute the capacitance, resistance, or inductance from the electric or magnetic fields or their energy densities.
7. Set up and solve Faraday’s law of induction.
8. Identify plane waves and their characteristics in some materials.

**Contribution to Program Objectives:** Partial fulfillment of Criterion 3 objectives A, B, C, E, G, I, K

**Course Topics: In the text**

Review of vector algebra, vector calculus,

and coordinate systems. Chapters 1 - 3

Electrostatic principles. Chapters 4, 5

Solution to electrostatic problems. Chapter 6

Steady electric currents. Chapter 5

Magnetostatic principles. Chapters 7, 8

Time varying magnetic fields and transformers. Chapter 9

Displacement current, Maxwell’s equations. Chapter 9

Introduction to transmission lines. Chapter 11

Last modified: December 4, 2017