

## EECE 3110: Electromagnetic Fields I

TEXT: Elements of Electromagnetics, 5<sup>th</sup> Edition  
by M. N. O. Sadiku

INSTRUCTOR: Dr. James E. Richie  
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Office Hours:

Tuesday 1:00 – 3:00 pm (in lab)

Wednesday 3:30 – 4:30 pm

Friday 1:00 – 3:30 pm

### 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.

### 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...*

- compute and explain the meaning of the curl, divergence, gradient and Laplacian of fields.
- set up and solve electrostatic problems using integral equation techniques.
- set up and solve magnetostatic problems using integral equation techniques.
- qualitatively estimate the direction of the magnetic field and/or electric field from their sources.
- identify sources of capacitance, resistance, and inductance.
- compute the capacitance, resistance, or inductance from the electric or magnetic fields or their energy densities.
- set up and solve Faraday's law of induction.
- identify plane waves and their characteristics in some materials.

**Prerequisite:** ELEN 2020(C), MATH 2450, PHYS 1004, Knowledge of a higher level computer language.

**Test Dates:** There will be four hour exams. The lowest score will be dropped (but not forgotten).

**Final Exam:** Thursday December 15, 2011 from 1:00pm to 3:00pm.

All students must take the final exam.

A Design project will be assigned early in the term. Specifics regarding reports, due dates, teams, etc. will be given with the project. A computer project will also be assigned during the semester.

HOMEWORK will be collected and graded. Solutions to the assignments will be handed out with the graded homework. The homework will be graded as one point per problem, and scaled to 100 points at the end of the semester.

“Rules” for homework:

- (a) LATE HOMEWORK WILL NOT BE ACCEPTED. Note that homework will be collected at the beginning of class.
- (b) Homework must be NEAT, presented on  $8\frac{1}{2} \times 11$  paper and MUST be stapled if more than one sheet (with a metal staple). IF PAGES ARE NOT STAPLED, ONLY THE FIRST PAGE WILL BE GRADED.

READING ASSIGNMENTS will be given at each lecture. The reading will be strongly related to the following lecture.

POP QUIZZES will be given at the beginning of some lectures. This is to insure that the material is read. The material for each quiz will be on the reading or on material from the previous lecture.

Grading (and expected performance curve):

Four Tests	300 points	93 to 100	A
Final Exam	100 points	89 to 92	AB
Projects	100 points	85 to 88	B
Homework	100 points	81 to 84	BC
Quizzes	100 points	77 to 80	C
		73 to 76	CD
		69 to 72	D
Total	700 points		

ATTENDANCE is expected for all class sessions. Excessive absences (more than four) can result in an instructor initiated “Withdrawal for Absence”(WA). For the purpose of this policy, attendance will be monitored by a **combination** of the following methods:

- (1) occasional in-class “roll call”,
- (2) appearance at all regularly scheduled tests,
- (3) submission of all homework and projects on their regularly scheduled due dates.

All missed exams, homework and projects will be counted as absences unless the student has consulted with the instructor within 24 hours of the due date.

LECTURE POLICY: All cell phones, laptop computers, and other electronic devices must be turned off and stored during lecture.

VERY IMPORTANT WORDS OF ADVICE: Keep up with class. Plan on spending a minimum of one hour per day working meaningfully on the course material and class notes. Further problems can be found in many electromagnetics texts.

### **Tentative Topical Outline**

- I. Review of vector algebra, vector calculus, and coordinate systems.
- II. Electrostatic principles.
- III. Solution to electrostatic problems.
- IV. Steady electric currents.
- V. Magnetostatic principles.
- VI. Time varying magnetic fields and transformers.
- VII. Displacement current, Maxwell’s equations, and plane waves.