PHYSICS 332: Electromagnetism
Spring Semester 2007

Instructor: Dr. H. Paul Shuch, Visiting Professor of Physics & Astronomy
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Lecture: MWF 10:15 - 11:20 AM, Room D-301
Laboratory: Thursday, 1:00 – 3:50 PM, Room C-204
Office Hours: T Th 12:00 – 1:00 PM, W 2:00 – 4:00 PM, Room D-304
Text: Electromagnetics, John D. Kraus, McGraw-Hill Series in Electrical Engineering (any edition – used copies are available on Amazon.com)
Supplemental Text (not required, but highly recommended): Div Grad Curl and All That: an informal text on vector calculus, H. M. Schey, any edition – used copies are available on Amazon.com)

Catalog description:

A theoretical treatment of classical electromagnetism. Topics include: electrostatics, magnetostatics, electric and magnetic potentials, electric and magnetic properties of matter, Maxwell's equations, the electromagnetic field, and the propagation of electromagnetic radiation. *Four hours of lecture and three hours of laboratory per week. Prerequisites: Math 129, and a grade of C or better in Phys 226.*

Weekly Topic Schedule (preliminary, subject to change):

1. Quantifying charge
2. The static electric field
3. Gauss' Law for electricity
4. The steady electric current
5. The static magnetic field
6. Gauss' Law for magnetism
7. Kirchhoff's Laws for voltage and current
8. Ampere's Law
9. Faraday's Law
10. Maxwell's Equations
11. Characteristics of free space
12. Transmission lines
13. The electromagnetic spectrum
14. Antennas and wave propagation
15. Wave/particle duality

Grading scheme:

Class participation	20%
Laboratory	20%
Quizzes	20%
Midterm	20%
Final	20%
Total	100%

Class Participation component:

Obviously, you cannot participate fully in this class if you are not present. Thus, regular attendance, although not explicitly graded, is vital to your success in this course. Lectures are meant to be a participatory experience, wherein the professor presents material meant to invoke direct participation in its development. To blandly sit by, hurriedly copying down material presented at the board in the form of a derivation, problem solving exercise, or proof, is not an effective means to develop a full understanding, and it is the latter that should be the student's objective -- developing understanding. Success in electromagnetics requires the exercise of logical thought. That should be the greatest thing you take away from this course as you integrate the lecture, the text, homework, and the lab experience. It is the student that does the learning in any worthwhile academic endeavor.

Therefore, it would be advantageous for the student to come to lecture having read over the text material for the day, and to follow along with the instructor as lecture material is developed in word and derivation. At the very least, the student should be familiar with the terminology and definitions germane to a given day's lecture material. Also, the student should be sufficiently prepared that he or she may be able to foresee the direction in which a derivation might be heading, being no more than a line or two behind in the development of any mathematics involved in said derivation at the board. To facilitate this, in each lecture, various questions will be asked to the class, directed at different individuals selected. These questions may come at any time during the class meeting, and will be sufficiently gauged that anyone who has prepared for the lecture should be readily able to answer them. Although any student is permitted to pass on any question, your responses will be recorded as part of this grade component.

You may be asked to go to the board and demonstrate a solution, but you will not be put on the spot! You are free to pass on this opportunity, but those rising to the challenge will receive bonus participation points. Going to the blackboard can be advantageous to your grade determination as well as a means whereby you can increase your class participation component of the overall grade.

Laboratory component:

During the first laboratory meeting, we will discuss the structure of the formal laboratory reports that you will be expected to turn in. You will be working with a lab partner, but each of you must prepare and turn in lab reports. Labs will be rotated from week to week, because there is insufficient hardware and equipment for everyone to do the same experiment each week. Labs are due in lecture on the Monday immediately following your completion of an experiment. No exceptions! A minimum number of successfully completed lab exercises is required. Extra labs can be done to boost a marginal lab grade.

Time permitting, this semester’s lab experience will culminate in a major group project, on which the entire class collaborates. Your contribution to this project will form a part of the Class Participation grading component. Your suggestions as to a suitable project are hereby solicited.

Quiz component:

A good working understanding of electromagnetics requires the ability to utilize field and wave theory to solve various theoretical and practical problems. There is no convenient way to learn this material without plenty of problem solving. A qualitative grasp alone is an insufficient understanding of physics. Brief weekly quizzes will give you an opportunity to demonstrate your ability to quantitatively apply the principles studied in class.

Homework problems will be assigned from each chapter. As we go over the material in that chapter, you should work progressively on those problems. I do *not* collect and grade your homework. It is expected that you will work through the problems, and seek assistance with those that you do not fully understand. You *will* see some of these problems again in weekly quizzes, as well as on exams, so it behooves you to complete all assigned homework problems! Solutions will be posted to the department bulletin board, or course website, after quizzes have been graded. Extra credit will be given for unusual or elegant solutions, so be creative.

Examination components:

A single midterm exam, and a comprehensive final exam, will be comprised of problems similar to those in the homework sets and quizzes, plus questions similar to those found at the end of chapters. These require a short answer, and test your qualitative knowledge of the electromagnetic theory discussed in that chapter. Examinations will include both quantitative problem solving and qualitative short answer questions.

The final exam will be of the take-home variety. The final will be handed out a reasonable amount of time in advance of the period during the finals week selected by the Registrar for the final examination. It must be turned in on the scheduled exam day.

Professor's comment:

Electromagnetism forms an integral part of most of the modern technology you encounter in everyday life, from motors and electrical appliances, to radios and microwave ovens, to cellphones, the Internet, and satellite TV. It also describes much of the workings of the natural universe. In this course, we will be posing (and then answering) a wide variety of questions:

> Why do radio signals travel at the speed of light? What *is* the speed of light? How can these signals travel through free space? What *is* free space? How does the Sun's energy get here? What *is* the Sun's energy? What is a photon? How can it have mass? What is the energy in a photon? What do we mean by *energy*? What color is a given photon? What do we mean by *color*? Are there invisible colors? What color is the Sun? *Why*?

Upon successful completion of this course, you will be able to answer these questions and more, and perhaps to come up with some interesting questions of your own.

Revised 22 December 2006