Physics 212. Electricity and Magnetism. Professor Michael Dine

Fall, 2010. Syllabus

Contact Information: ISB 323. Phone: 9-3033 Email (best): dine@scipp.ucsc.edu

Office hours: Tuesday 2:00-4:00 (subject to change) or by appointment.

Course website: go to department website and click on Dine, or go to http : //scipp.ucsc.edu/˜dine Homework and solutions and handouts will be posted here.

Course Description:
his is a "bread and butter" E&M course. As in most such courses in the U.S., we will use the text by Jackson. After a brief introduction to Maxwell's equations and certain broad areas of the subject, the text – and the course – turn to an extended treatment of electrostatics and magnetostatics. Much of the effort is devoted to the solution of boundary value problems and problems with specified charge and current distributions. Jackson brings to bear many of the standard methods of mathematical physics, such as Green's functions and special functions, to deal with these. For both experimentalists and theorists these methods are quite useful. In many practical situations (wave guides, resonant cavities, ...) it is important to be able to estimate or calculate the electric and magnetic fields. Boundary value problems and Green's function methods are important in field theory, condensed matter physics, general relativity and beyond. After the first five chapters, the text finally turns to the full, time-dependent structure of Maxwell's equations. We will cover at least through chapter 7, on electromagnetic waves.
This will be a challenging course – for you and for me. It is important to devote a lot of time to it. You will need to keep up with the reading. The reading has to be done in a very active way, with pen and lots of scrap paper ready. Similarly for review of class notes. The problem sets will be demanding.
Books on Reserve:

1. Landau and Lifschitz, *Classical Theory of Fields.*
2. Panofsky and Philips, *Classical Electricity and Magnetism*
3. Feynman Lectures on Physics, Vol. 2

I will put other books on reserve from time to time as seems appropriate.

Homework, exams,etc: There will be a problem set about once per 1.5 weeks. Whether the mid term and final will be in class or take home will be subject for discussion as the time approaches.

Very **tentative Schedule; will be updated as quarter progresses.**
Chapter numbers refer to Jackson, unless otherwise indicated.)
It is important to do the indicated reading.

1. Week 1: (Sept. 23) Introduction, and elements of electrostatics. Chapter I, chapter 1.

2. Week 2 (Sept. 28, 30). Electrostatics, continued; method of images. Chapter 1 (through section 1.13), chapter 2.

3. Week 3 (October 5,7) Boundary value problems in electrostatics: fourier analysis, Green's functions, some use of orthogonal functions (chapter 2).

4. Week 4 (Oct. 12,14) Boundary value problems: solution using orthogonal functions (Chapter 3)

5. Week 5 (Oct. 19,21). Multipole expansions. Macroscopic Media: dielectrics (Chapter 4). 12) Week 6 (Oct. 26,28) Magnetostatics. (Chapter 5; handouts from Feynman, elsewhere).

6. Week 7 Nov. 2,4. Dynamics (finally!). Study of full time-dependent equations. Wave equations. Scalar and Vector potentials. Conservation of energy and momentum. Magnetic monopoles (chapter 6, handouts).

7. Week 8 (Nov. 9,11). Dynamics (continued.

8. Week 9 (Nov. 16,18). Plane waves and their propagation (Chapter 7).

9. Week 10 (Nov. 23). Wave propagation (continued) Week 11 (Nov. 30, Dec. 2). Wave propagation (continued).