PHYS 381 – Electricity and Magnetism I, Fall Quarter 2004

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Course Description

This course is the first of three parts of the electricity and magnetism sequence (PHYS 381-3) for physics majors. The PHYS 381-3 sequence is designed to provide the minimum knowledge of electricity and magnetism that B.S. physics majors should have when they graduate. The major topics to be covered in PHYS 381 include the electrostatics of discrete and continuous charge distributions, the integral and differential forms of Gauss' Law, the electrostatic properties of conductors, electric potential, energy and work in charge distributions, Laplace's equation in one, two, and three dimensions, separation of variables and Laplace's equation in Cartesian, cylindrical, and spherical coordinates, application of boundary conditions, multipole expansions for charge distributions.

Course Objectives

The successful student will be able to:

- Apply Coulomb's Law to discrete and symmetric continuous charge distributions
- Clearly and concisely discuss the concept of a vector field
- Clearly and concisely discuss the physical significance of the electric field
- Clearly and concisely discuss the connection of the electric field to Coulomb's Law
- Calculate the electric field due to discrete and symmetric continuous charge distributions
- Apply Gauss' Law to symmetric charge distributions
- Clearly and concisely discuss the electrostatic properties of conductors
- Clearly and concisely discuss the physical significance of electric potential and the connection of electric potential to the electric field
- Calculate the work required to create discrete and continuous charge distributions and the electric potential energy contained in charge distributions
- Solve Laplace's equation to one, two, and three dimensions
- Solve Laplace's equation in Cartesian, cylindrical, and spherical coordinates
- Apply boundary conditions to electrostatic problems
- Carry out multipole expansions for charge distributions and interpret the physical meaning of the terms in the expansion

Text: *Introduction to Electrodynamics* by David J. Griffiths, chapters 1-3.

Course grading will be based on: 2 exams: 20% each x 2 = 40%
Homework: 40%
In-class exercises: 20%

Guaranteed minimum letter grades: 94-100: A; 90-93: A-; 86-89: B+; 83-85: B; 80-82: B-; 76-79%: C+; 73-75: C; 70-72: C-; 60-69%: D.

Homework: Homework accounts for 40% of your grade. You are encouraged to work together on the homework and to seek my help when you run into difficulty. Remember, however, that you will not be able to work together or seek my help on exams, and as such you should do your best to work as much of the homework on your own as is possible. I highly recommend that you seriously attempt the homework assignments on your own before you get together with other members of the class to work on them. Homework will be assigned every Thursday and will be due by 4 PM the following Tuesday. Each assignment will typically consist of one or two significant problems. No late homework assignments will be accepted except in well-documented extenuating circumstances.

In class exercises: We will frequently work on in-class exercises, some of which will be worth 20% of your grade. All of the in-class exercises will be handed in for grading, however, I will not grade every exercise and I will randomly decide which ones to grade. You will have until the beginning of class on the next day to hand in the completed exercise. As with the homework assignments, you are encouraged to work together on the in-class exercises. No in-class exercises will be accepted after the beginning of class on the next day except in well-documented extenuating circumstances.

Tentative Class Schedule

Monday	**Tuesday**	**Wednesday**	**Thursday**
		22 Sept start electrostatics text: 2.1-2.5	**23 Sept** continue electrostatics
27 Sept continue electrostatics	**28 Sept** continue electrostatics	**29 Sept** continue electrostatics	**30 Sept** continue electrostatics
4 Oct continue electrostatics	**5 Oct** continue electrostatics	**6 Oct** continue electrostatics	**7 Oct** continue electrostatics
11 Oct continue electrostatics	**12 Oct** continue electrostatics	**13 Oct** continue electrostatics	**14 Oct** continue electrostatics
18 Oct continue electrostatics	**19 Oct** continue electrostatics	**20 Oct** continue electrostatics	**21 Oct** finish electrostatics
25 Oct review	**26 Oct** **Exam 1**	**27 Oct** start Laplace's equation text: 3.1, 3.3	**28 Oct** continue Laplace's equation
1 Nov continue Laplace's equation	**2 Nov** continue Laplace's equation	**3 Nov** continue Laplace's equation	**4 Nov** continue Laplace's equation
8 Nov continue Laplace's equation	**9 Nov** continue Laplace's equation	**10 Nov** continue Laplace's equation	**11 Nov** **Veteran's Day**
15 Nov continue Laplace's equation	**16 Nov** continue Laplace's equation	**17 Nov** finish Laplace's equation	**18 Nov** start multipole expansions text: 3.4
22 Nov continue multipole expansions	**23 Nov** continue multipole expansions	**24 Nov** **Thanksgiving Break**	**25 Nov** **Thanksgiving Break**
29 Nov continue multipole expansions	**30 Nov** continue multipole expansions	**1 Dec** continue multipole expansions	**2 Dec** finish multipole expansions

Exam 2 (Final Exam) TBA