B. Grinstein DEPARTMENT OF PHYSICS SPRING 2009

Physics 2B — Electricity and Magnetism

Course Outline

Electric and magnetic forces rule! They are responsible for the majority of forces we commonly experience: spring (elastic) forces, contact forces, tension, friction, sticking, etc. They bind electrons into atoms, atoms into molecules, molecules into stuff (solids, glasses, liquids, buckyballs, soccerballs, surfboards, etc). They underlie the design and operation of familiar devices: light bulbs, DVDs, coffee-makers, electro-motors, computers, video games, microwave ovens, CD players, radio and TV, and a gazillion more. Light, radio-waves and γ-rays are also examples of electromagnetic phenomena.

Our objective in this course is to get a good understanding of electric and magnetic phenomena. More precisely, we will understand how electric and magnetic fields affect charged particles (the "Lorenz Force Law" equation), and we will learn to describe how electric and magnetic fields are produced by charged particles (four "Maxwell Equations"). While this collection of five equations summarizes the totality of knowledge about electromagnetic forces, a lot of work is required to uncover all the phenomena described by them. Much of our work will be devoted to understanding the meaning of the equations and the way to apply them to specific physical situations.

One most surprising aspect of Maxwell equations is that they predict the existence of waves that propagate at the speed of light. This, in fact, is the crowning achievement of Maxwell's theory. Although not included in the course description in the course catalog, we will talk a bit about propagation and production of electromagnetic waves during week 9 of the course.

Bellow is an outline of the material to be covered, in accordance with the UCSD general catalog of courses. You are responsible for ALL the material listed here under "Reading" even if not covered in lecture. *Reading the material ahead of lecture is not only mandatory, it is necesary to benefit form attending lecture.* In fact, I plan to lecture very little, only on points that I think need more clarification than supplied in the text. Lecture time is better spent demonstrating phenomena, asking and solving questions, presenting sample problems. The outline bellow indicates what you should have read by the Monday lecture of any given week.

Week	**Reading (Chapter)**
3/30	Electric charges and forces (26)
4/6	The Electric Field (27)
4/13	Gauss's Law (28)
4/20	Electric potential (29)
4/27	Potential and Field (30)
5/4	Current and Resistance (31)
5/11	Fundamentals of Circuits (32)
5/18	The Magnetic Field (33)
5/25	Electromagnetic Induction (34.1-8) Electromagnetic Fields and Waves (35.2–35.4)
6/1	LC and LR circuits (35.9-10) AC circuits (36)

How to read the physics textbook. Do not read the text as you would read a novel. Pause after each paragraph and ask yourself whetehr you understood it. Pause again at the end of each section and try to summarize what you have learned without consulting the text. Skim through the end-of-chapter questions, which test your qualitative understanding of the material, and convince yourself that you can answer them fully. If you can't, re-read the section that contains the relevant material, then try to answer the question again. You may want to fill the *workbook* before attempting end-of-chapter questions and problems.