January 2009

Physics 133 – General Physics III (4)
(Also listed as HNRS 133)
Course Outline GE B3 & B4

Prerequisite for Phys 133: PHYS 131 or HONORS 131 or PHYS 141; MATH 142.

Learning Objectives and Criteria:
Upon completion of the course the student is expected to know:

a: Electrical properties are determined by the electronic structure of the atoms.
b: Electrical interactions are governed by Coulomb's Law.
c: The concepts of electric field and electric potential.
d: The definition of electrical current and to be able to analyze simple circuits.
e: That magnetic fields are produced by electrical currents.
f: That voltages can be generated by varying magnetic fields.
g: The inter-relationship between electricity and magnetism.

Text and References:
Young and Freedman, University Physics, 12th edition, Pearson Addison Wesley, 2008.

Physics 133 is the third in our Phys 131/141, 132, 133 calculus-based sequence. It is required of all physics majors, all engineering students, as well as students in chemistry, mathematics, and architectural engineering. In this course, the students are introduced to the concepts of electric field and electric potential and learn to analyze simple circuits. It also underscores the interconnection between electricity and magnetism. The students will realize that to understand the properties of matter one must understand the electrical interactions between atoms. This course also serves to prepare students for more advanced courses in their field of study.

Content and Method:

Method: Physics 133 is offered in a traditional lecture/lab format. It meets a total of 6 hours each week - 3 hours of lecture and one 3-hour lab.

Content: Physics 133 will adhere to the following topics:

- Electric charge, conductors and insulators, Coulomb's Law.
- Electric fields due to point charges, electric fields due to charge distributions, Gauss' Law.
- Electric potential and electric potential energy, potential due to a point charge and potential due to charge distributions.
- Capacitors, capacitors in series and parallel, energy stored in capacitors.
- Electric current, resistance and Ohm's law, simple circuits, resistors in series and parallel.
- Multi-loop circuits and Kirchhoff''s rules, the RC circuit.
- Magnetic fields, force on a charge moving in a magnetic field, applications, forces on currents, torque on a current-carrying loop in a magnetic field.

- Magnetic fields generated from currents in terms of the Biot-Savart Law, magnetic fields due to line currents, magnetic field of a current-carrying solenoid, Ampere's Law.
- Magnetic flux, Faraday's Law, electric generators, inductance.
- Energy stored in solenoids, LC circuits.

Lab Sections:

The multiple sections of the course will all do the same experiment in a given week. Usually the students will perform 10 experiments in a given quarter. The students typically work in groups of three at each of the 8 stations, limiting the class size to 24. The students will spend most of the 3-hour period collecting and analyzing data. They will then be required to analyze their data and discuss their results in a written or oral report. In a typical quarter, the students will do the following experiments:

- Electrostatics
- Electric field
- Electric potential and field
- Oscilloscope
- Solar cells
- Temperature & resistivity
- Light bulbs & resistance
- RC circuits
- Current balance
- Faraday's Law

To ensure uniformity as much as possible, the instructor in charge of the course provides the syllabus for all instructors involved in the course. The syllabus outlines the chapters and topics to be covered for a given week as well as the homework assignments for that particular week. All students in the various sections will do the same laboratory experiment scheduled for that particular week.

Methods of Assessment:

Lecture/Lab Sections: The methods of assessment, in order of importance, are:
Exams (2 or 3 one-hour exams and a final exam); Weekly homework assignments; Quizzes; Laboratory reports.