Eastern Nazarene College
Department of Physics

Physics 322
John U. Free

Study Guide for Exam #4

Topic **Faraday's Law, Electromagnetic Waves**
Chapters **7, part of 8, and part of 9**
Date **Thursday, December 11, 2008**

Objectives

The student will be able to:

Take-class part (closed-book)

1. Define current and current density.
2. State the relationship between current and current density.
3. Define resistance in terms of the resistivity.
4. State Ohm's law in terms of the electric field and conductivity.
5. Outline the classical model of electrical conductivity.
6. State how conductivity depends on relaxation or collision time.
1. Write and use Faraday's law of electromagnetic induction (Eqn. 9.1 and 9.2).
2. Write down Maxwell's equation (Eqn. 9.4)
5. Define and explain mutual inductance between two coils.
6. Define and explain self inductance in a coil.
1. Define the following terms: displacement current, wave vector, phase velocity, group velocity, and polarization.
2. Write down the wave equation in one, two, and three dimensions.
3. Write down the solution to the wave equation.
4. Write down Maxwell's equations (in matter) in integral and differential form.
5. Derive the wave equation from Maxwell's equations.
6. Define the Poynting vector for an electromagnetic wave.
7. Describe how electromagnetic waves are generated.
8. Describe how electromagnetic waves are reflected and refracted from a surface.

Take-dorm part (open-text)

1. Use Faraday's law of electromagnetic induction (Eqn. 9.1 and 9.2).
2. Derive Maxwell's equation relating the curl of the electric field to the time change of the magnetic field.
3. Calculate the stored energy in a current loop in a magnetic field.
4. Calculate the mutual inductance between two coils.
5. Calculate the self inductance in a coil.
6. Use the Poynting vector to find the energy in an electromagnetic wave.