1. Read course notes and appropriate Sections of Chapter 1 of the textbook.

2. **Wave Equations.** Starting from Maxwell’s equations, derive wave equations for electromagnetic fields. Assume only the Magnetic current source exists. Decompose the wave equations in the rectangular coordinate. If the magnetic current only has an y component, what components will electric and magnetic fields have?

3. **Green’s Function for Wave Equation.** Do problem 1.5-2 from your book.

4. **Radiation.** Given \( \mathbf{J} = \hat{y} J_0 \delta(x) \delta(y) \delta(z) \) (where \( \delta(r) \) is the Dirac delta function), find the expressions for the \( \mathbf{E} \) and \( \mathbf{H} \) fields in terms of spherical components using the equations:

\[
\mathbf{H} = \frac{1}{\mu} \nabla \times \mathbf{A}
\]

\[
\mathbf{E} = -j \omega \mathbf{A} - j \frac{\nabla (\nabla \cdot \mathbf{A})}{\varepsilon_0 \mu_0}
\]

Show all details. Simplify your results for far field expressions. Discuss your observations. Hint: First calculate \( \mathbf{A} \) in the rectangular coordinate, and then convert to the spherical coordinate to calculate \( \mathbf{E} \) and \( \mathbf{H} \) fields.

5. **Review of electromagnetics.** Answer the following review questions. Only a few words are needed in each case.

1) What is the relative permeability of most physical materials?
2) What quantity is most important in determining whether a material is a “good” conductor or not?
3) Give the mathematical expression used to convert the complex representation of a time-harmonic function back to a real quantity.
4) If a wave propagates downward from a satellite to a ground station and the E-field is pointing NORTH at a particular instant in time, in what direction is the H-field?
5) If an E-field of 1 [v/m] is present at the surface of a perfect conductor what is the value of the field 1.0 cm down inside the material?
6) What name is given to the quantity that equals the ratio of the magnitude of the E-field to the magnitude of the H-field of a uniform plane wave?
7) In what direction is the electric field at the surface of a perfectly conducting sphere?
8) If the electric field at the surface of a perfect conductor is normal and pointing away from the conductor, is the surface charge there positive, negative, or zero?
9) In what direction are the currents, E-field lines, and H-field lines on a coaxial line operating in the TEM mode? Use cylindrical coordinates.
10) What does the abbreviation VSWR stand for?

**PS:** It is assumed that you will work out all the problems to your best ability. Reference any sources that you use.