PHYS 3414 - Electricity and Magnetism- Homework Set 5

Chapter 5 - Maxwell's Equations and Review

This set will not be collected, but should be completed before the test at 12:30pm Monday February 25, 2008.

Good's Problems

5.1

5.2

5.3

5.4

5.5

5.6

5.8

5.12

Exam Review Questions

Most of the above are excellent review questions. The following questions would be considered good test questions. These would be fairly difficult test questions.

1 Consider a spherical volume charge with uniform volume charge density Γ and radius a. The volume has a cavity centered at $a/4\hat{x}$ with radius $a/2$. Compute the electric force on a charge q placed at the center of the cavity.

2 An infinite slab of current occupying the region $-a < z < a$ has current density $\vec{J} = J_0\hat{x}$. Compute the magnetic field everywhere. Compute the magnetic force on a charge q moving with velocity $\vec{v} = v_0\hat{z}$ at the point $\vec{r} = (0, 0, a)$.

3 Consider an electric and magnetic field confined to the cylindrical region $\rho < a$.

$$\vec{E} = \gamma_0\rho^2\hat{\rho} \qquad \vec{B} = \gamma_1\rho\hat{z}$$

Is this combination a possible electromagnetic field? If yes find the charge density and current. In both cases support your choice.

4 A non-uniformly charged disk with surface charge density $\sigma = \lambda\rho$ and radius a is parallel to an infinite plane with charge density σ_p. Calculate the total force exerted by the plane on the disk.

5 Compute the magnetic field along the axis of a disk with non-uniform charge density $\sigma = \lambda\rho$ rotating with an angular velocity ω about its axis.

6 Compute the field along the axis of a non-uniform disk of charge with radius a and charge density $\sigma = \lambda\rho$.