Preparation Assignment Due Oct. 2, 2000

Fields and Waves I

1. The outer conductor of a copper coaxial conductor has an inner diameter of 4 mm and an outer diameter of 5 mm. What is the resistance of 100 m of conductor?

2. In a reference on PC Boards it was stated that a 7 mil wide trace had a resistance of about 0.1 ohms per inch. Assuming the conductor is made of copper how thick is the trace?

3. What is the earth's magnetic field?

4. If we have a long wire carrying 1 Ampere, how far away must you be so that the magnetic field produced by the wire is equal to the earth's field?

Preparation Assignment Due Oct. 4, 2000
Fields and Waves I

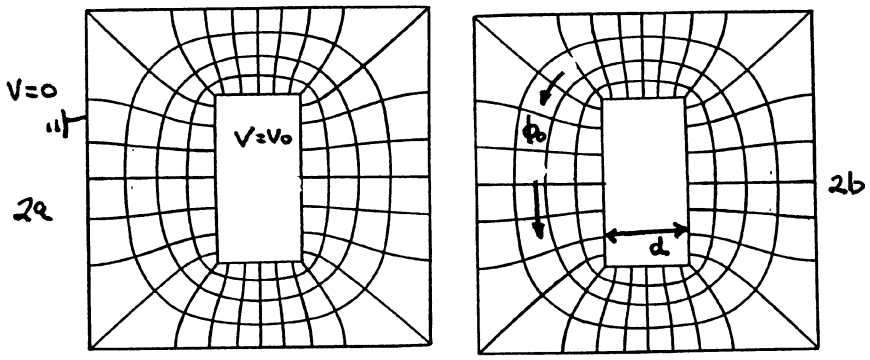
1. What coordinate system would you choose to analyze the magnetic field of a coaxial conductor? A solenoid?

2. Find the magnetic field and flux density in a solenoid of length L, cross sectional area S and N turns with current I. What is the total flux through the solenoid?

Homework 4, Due Oct. 5, 2000

1. A plexiglas disk of radius a carries a surface charge density ρ_s C/m^2 and is rotating around its axis at N rpm. Find the total current in the disk and find the magnetic field at the center of the disk. (I suggest you use the formula for the field of a loop of current evaluated at the center of the loop.)

2. a) In Figure 2a below we have a charged inner conductor of rectangular cross section inside a metal box which is grounded. Find the capacitance per unit depth assuming air between the two conductors.



b) The same flux plot can be used to describe the magnetic field in the same geometry. If a surface current is flowing into the page, say on the surface of the inner conductor and back out of the page on the outer rectangular box, then then the closed semi-elliptical lines surrounding the inner box which were equipotential lines in part a of this problem are now magnetic flux lines. (Actually there is a small problem with making the analogy which we will discuss when we get to magnetic potential.) The figure is repeated as Figure 2b with the flux in a tube (per unit depth) indicated as ϕ_0. Find the total flux in the problem and find the current in the inner conductor by evaluating $H \cdot d\ell$.

3. An electron beam has current density given by $J = J_0 \left(1 - \frac{r}{a}\right) \hat{a}_z$, where a is the radius of the beam. $J = 0$ for $r > a$. Find the magnetic field everywhere using Ampere's law. Check by evaluating $\nabla \times H$.