

EE 534 NUMERICAL METHODS IN ELECTROMAGNETICS
HOMEWORK 1

Due: 08/04/2015

- 1) Starting with the Maxwell's equations and the constitutive relations, derive the Wave equation for the magnetic field intensity in a source region with current density \vec{J} , charge density ρ and constitutive parameters ϵ and μ .
- 2) Write the time domain expression of the uniform plane wave, in a non-magnetic ($\mu = \mu_0$) medium having $\epsilon_r = 4$ which is operating at $f = 300\text{MHz}$ and propagating in the x direction. Assume that the amplitude of the wave is 1mV/m and it is y - polarized.
- 3) In free space, the electric flux density is given by $\vec{D} = D_0 \cos(\omega t + \beta z)\hat{a}_x$. Find \vec{H} by using the Maxwell's equations.
- 4) Classify these equations as elliptic, hyperbolic or parabolic.

a) $4 \frac{\partial^2 \Phi}{\partial x^2} + 2 \frac{\partial \Phi}{\partial x} + \frac{\partial \Phi}{\partial y} + x + y = 0$

b) $e^x \frac{\partial^2 V}{\partial x^2} + \cos y \frac{\partial^2 V}{\partial x \partial y} - \frac{\partial^2 V}{\partial y^2} = 0$

State whether the equations are homogeneous or inhomogeneous.