Code No: OR220453 **OR**

II B.Tech II Semester Supplementary Examinations, April/May 2005
E M WAVES AND TRANSMISSION LINES
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State the Coulomb's law in SI units and indicate the parameters used in the equations with the aid of a diagram.
   (b) Point charges Q_1 and Q_2 are respectively located at (4, 0, -3) and (2, 0, 1). If $Q_2 = 4$ nC, find Q_1 such that.
      i. The E at (5, 0, 6) has no Z-component.
      ii. The force on a test charge at (5, 0, 6) has no X-component.

2. (a) Explain the nature of line, surface and volume current distributions as applicable to static magnetic fields. List out the expressions for the magnetic field intensity in these three cases.
   (b) Determine the voltage induced in a conducting bar positioned at y = 8 cm., in xy-plane, in a magnetic field of $10000Cos(10^6t)\hat{Z}A/m$. What will be the result if the magnetic field is stationary ?
   (c) Sketch the electric and magnetic field lines in the cross section of a coaxial cable. Hence compare the two types of field distributions (no derivations).

3. (a) Starting from Maxwell's equations, derive the wave equations for an e.m wave in free space.
   (b) A uniform plane wave is incident normally on a plane surface separating two loss less dielectric media. Discuss quantitatively the phenomena that takes place.

4. (a) Explain the terms "Linear Polarization", "Elliptical polarization" and "Circular polarization".
   (b) In a medium $\bar{E} = 16e^{-x/20}\ Sin\quad (210^8t - 2x)\hat{Z}V/m$. Find the direction of propogation, the propogation constant, wavelength, speed of the wave and skin depth.

5. (a) In a perfect dielectric medium, the electric field progressing in the Z-direction is given by the equation $E_x = E_{xo}Cos(wt - \beta Z)$ and the associated magnetic field by $Hy = Ex/\eta$ where E_{xo} is the Peak Value of E_x at t = 0 and Z=0 and h is the intrinsic impedance of the dielectric. Prove that the average power flowing through an area S normal to the Z-axis is given by P_Z, $a_x = \frac{E_{x0}^2 S}{2\eta}$
   (b) In a non-magnetic medium, $\bar{E} = 4Sin(2\pi 10^7 t 0.8x)\hat{Z}V/m$. Determine $\bar{H}$, dielectric constant, intrinsic impedance and the time average power carried by the wave

6. (a) Explain the mechanism of propagation in a rectangular guide and account for the losses.

   (b) Give the boundary conditions on E and H at each perfectly conducting wall of the wave guide and explain their significance.

7. (a) For any uniform transmission line for which R, L, C and G per unit length are independent of position along the line. Show that the variation along the line of V and I can always be represented by the exponential law.

   (b) Derive an expression for the inductance and capacitance per unit length of coaxial transmission line.

8. (a) Define the reflection coefficient and derive the expression for the i/p impedance in terms of reflection coefficient.

   (b) Explain how the i/p impedance varies with the frequency with sketches.

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