Code No: NR220403 **NR**

II B.Tech II Semester Supplementary Examinations, Apr/May 2006
EM WAVES AND TRANSMISSION LINES
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is the potential function at point P due to point charges Q_1 and Q_2 at distances r_1 and r_2 respectively and a line charge of density ρ_L C/m whose elemental charge $\rho_L dl$ is assumed to be at distance r_3 from P? [8+8]
   (b) A point charge of 15nC is situated at the origin and another point charge of -12nC is located at the point (3,3,3)m. Find $\overline{E}$ and V at the point (0,-3,-3).

2. (a) Define and explain the Biot-Savart's Law. Hence obtain the field due to a straight current carrying filamentary conductor of finite length.
   (b) In a medium of $\varepsilon = 5\ \varepsilon_0$, $\mu = 2.5\ \mu_0$, $\sigma = 0.2$ m mho/m.,
   E = 20 μV/m., find the conduction current density. If this current density exists in a cylindrical rod of 2 cm. diameter, evaluate the current that can flow through the rod. [8+8]

3. (a) Define uniform plane waves. Solve the wave equations for uniform plane waves in a medium of conductivity σ and hence establish the relations for propogation constant, attenuation and phase constants in terms of σ. [10+6]
   (b) Explain the characteristics of the propogating waves in a good conducting medium.

4. (a) What is meant by the polarization of wave? When is the wave linearly polarized and circularly polarized? [8]
   (b) A traveling wave has two linearly polarized components $E_x = 2CosWt$ and $E_y = 3\ Cos\ (Wt + \pi/2)$
      i. What is the axial ratio. [3+3+2]
      ii. What is the tilt angle of the major axis of the polarization ellipse?
      iii. What is the sense of rotation?

5. (a) Account for the presence of TE, TM and TEM waves in Parallel plane wave guides and explain their significance. [8+8]
   (b) Assuming z-direction of propogation in a Parallel plane wave guide, determine the expressions for the transverse field components in terms of partial derivation of E_Z *and* H_Z.

6. (a) Derive the relation $\lambda = \frac{\lambda_g \lambda_c}{\sqrt{\lambda_c^2 + \lambda_g^2}}$. defining $\lambda, \lambda_g, \lambda_c$
   where λ is free space wave length , λ_g is the wave length measured in the guide, and λ_c is the cut off wave length. [10+6]

(b) Explain impossibility of TEM wave propagation in wave guides.

7. (a) What do you understand by frequency distortion on a transmission line? [2+10+4]

(b) Derive the relationship between secondary constants and primary constants of a transmission line.

(c) Explain the significance of loading of transmission Lines?

8. (a) Explain the significance and Utility of $\lambda/8, \lambda/4, and \lambda/2$ Lines. [8+8]

(b) A low loss transmission line of 100Ω characteristic impedance is connected to a load of 200Ω. Calculate the reflection coefficient and standing wave ratio. Derive the relationships used.

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