Con. 2599-09. (REVISED COURSE) VR-3822

(216) S.E. (EXTC) Sem IV (CR)

(3 Hours) [Total Marks : 100

Electromagnetic Wave Theory

04/06/09

3 p.m. to 6 p.m

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume any **suitable data** if **required**.
(4) **Figures** to **right** indicates **full** marks.

1. Solve the following :— **20**
   (a) Convert p(3, 45°, 60°) in —
      (i) Cartesian
      (ii) Cylindrical co-ordinate system.
   (b) If $\nabla \times \bar{V} = 0$. Find constant a, b and c. So that —
   $\bar{V} = (x + 2y + az)\,\hat{a}x + (bx - 3y - z)\,\hat{a}y + (4x + cy + 2z)\hat{a}z$
   is irrotational.
   (c) State Coulombs Law in Electrostatics.
   (d) Explain Method of Images.

2. (a) Find Electric field intensity due to infinite line charge. **10**
   (b) A spherical charge distribution is given by — **10**

$$\rho_V = \rho_o \left[1 - \frac{r^2}{a^2} \right] \quad \text{for} \quad 0 \le r \le a$$

   Find $\bar{E}$ at $\frac{r}{a} = 0 \cdot 745$..

3. (a) Prove that the divergence of electric field and that of electric flux density in a charge free region is zero. **10**
   (b) A total charge of $\frac{40}{3}$ hc is uniformly distributed over a circular ring of radi 2 m placed on z = 0 plane with center at origin. Find electric potential at (0, 0, 5). **10**

4. (a) State Uniqueness Theorem and give its proof. **10**
   (b) Prove that a static electric field is irrotational and the static magnetic field is solenoidal. **10**

5. (a) Derive formula to find Magnetic intensity due to infinite long straight conductor on z-axis by Biot-Savart's law. **10**
   (b) State Ampere Circuital Law and find H due to straight current carrying conductor on Z axis at point P. **10**

6. (a) Explain Scalar and Vector Magnetic potential. **10**
   (b) Define poynting vector. Obtain the integral form of poynting theorem and explain each term. **10**

7. (a) A 10 GHz plane wave travelling in free space has an amplitude E_x = 10 V/m. Find V, λ, β and η also find $\bar{H}$. **10**
   (b) What is Wave Impedance or Intrensic Impedance ? Calculate wave impedance for free space. **10**