

**B. TECH.****THEORY EXAMINATION (SEM-IV) 2016-17****ELECTROMAGNETIC FIELD THEORY****Time : 3 Hours****Max. Marks : 100****Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.****SECTION – A**

- 1. Attempt all parts of the following questions: 10 x 2 = 20**
- Explain the physical significance of Divergence and Curl.
  - Derive an expression for inductance per unit length of coaxial conductors.
  - Express  $B = \left(\frac{10}{r}\right)r + r \cos \theta \theta$  in cylindrical coordinates.
  - Explain the terms – Transmission coefficient and reflection coefficient.
  - Prove the electric field vector  $E = (\text{grad } V)$ , where  $V$  is a scalar potential field.
  - Transform the point (1, 1, 6) to spherical coordinates.
  - Verify whether the scalar field  $S = \rho^2 z \cos 2\Phi$  in cylindrical coordinates is a solution of Laplace's equation.
  - A copper wire carries a conduction current of 1 amp at 60 Hz. What is the displacement current in the wire? Assume  $\mu = \mu_0$ ,  $\epsilon = \epsilon_0$  and  $\sigma = 5.8 \times 10^7$  ohm/m.
  - State Stoke's theorem and Divergence theorem.
  - State Gauss's law and derive the related Maxwell equation.

**SECTION – B**

- 2. Attempt any five of the following questions: 5 x 10 = 50**
- Derive and explain the mathematical form of Poynting theorem.
  - Given that  $D = \left(\frac{5r^2}{4}\right)r$  in spherical co-ordinate. Find the volume enclosed between  $r=1$  and  $r=2$ .
  - Explain the phenomenon of polarization and its types.
  - Prove that the magnetic field due to an infinite conductor carrying current  $i$  at a distance  $r$  is  $H = \frac{i}{2\pi r}$  A/m
  - Explain the tangential and normal boundary conditions between two dielectrics for static electric fields.
  - Calculate  $E$  at  $P(1, 1, 1)$  in free space caused by four identical 3-nC point charges located at  $p_1 = (1, 1, 0)$ ,  $p_2 = (-1, 1, 0)$ ,  $p_3 = (-1, -1, 0)$  and  $p_4 = (1, -1, 0)$ .
  - State and explain Maxwell's equations for time varying fields in differential and integral forms and their significance.
  - A uniform plane wave propagating in good conductor. If the magnetic field intensity is given by  $H = 0.1e^{-15} \cos(2\pi \times 10^8 t - 15z) i$  A/m, determine the conductivity and corresponding component of  $E$  field. Also calculate the average power loss in a block of unit area and thickness  $t$ .

**SECTION – C****Attempt any two of the following questions: 2 x 15 = 30**

- A uniform plane wave propagating in a medium has  $E = 2e^{-az} \sin(10^8 t - \beta z) j$  V/m. If a medium is characterized by  $\epsilon_r = 1$ ,  $\mu_r = 20$  and  $\sigma = 3$  S/m, determine  $\alpha$ ,  $\beta$  and  $H$ .
- Discuss the solution of plane wave equation in conducting media (Lossy Dielectric). Derive the above up to Propagation Constant. Attenuation Constant and Phase Constant.
- Explain the reflection of plane wave for the normal incidence. Discuss about Reflection and Transmission coefficient for **F** and **H**.