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**

   (a) Explain the physical significance of Divergence and Curl.

   (b) Derive and expression for inductance per unit length of coaxial conductors.

   (c) Express $B = \left(\frac{10}{r}\right)a_r + r\cos\theta\, a_\theta$ in cylindrical coordinates.

   (d) Explain the terms – Transmission coefficient and reflection coefficient.

   (e) Prove the electric field vector E = (grad V), where V is a scalar potential field.

   (f) Transform the point (1, 1, 6) to spherical coordinates.

   (g) Verify whether the scalar field $S = \rho^2 z\cos 2\Phi$ in cylindrical coordinates in a solution of Laplace's equation.

   (h) A copper wire carries a conduction current of 1 amp at 60 Hz. What is the displacement current in the wirte? Assume $\mu = \mu_0$, $\varepsilon = \varepsilon_0$ and $\sigma = 5.8 \times 10^7$ ohm/m.

   (i) State Stroke's theorem and Divergence theorem.

   (j) State the Gauss's law and derive the related Maxwell equation.

SECTION – B

2. **Attempt any five of the following questions:**   **5 x 10 = 50**

   (a) Derive and explain the mathematical form of Poynting theorem.

   (b) Given that $D = \left(\frac{5r^2}{4}\right)r$ in spherical co-ordinate. Find the volume enclosed between r=1 and r=2.

   (c) Explain the phenomenon of polarization and its types.

   (d) 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

   (e) Explain the tangential and normal boundary conditions between two dielectrics for static electric fields.

   (f) 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 $p_4 = (1, -1, 0)$.

   (g) State and explain Maxwell's equations for time varying fields in differential and integral forms and their significance.

   (h) A uniform plane wave propagating in good conductor. If the magnetic field intensity is given by $H = 0.1e^{-15}\cos(2\pi \times 10^8 l - 15z)\,i$ 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**

3. 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 $\varepsilon_r = 1$, $\mu_r = 20$ and $\sigma = 3$ S/m, determine α, β and H.

4. Discuss the solution of plane wave equation in conducting media (Lossy Dielectric). Derive the above up to Propagation Constant. Attenuation Constant and Phase Constant.

5. Explain the reflection of plane wave for the normal incidence. Discuss about Reflection and Transmission coefficient for F and H.