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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 $B = \left(\frac{10}{r}\right) r + r\cos\theta\ \theta$ 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 $S = \rho^2 z cos2\Phi\ \Phi$ 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=1and 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 $E = 2e^{-\alpha z}\sin(10^8 t - \beta z)\, j$ V/m. If a medium is characterized by $\varepsilon_r = 1$, $\mu_r = 20$ and σ = 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 **E** and **H**.

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