(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2110 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2012-13

FUNDAMENTALS OF E.M. THEORY

Time : 2 Hours *Total Marks : 50*

Note : *(1) Attempt all the questions.*

(2) All questions carry equal marks.

1. Attempt any **TWO** parts of the following : **(5×2=10)**

   (a) Express $B = (10/r)\, a_r + r \cos\theta\, a_\theta$ in Cartesian and cylindrical co-ordinates.

   (b) Given that $D = (5r^2/4)\, a_r$ in spherical co-ordinate. Find the volume enclosed between r = 1 and r = 2.

   (c) Evaluate div (curl A) if $A = (\sin\phi/r^2)\, a_r - (\cos\phi/r^2) a_\phi$.

2. Attempt any **TWO** parts of the following : **(5×2=10)**

   (a) Determine charge density if electric flux density $D = r \sin\phi\, a_r + 2r \cos\phi\, a_\phi + 3z^2\, a_z$.

   (b) An electric potential on a plane is described by $V = 100\, r^{-3}$ (where r is the distance from the source). Calculate the electric field at the point (0.5, 60°, 45°).

   (c) A copper wire carries a conduction current of 1 amp at 60 Hz. What is the displacement current in the wire ? Assume $\mu = \mu_0$, $\varepsilon' = \varepsilon'_0$ and $\sigma = 5.8 \times 10^7$ υ/m.

3. Attempt any **TWO** parts of the following : **(5×2=10)**

(a) Prove that the magnetic field due to an infinite conductor carrying current I at a distance r is $H = I/(2\Pi r)$.

(b) Find α and β for the propagation of wave in good conductor, also show that angle of characteristic impedance is always 45° for good conductors.

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

4. Attempt any **TWO** parts of the following : **(5×2=10)**

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

(b) Find the magnetic field intensity at (1.5, 2, 3) due to a conductor carrying current of 24 A along z-axis extending from z = 0 to z = 6.

(c) Define the following :—

(i) Reflection co-efficient

(ii) Wave impedance

(iii) VSWR.

5. Attempt any **TWO** parts of the following : **(5×2=10)**

(a) A uniform plane wave propagating in a medium has $E = 2e^{-az} \sin(10^8 t - \beta z)$ ay v/m.

If a medium is characterized $\varepsilon_r = 1$, $\mu_r = 20$ and $\sigma = 3$ s/m, determine α, β and H.

(b) Derive an expression of magnetic field intensity due infinitely long transmission line using Ampere's Circuit of Law.

(c) Derive the expression of four Maxwell's equations for static and time varying EM fields, also indicate the law associated with them. Derive an expression for continuity equation.