(i)   The direction of wave propagation

(ii) $\lambda, f, \varepsilon_r$

(iii) $\overline{H}$

(c) Explain the plain wave in good conductor.

—x—

435

NEC-404

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

PAPER ID : 131403

Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ]

B.Tech. IV Sem.

SPL. THEORY EXAMINATION, 2014-15

ELECTROMAGNETIC FIELD THEORY

Time : 2 Hours]   *[Total Marks : 50*

Note: Attempt all questions. Each question carries equal marks.

1.   Attempt any four of the following :   3.5 x 4 =14

(a) Explain the spherical coordinate system.

(b) Explain the gradient of a scalar field. Show that the gradient of a scalar is a vector.

(c) Calculate the areas of the following surfaces using the differential surface area ds:

(i) $\rho = 2, \ 0 < z < 5, \ \pi/3 < \phi < \pi/2$

(ii) $z = 1, \ 1 < \rho < 3, \ 0 < \phi < \pi/4$

(d) Find the volume cut from the sphere radius r=a by the cone $\theta = \alpha$. Calculate the volume when $\alpha = \pi/3$ and $\alpha = \pi/2$.

(e) If $U = xz - x^2 y + y^2 z^2$, evaluate divgrad U.

(f) Given $\phi = xy + yz + xz$, find gradient ϕ at point (1,2,3) and the directional derivative of ϕ at the same point in the direction towards point (3,4,4).

2. Attempt any two of the following :   6x2=12

(a) Let

$$\rho_v = \begin{cases} \left(\dfrac{10}{r^2}\right) . \dfrac{mc}{m^3} & 1 < r < 4 \\ 0, & r > 4 \end{cases}$$

Find the net flux crossing surface r=2m and r=6m.

(b) At the centre of hollow dielectric sphere $(\varepsilon = \varepsilon_0 \varepsilon_r)$ is placed a point charge Q. If the sphere has inner radius a and outer radius b, calculate $\vec{D}, \vec{E}$ and $\vec{P}$.

(c) Explain the method of images.

3. Attempt any two of the following :   6x2=12

(a) Explain the Scalar and Vector potentials.

(b) A rectangular coil of area 10cm² carrying current of 50A lie on plain 2x+6y-3z=7 such that the magnetic moment of the coil is directed away from the origin. Calculate its magnetic moment.

(c) Given that :

$$\overline{H_1} = -2a_x + 6a_y + 4a_z A/m$$

in region $y - x - 2 \leq 0$, where $\mu_1 = 5\mu_0$, calculate :

(i) $\overline{M_1}$ and $\overline{B_1}$

(ii) $\overline{H_2}$ and $\overline{B_2}$ in region $y - x - 2 \geq 0$.

where $\mu_2 = 2\mu_0$.

4. Attempt any two of the following :   6x2=12

(a) Explain Maxwell's equation in differential and Integral form.

(b) A plain wave in a non-magnetic medium has

$$\overline{E} = 50\sin(10^8 t + 2z)a_y \; V/m$$

Find :