(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 2010-11

FUNDAMENTALS OF E.M.THEORY

Time : 2 Hours   *Total Marks : 50*

Note : Attempt **all** questions.

1.   Attempt any **four** of the following :   **(5×4=20)**

   (a)   State and prove divergence theorem.

   (b)   Given two vectors $R_A = -a_x - 3a_y - 4a_z$, $R_B = 2a_x + 2a_y + 2a_z$ and $C(1,3,4)$. Find :

     (i) R_{AB}

     (ii) $|R_A|$

     (iii) a_A

     (iv) a_B

     (v)   Unit vector directed from C toward A.

   (c)   Derive an expression of energy density in electrostatic field.

   (d)   The potential in free space is given by :

$$V = (50/r), \quad a < r < b \text{ (spherical)}$$

     (i)   Show $\rho_v = 0$ for $a < r < b$

     (ii)   Find the energy stored in region $a < r < b$.

(e) Define scalar field and vector field with suitable example.

(f) Discuss different coordinate system. Show various parameter with diagram.

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

(a) Discuss electrostatic boundary condition between conductor and free space.

(b) Define continuity equation in point form and integral form.

(c) A capacitor with two dielectric is as follows :

Plate areas = 100 cm², dielectric 1 thickness = 3 mm, ε_{r1} = 3, dielectric 2 thickness = 2 mm, ε_{r2} = 2, if the potential of 100 V is applied across plate. Find the energy stored in each dielectric & potential gradient in each dielectric.

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

(a) Derive Maxwell's equation from Faraday's law and Ampere circuital law.

(b) A current element $I_1 \Delta L_1 = 10^{-5} a_z$ AM is located at $P_1(1,0,0)$ while a second element $I_2 \Delta L_2 = 10^{-5}(0.6a_x - 2a_y + 3a_z)$ AM is located at $P_2(-1,0,0)$ both in free space. Find the vector force on element 2 by element 1.

(c) Derive an expression of magnetic field intensity due to infinite long straight conductor using Ampere's circuital law.

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

(a) Derive the condition for polarization of uniform plane wave. Write a short note on linear polarization of uniform plane wave.

(b) Derive an expression of uniform plane wave in free space and good conductor.

(c) A medium is characterized by $\varepsilon_r = 2.5$, $\mu_r = 4$, $\sigma = 10^{-3}$S/m at frequency of 10 MHz.

Find :

(i) Attenuation constant

(ii) Phase constant

(iii) Propagation constant

(iv) Velocity of propagation

(v) Intrinsic impedance.