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 : $(5 \times 4 = 20)$

    (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 :

        $V = (50/r)$, $a < r < b$ (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 : $(5\times2=10)$

(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 $= 100$ cm^2, dielectric 1 thickness $= 3$ mm, $\varepsilon_{r1} = 3$, dielectric 2 thickness $= 2$ mm, $\varepsilon_{r2} = 2$, 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 : $(5\times2=10)$

(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 : $(5\times2=10)$

(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.