2 4 4 4

Electromagnetic Engineering
(New) (1020)

P. Pages : 3

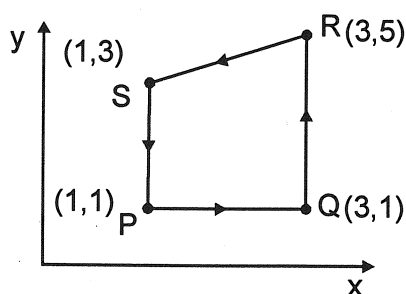Time : Three Hours   Max. Marks : 100

Instructions to Candidates :
1.   Do not write anything on question paper except Seat No.
2.   Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3.   Students should note, no supplement will be provided.
4.   Answer **any two** question from each unit.
5.   Assume suitable data if necessary.
6.   Use of non-programmable electronics calculator is allowed.
7.   Neat diagram must be drawn whenever necessary.

UNIT - I

1.   a)   i)   If $V = \dfrac{50}{\gamma}$ in free space, calculate volume charge density and energy stored in region $a < \gamma < b$ use spherical system.   **7**

          ii)   Show that $\psi = Q$.   **3**

     b) $Q_1 = 10nC$ at $(0, -4, 0)$, $Q_2 = 20nC$ at $(0, 0, 4)$ obtain location of Q_3 if total $\overline{E} = 0$ at origin, use $Q_3 = 40nC$.   **10**

     c)   i)   Calculate $\overline{E}$ at $(x, -2, 0)$; if a plane $z = 8m$ carries the surface charge density of $4nc/m^2$ and line $y = 2$ m and $z = -2m$, carries charge density of $2\pi nc/m$.   **5**

          ii)   Evaluate $\int \overline{A} \cdot \overline{dl}$ for path PQRSP as shown in fig. use $\overline{A} = x \cdot \hat{a}y$.   **5**
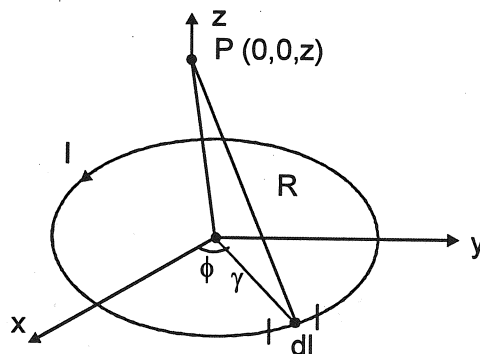
UNIT - II

2. a) By using Laplace's equation, find capacitance per unit length of co-axial cable of inner radius 'a' and outer radius 'b'. Assume $V = V_0$ at $\gamma = a$, $V = 0$, at $\gamma = b$. **10**

    b) If $\overline{D}_1 = 2ax + 5ay - 3az$ nc/m^2 and region $z < 0$ is characterised by $\epsilon_{r2} = 2$ and $z > 0$, $\epsilon_{r2} = 5$. Calculate :
        i) $\overline{D}_{N1}$ $\overline{D}_{N2}$ $\overline{D}_{t2}$, $\overline{D}_2$
        ii) Energy density in each region.
        iii) Ratio of $|\overline{P}_2|$ and $|\overline{P}_1|$. **10**

    c) i) Show that $\nabla \cdot J = -\dfrac{\partial \rho v}{\partial t}$. **5**

        ii) Obtain boundary condition between dielectric and conductor. **5**

UNIT - III

3. a) Evaluate stoke's theorem for $\overline{H} = 6xy\ ax - 3y^2 ay$ A/m and rectangular path $q < x < 5$; $-1 < y < 1$; $z = 0$ Let positive ds_z. **10**

    b) i) State and explain Biot-Savart law. **5**

        ii) Find magnetic flux density at a point on the axis of circular loop of radius 'γ' that carries current I as shown in fig. **5**

    c) i) Calculate incremental field at point P_2 caused by P_1 for I, $\Delta L_1 = 2\pi(0.6az - 0.8ay)$ μA·m, $P_1(4,-2,3)$ $P_2(1, 3, 2)$. **5**

ii)   1A flows through co-axial cable having a = 10cm, b = 20cm, c = 25cm calculate field intensity H at $\gamma = 5\,cm$, 11cm, 22cm, 40cm.   **5**

UNIT - IV

4.   a)   A transmission line of length 100m and $z_o = 100\,\Omega$ is terminated by $z_L = (100 - j200)\Omega$ Using Smitch-chart, determine line impedance and admittance at 0.25λ from the local end.   **10**

     b)   i)   Starting from wave equation in free-space, develope a Helmnot'z equation. **5**

          ii)   Derive wave equation for conducting medium in terms of $\overline{E}$ and $\overline{H}$.   **5**

     c)   A uniform plane wave in free space is $E_s = 200 \lfloor 30e^{-j250z}a_x$ calculate :   **10**
          i)   Frequency.
          ii)   Wave length
          iii) $\overline{H}$
          iv) $|\overline{E}|$ at z = 8mm and t = 6PS.

UNIT - V

5.   a)   A half wave dipole is radiating in free - space driven by current of 0.5A at the terminal; calculate $\overline{E}$ and $\overline{H}$ field 1 km from the antenna at angular
          i)   45°
          ii)   90°   **10**

     b)   Two identical point sources are separated by distance 'd' Each source has field pattern given by $E_0 = E$, $\sin\theta$. If $d = \lambda/2$ and phase angle is = 0, draw the radiation pattern.   **10**

     c)   Explain following terms: **10**

          i)   Yagi - Uda antenna.   ii)   Broad side array.

          iii)   End - fire array.   iv)   Pattern multiplication.

          v)   Directivity.

****