Con. 2711-08. (REVISED COURSE) CO–9973

(3 Hours) [Total Marks : 100

N. B. : (1) Question no. **1** is **compulsory**.
(2) Attempt any **four** questions from the remaining **six** questions.
(3) Assume any **suitable** data if **necessary**.

1. (a) State and explain Coulomb's Law. **20**
(b) Explain conduction current and displacement current.
(c) Explain the terms "distributed parameter" and "lumped parameter".
(d) Charge $Q_1 = 300\ \mu c$ is located at (1, –1, –3) experiences a force $F_1 = 8a_x - 8a_y + 4a_z$ N due to a point charge Q_2 at (3, –3, –2). Determine Q_2.
(e) Obtain 'H' due to infinitely long straight filament of current I.

2. (a) On a line described by x = 2, y = –4 m, there is uniform charge distribution of $\rho_e = 20$ nc/m. Determine the electric field E at (–2, –1, 4). **10**
(b) Charge lies in Z = –3 plane in the form of a square sheet defined by $-2 \le x \le 2$, $-2 \le y \le 2$, with charge density $\rho_s = 2\ (x^2 + y^2 + 9)^{3/2}$ nc/m^2. Find E at Origin. **10**

3. (a) A uniform line charge of $\rho_c = 3\ \mu c/m$ lies along z axis and concentric circular cylinder of radius 2 m has $\rho_s = \left(\frac{-1 \cdot 5}{4\pi}\right)\ \mu c/m^2$. Both distributions are infinite in extent with Z. Use Gauss law to find D in all directions. **10**
(b) Given $A = 30e^{-r}\ a_r - 2_z\ a_z$ in cylindrical co-ordinates evaluate both sides of divergence theorem by the volume enclosed by r = 2, z = 0 and z = 5. **10**

4. (a) Find the work done in moving a point charge Q = 5 μc from origin to $\left(2, \frac{\pi}{4}, \frac{\pi}{2}\right)$ in spherical co-ordinate system in the field. **10**

$$E = 5e^{-r/4}\ a_r + \frac{10}{r \sin\theta}\ a_\varphi\ V/m$$

(b) State and explain Biot-Savert's Law. Derive the expression for magnetic flux density B on the axis of circular ring of radius a at the distance 'd' from the plane of the ring. **10**

5. (a) Starting with Maxwell's equations derive the wave equation for a wave in conducting media and show that the wave gets attenuated when travelling in this medium. **10**
(b) In the region $0 < r < 0{\cdot}5$, in cylindrical co-ordinates, the current density is given by $J = 4{\cdot}5\ e^{-2r}\ a_z\ A/m^2$. Or J = 0 elsewhere. Use Ampere law to find H. **10**

6. (a) Given $E = E_m \sin(wt - \beta z)\ a_y$ in free space. Find D, B, H using Maxwell's equation. **10**
(b) Derive the equation of standing wave. Find the instantaneous rate of energy flow per unit area at a point. **10**

7. (a) Differentiate between scalar and vector magnetic potential. **20**
(b) Maxwell's equation in point as well as integral for steady electric and magnetic field.
(c) Derive Poisson's and Laplace equations.
(d) Impedance matching using Smith chart.
(e) State and explain Stoke's theorm.
