

Con. 5828-09.

(REVISED COURSE)

SP-7850

(3 Hours)

[Total Marks : 100]

- N.B. :** (1) Question No. 1 is **compulsory**,  
 (2) Attempt any **four** from remaining **six**.  
 (3) Assume any **suitable** data if **required**.  
 (4) **Figures to right** indicates **full** marks.

1. Solve any **four** :-

20

- (a) Convert  $P \left( 10, \frac{\pi}{6}, \frac{\pi}{3} \right)$  in cylindrical.  
 (b) State and prove Gauss's law.  
 (c) What is energy density in electrostatic field write its formula.  
 (d) Show that energy store in parallel plate capacitor is  $\frac{1}{2} CV^2$ .  
 (e) State and explain Amp. ckt law.

2. (a) It is required to hold 3 equal point charge of +Q each in equilibrium at the corner of an equilateral triangle. Calculate the point charge which will do this if placed at the centre of a triangle. **10**  
 (b) A charge density  $\rho_s = 0.5 \text{ nc/m}^2$  covers the infinite plane  $-x + 3y - 6z - 6 \text{ m}$ . Find electric field intensity on the side containing the origin. **10**

3. (a) Given that  $D = 30e^{-r/b} \hat{a}_r - 2\frac{z}{b} \hat{a}_z \text{ (c/m}^2\text{)}$  in cylindrical co-ordinates, find the outward flux crossing the right circular cylinder described by  $r = 2b$ ,  $z = 0$  and  $z = 5b \text{ (m)}$ . **10**

- (b) Find the work done in moving a point charge  $Q = 10 \mu\text{C}$  from origin to the point  $\left( 3\text{m}, \frac{\pi}{4}, \frac{\pi}{2} \right)$  in spherical co-ordinates. The equation of field is

$$E = 10r \hat{a}_r + \frac{5}{r \sin \theta} \cdot \hat{a}_\phi \text{ (v/m)}$$

4. (a) A total charge of  $\frac{40}{3} \text{ nc}$  is uniformly distributed over a circular ring of radius 2 m placed on  $z = 0$  plane with center at origin. Find electric potential at  $(0, \phi, 5)$ . **10**

- (b) Derive the equation of potential in terms of dipole moment. **10**

5. (a) Write short note on scalar and vector magnetic potential. **10**

- (b) State uniqueness theorem and give its proof. **10**

6. (a) Define Poynting vector. Obtain integral form of Poynting theorem and explain each term. **10**

- (b) Explain significance of Maxwell's equation. Also explain the concept of displacement current or current density. **10**

7. (a) Given that the electric field intensity of an electromagnetic wave in non-conducting dielectric medium with permittivity  $\Sigma = 9\Sigma_0$  and permeability  $\mu_0$  is

$$\vec{E}(z, t) = \hat{a}_y 5 \cos(10^9 t - \beta z) \text{ v/m}$$

Find the magnetic field intensity  $\vec{H}$  and the value of  $\beta$ .

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 (2) Attempt any **four** from remaining **six**.  
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- (a) Convert  $P \left( 10, \frac{\pi}{6}, \frac{\pi}{3} \right)$  in cylindrical.
- (b) State and prove Gauss's law.
- (c) What is energy density in electrostatic field write its formula.
- (d) Show that energy store in parallel plate capacitor is  $\frac{1}{2} CV^2$ .
- (e) State and explain Amp. ckt law.
2. (a) It is required to hold 3 equal point charge of +Q each in equilibrium at the corner of an equilateral triangle. Calculate the point charge which will do this if placed at the centre of a triangle. **10**
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7. (a) Given that the electric field intensity of an electromagnetic wave in non-conducting dielectric medium with permittivity  $\Sigma = 9\Sigma_0$  and permeability  $\mu_0$  is  $\bar{E}(z, t) = \hat{a}_y 5 \cos(10^9 t - \beta z) \text{ v/m}$  Find the magnetic field intensity  $\bar{H}$  and the value of  $\beta$ . **10**
- (b) Explain depth of penetration (Skin Depth). Find the skin depth at frequency 1.6 MHz in Aluminium whose  $\sigma = 38.2 \text{ Ms/m}$  and  $\mu_r = 1.0$ . Also find propagation constant and wave velocity in this medium (Assume  $\alpha = \beta = 1/\delta$ ) **10**