

QP Code : 582800

(3 Hours)

[Total Marks : 100

- N. B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** out of remaining **six** questions.
 (3) **Figures** to the **right** indicate **full** marks.
 (4) Assume suitable data wherever necessary.

1. (a) Prove that the curl of gradient of a scalar function is zero. 5
 (b) State and explain Ampere's Circuital law. 5
 (c) Find the area of spherical surface of a sphere having radius = 2m. 5
 (d) Explain the relation $\vec{P} = \vec{E} \times \vec{H}$. 5
2. (a) Derive the expression for electric field intensity at a general point P ($\rho, \phi, 0$) due to an infinite line charge placed along z axis. 10
 (b) Two infinite uniform sheets of charge $30 \mu\text{C}/\text{m}^2$ are located at $y = \pm 3\text{m}$. Determine E in all regions. 5
 (c) What is a uniform plane wave? 5
3. (a) Using Laplace's equation, derive the capacitance of a parallel plate capacitor. 10
 (b) Discuss the phenomenon of polarization in dielectric medium. Discuss how it gives rise to bound charge densities. 10
4. (a) State and explain general set of Maxwell's equations in point form and integral form. 10
 (b) Given $\vec{D} = (8x + 4x^3) \hat{x} - 2y \hat{y} + 2z \hat{z} \text{ C}/\text{m}^2$. Find charge Q in the region $-a < x, y, z < +a$. 10
5. (a) Starting from Maxwell's equations derive equation of EM wave in free space. 10
 (b) Derive the expression for the Poynting theorem and state the significance of each term. 10
6. (a) Define the terms: Characteristic impedance, propagation constant, Phase velocity and intrinsic impedance. 10

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- (b) A lossy dielectric has $\mu_r = 1$ and $\epsilon_r = 1$, $\sigma = 2 \times 10^{-8}$ S/m. An electric field $E = 200 \sin \omega t \hat{z}$ V/m at a certain point in the dielectric. **10**
- At what frequency $J_C = J_D$.
 - At this frequency calculate the instantaneous displacement current density.

7. Write short notes on any **three** of the following **20**
- Equation of continuity of current.
 - Method of images.
 - Mutual inductance
 - Boundary condition in Electric field

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