

QP Code : 1512

(3 Hours)

[ Total Marks : 100

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

1. Attempt any four :-

- (a) State and explain vector form of coulomb's law. 20  
 (b) Explain the method of Images.  
 (c) State and prove Gauss's law for electrostatics.  
 (d) Explain what is depth of penetration (skin depth). Find the skin depth at 1.6 MHz in Aluminium given  $\sigma = 38.2 \text{ M s/m}$  and  $\mu_r = 1.0$ .  
 (e) Explain polarization of electromagnetic waves.
2. (a) Derive the expression for Electric Field intensity due to an infinite surface charge. 10  
 (b) In the region of free space that includes the volume 10  
 $2 \leq (x, y, z) \leq 3$ ;  $\vec{D} = \frac{2}{z^2} (yz\vec{a}_x + xz\vec{a}_y - xy\vec{a}_z)$   
 verify the divergence theorem for  $\vec{D}$
3. (a) In the space, a line charge density  $80 \text{ nC/m}$  lies along the entire Z-axis, while point charges of  $100 \text{ nC}$  each are located at  $(1, 0, 0)$  and  $(0, 1, 0)$ . Find the potential difference  $V_{PQ}$  given  $P(2, 1, 0)$  and  $Q(3, 2, 5)$  10  
 (b) Derive Laplace's and Poisson's equation. 10
4. (a) Derive an expression for magnetic field intensity due to an infinite current carrying conductor along Z-axis. 10  
 (b) State Farady's law. Give expressions for emf when there is : 10  
 (i) Stationery loop in time varying  $\vec{B}$ -field  
 (ii) Moving loop in static  $\vec{B}$  field
5. (a) Explain Maxwell's equations in differential and integral form for time varying fields. 10  
 (b)  $\vec{H} = H_x(\omega t - \beta z)\vec{a}_x$  exists within a dielectric of permittivity  $\epsilon$  10  
 Estimate the corresponding displacement current density and then find the charge density and electric field corresponding to H-field.

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6. (a) State and derive expression for Poynting theorem. Explain each term's meaning and significance. 10
- (b) Given  $\vec{H} = 6r \sin \phi \vec{a}_r + 18 r \sin \theta \cos \phi \vec{a}_\phi$ ; in spherical system; evaluate stoke's theorem for the portion of the sphere  $r = 4$ ,  $0 \leq \theta \leq 0.1 \pi$  and  $0 \leq \phi \leq 0.3 \pi$  10
7. (a) Explain the concept of scalar and vector magnetic potential. 10
- (b) Derive electromagnetic wave equation for free space. 10
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