

- N.B:** (1) Q. No. 1 is compulsory  
 (2) Attempt **any three** out of remaining questions  
 (3) Figures to right indicate full marks & assume data wherever necessary

**Q1** Attempt **any four** out of the following (20)

- (a) State and explain Gauss law of electrostatics.  
 (b) Explain point form of continuity equation.  
 (c) State and explain Lorentz force equation.  
 (d) Find force on  $Q_2=200\mu\text{C}$  at  $P_1 (0, 4, 0)$  due to  $Q_1 = -150\mu\text{C}$  at  $P_2 (-3, 0, 0)$  in free space.  
 (e) Define characteristics impedance and propagation constant.

**Q2** (a) Prove that the tangential component of  $E$  is continuous across a dielectrics Interface and  $D$  is discontinuous (10)

- (b)  $D = (10r^3/4) \mathbf{a}_r$  (c/m<sup>2</sup>) in cylindrical co-ordinates. Evaluate both sides of divergence theorem for the volume enclosed by  $r=1$  and  $r=2\text{m}$ ,  $z=0$  and  $z=10\text{m}$ . Calculate the outward flux. (10)

**Q3** (a) Explain magnetic scalar and vector potentials and derive the expression for them (10)

- (b) Current density  $\mathbf{J}=10^2 \sin\theta \mathbf{a}_r$  A/m<sup>2</sup> in spherical co-ordinate. (10)

Find current crossing the spherical shell of radius  $r=0.02\text{m}$

**Q4** (a) Define inductance and mutual inductance. Derive inductance of solenoid (10)

- (b) Find the potential variation, e-field and capacitance between two spherical shells (10) of radius  $a$  and  $b$ . When inner shell placed at a potential  $V_0$  and outer shell is grounded.

**Q6** (a) Define uniform plane wave and derive the expression for lossy dielectrics. (10)

- (b) Given  $\mathbf{E} = E_m \sin(\omega t - \beta z) \mathbf{a}_y$ , in free space. Find  $\mathbf{D}$ ,  $\mathbf{H}$ ,  $\mathbf{B}$  at  $t=0$  (10)

**Q7** (a) A 300 MHz plane wave propagates through fresh water ( $\sigma=0$ )  $\mu_r=1$ ,  $\epsilon_r=78$ . (10)

Calculate  $\eta$ ,  $v$ ,  $\lambda$ ,  $\beta$ , alpha and delta.

- (b) State Maxwell's equation in AC and DC form. (10)

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