

Duration : 3 Hours

Marks : 80

- 1] Question no. 1 is Compulsory
- 2] Attempt any three questions out of remaining questions
- 3] Assume suitable data if require

Q1 Attempt any Four**(20 Marks)**

- a) Calculate charge density due to electric flux density $\vec{D} = 4r \sin \phi \hat{a}_r + 2r \cos \phi \hat{a}_\phi + 2z^2 \hat{a}_z \text{ C/m}^2$
- b) Obtain point format of Continuity equation
- c) Express Biot Savart's law in vector format
- d) For parallel plates capacitor with plate area 10cm^2 and plates separation 3mm has voltage of $100 \sin 10^3 t \text{ V}$ applied to its plates. Calculate displacement current density ($\epsilon = 2\epsilon_0$)
- e) Define following terms:
 - Uniform Plane waves
 - TEM wave
- f) Define the term Characteristic Impedance, Write expression for the same for Lossy and Lossless lines
- g) Show that $\vec{E} = -\nabla V$

Q. 2**(20 Marks)**

- a) A sheet charge of $\rho_s = 2\text{nC/m}^2$ located at $x = 2$ in free space and line charge $\rho_l = 20\text{nC/m}$ is located at $x = 1$ & $z = 4$, find electric field at the origin and direction of electric field at (4,5,6)
- b) For infinite long conductor of radius 'a' carrying current I, determine Magnetic field everywhere.

Q. 3**(20 Marks)**

- a) Explain in brief Maxwell's Equation for Time varying field in Integral and Point format, also give their significance
- b) Magnetic field component of an EM wave propagating through a non-magnetic medium ($\mu = \mu_0$) is:

$$\vec{H} = 25 \sin(2 \times 10^8 t + 6x) \hat{a}_y \text{ mA/m}$$

Determine:

- The direction of wave propagation
- The permittivity
- Electric Field

Q. 4**(20 Marks)**

- a) List boundary conditions for time varying field if given that:

$$\vec{D} = 50\hat{a}_x + 80\hat{a}_y - 30\hat{a}_z \text{ nC/m}^2$$

In region $x \geq 0$ where $\epsilon = 2.1\epsilon_0$. Find Electric charge density for region $x \leq 0$ where $\epsilon = 7.6\epsilon_0$.

- b) Obtain Poisson's and Laplacian's Equation used to solve boundary problems for conducting plates described as $V(z=0) = 0\text{V}$ and $V(z=2\text{mm}) = 50\text{V}$. Determine:
 - V
 - \vec{E}
 - \vec{D}

Q. 5

(20 Marks)

- a) Lossless 50Ω transmission line terminated by a load impedance $Z_L = 75 + 60j \Omega$, using Smith chart determine:
- Reflection Coefficient
 - SWR
 - Input Impedance at 0.2λ from load verifying the same using analytical solution
- b) Obtain Integral form of Poynting Theorem and Explain significance of each term

Q. 6 Write short note on

(20 Marks)

- a) Electric Dipole
- b) Electrostatic discharge
- c) Magnetic Levitation
- d) Wave propagation through lossy dielectrics