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 $\overline{D} = 4r\sin\emptyset\,\widehat{a_r} + 2r\cos\emptyset\,\widehat{a_\emptyset} + 2z^2\widehat{a_z}\ C/m^2$

**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 saperation 3mm has voltage of $100\sin 10^3 t\ V$ applied to its plates. Calculate displacement current density ($\varepsilon = 2\varepsilon_0$)

**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 $\bar{E} = -\nabla V$

**Q. 2** **( 20 Marks)**

**a)** A sheet charge of $\rho_s = 2nC/m^2$ located at $x = 2$ in free space and line charge $\rho_l = 20nC/m$ 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:

$$\overline{H} = 25\sin(2\times 10^8 t + 6x)\overline{a_y}\ mA/m$$

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:

$$\overline{D} = 50\overline{a_x} + 80\overline{a_y} - 30\overline{a_z}\ nC/m^2$$

In region $x \geq 0$ where $\varepsilon=2.1\varepsilon_0$. Find Electric charge density for region $x \leq 0$ where $\varepsilon=7.6\varepsilon_0$.

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

**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 $0.2\lambda$ 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

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