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

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:

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

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:

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

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
- $\bar{E}$
- $\bar{D}$

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
