(3 Hours) **(Total Marks : 80)**

N.B.: 1. **Q. No. 1** is **compulsory**.
2. Attempt **any three** out of the remaining **five** questions.
3. Assume suitable **data**.

Q1. Attempt any **FOUR :** **(20)**

a) Write a short note on memristor.
b) A circular loop conductor having a radius of 0.15 m is placed in the x-y plane. This loop consists of a resistance of 20 Ω. If magnetic flux density is $\mathbf{B} = 0.5 \sin 10^3 t\, \mathbf{a_z}$ (Tesla) find the current flowing through this loop.
c) Derive Poisson's and Laplace's equation.
d) Derive continuity equation.
e) State and explain Gauss's law.
f) Define and explain the significance of vector magnetic potential.

Q2.a) Evaluate both sides of the divergence theorem for the field $\mathbf{D} = 2xy\, a_x + x^2\, \mathbf{a_y}$ (C/m^2) and a rectangular parallelepiped formed by the planes x=0 to 1, y= 0 to 2, z= 0 to 3. **(10)**

b) Derive expression to find magnetic field intensity due to infinite long straight conductor on z-axis by Biot- Savart law. **(10)**

Q3. a) Derive Maxwell's equation for time varying fields in point and integral form and explain its significance. **(10)**

b) Define reflection coefficient, transmission coefficient and standing wave ratio. For normal incidence, determine the amplitudes of reflected and transmitted electric and magnetic fields **E** and **H** at interface of two regions at z=0. Given: Incident Ei= 1.5×10^{-3} V/m. $\varepsilon_{r1} = 8.5$, $\mu_{r1} = 1$, $\sigma_1 = 0$. Second region is free space. **(10)**

Q4. a) State Poynting theorem. Derive mathematical expression for Poynting theorem and explain the meaning of each term. **(10)**

b) In free space, $V = 6xy^2z + 8$. Find electric field intensity **E** and volume charge density ρ_v at point P (1, 2,-5). **(10)**

Q5. a) A lossless transmission line with $Z_0 = 50\ \Omega$ is 30 m long and operates at 2 MHz. The line is terminated with a load $Z_L = 60 + j40\Omega$. If $\upsilon = 0.6$ c on the line, find reflection coefficient, standing wave ratio and input impedance.Use analytical method and Smith chart method. **(10)**

b) Derive boundary conditions for electrostatics and magnetostatics. **(10)**

Q6. Write short notes on any **FOUR :** **(20)**

a) Inkjet Printer.
b) Microstrip lines.
c) Graphene.
d) Wave propagation in free space.
e) Electric Dipole.
f) Skin effect.
