(Time: 3 Hours) **[Maximum Marks: 80]**

N.B.: 1. Q. 1 is compulsory
2. Answer any three out of remaining five questions
3. Assumptions made should be clearly stated.
4. Assume any suitable data wherever required but justify the same

Q. 1 Solve **ANY FOUR** questions from following. (Each question carries 5 marks)

a) Point charge Q= 5 μC placed at origin, find electric potential at (0,4,3)m . **(05)**

b) Explain Lorentz's force equation for either moving charge or the current carrying element. Enlist two applications of Lorentz's force in electrical measurements. **(05)**

c) Convert the following points specified in cylindrical into spherical co-ordinates **(05)**
(i) (2,5π/3, -2)
(ii) (4, π/6,1)

d) Define gradient of a scalar quantity. Derive the relation between $\overline{E}$ and the electric potential V. **(05)**

e) Derive point and integral forms of Ampere's circuital law. **(05)**

Q. 2 a) Derive electric field intensity due to an infinite line with line charge density of ρ_l (C/m) and infinite plane having surface charge density $\rho_s \left(C/m^2\right)$. **(10)**

Q. 2 b) A charge of $Q_1 = 3X10^{-4}C$ at A(1,2,3)m and a charge of $Q_2 = -10^{-4}C$ at B(2,0,5)m in a vacuum. Find following forces exerted on **(10)**
i) charge Q_2 by charge Q_1
ii) charge Q_1 by charge Q_2.
Infer the relation between above two forces.

Q. 3 a) Evaluate the charge enclosed and flux emitted by the closed surface using Gauss Divergence theorem for the electrostatic field with surface flux density $\overline{D}$ =2xy$\overline{a_x}$ +x^2 $\overline{a_y}$ C/m^2.The rectangular parallelopiped is formed by the planes x=0 and 1m,y=0 and 2m,z=0and 3m. **(10)**

Q. 3 b) For a vector field show that the divergence of the curl of any vector field is zero. **(10)**

Q. 4 a) Given the magnetic vector potential $\overline{A}$ = -ρ^2/4 $\overline{a_z}$ Wb/m. Calculate flux density and the total flux crossing the surface ϕ=π/2,1≤ρ≤2m,0≤z≤5m. **(10)**

Q. 4 b) Derive the Poisson's and Laplace equation. Formulate the capacitance of a parallel plate capacitor with air as a dielectric medium, d is the separation between plates with A as area of plates. **(10)**

Q. 5 a) Calculate the magnetic field intensity $\overline{H}$ due to infinite conductor carrying current I along z axis. **(10)**

Q. 5 b) A dipole with dipole moment -5 $\overline{a_z}$ nC/m is located at point(0,0,-2)m.Find the potential at origin. **(10)**

Q. 6 a) Derive Maxwell's equations in time domain and frequency domain. **(10)**

Q. 6 b) Formulate wave equation for perfectly dielectric medium. **(10)**
