

Time-3 Hours

Total Marks-80

N.B.: - (1) Question No.1 is compulsory.

(2) Attempt any Three questions out of remaining five questions.

(3) Assume suitable data if necessary and justify the same.

Q 1. Answer any four questions.

- A) Draw rectangular, cylindrical and spherical co-ordinate system and explain differential element \overline{dl} , differential surface \overline{ds} and differential volume dv for all co-ordinate system **05**
- B) Derive relationship between electric potential V and electric field intensity \overline{E} . **05**
- C) Explain Lorentz force equation for a moving charge and its applications **05**
- D) Derive Poisson's and Laplace's equation for a dielectric medium. **05**
- E) Compare electric and magnetic fields using any five points. **05**
- Q2 a) Derive electric field intensity \overline{E} due to infinite line charge with charge density ρ_l C/m. **10**
- Q 2 b) Two point charges $-4\mu\text{C}$ and $4\mu\text{C}$ are located at $(2,-1,3)\text{m}$ and $(2,-1,-3)\text{m}$ respectively in free space. Find the force and electric field on $1\mu\text{C}$ charge at origin $(0,0,0)\text{m}$. **10**
- Q 3 a) Derive magnetic field intensity \overline{H} due to an infinite straight conductor carrying a current I . **10**
- Q 3 b) For current density $\overline{J} = 10z \sin^2 \phi \overline{a}_\rho$ A/m². Find the current through cylindrical surface $\rho = 2\text{m}, 1 \leq z \leq 5\text{m}$. Draw the circuit diagram and analyze the direction of current. **10**
- Q 4 a) Derive continuity equation for current for transient state condition. **10**
- Q 4 b) In cartesian co-ordinate a potential is a function of x only. At $x = -1\text{ cm}$ $V = 25\text{ V}$ and $\overline{E} = -1 \times 10^3 \overline{a}_x$ V/m throughout the region. Find potential function V at x which is in between two plates **10**
- Q 5 a) Find electric flux density \overline{D} , magnetic flux density \overline{B} and magnetic field intensity \overline{H} in free space, given that $\overline{E} = E_m \sin(377t - \beta z) \overline{a}_y$. **10**
- Q 5 b) i. Derive the modified form of Ampere's circuital law from conventional Ampere's circuital law **10**
ii. Write a note on surface voltage gradient on conductor or an electrode
- Q 6 a) Derive of the electromagnetic wave equation from Maxwell's equation in phasor form for any medium. **10**
- Q 6 b) Derive Gauss laws in the point form for an electric field and magnetic field. **10**
