Duration – 3 Hours **Total Marks assigned to the paper- 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. **Each questions carry 5 marks. Attempt any four questions.**

a. Prove that 'The line integral of the magnetic field around some closed loop is equal to the sum of the currents which pass through the loop'. **05**

b. Explain Lorentz's force equation for moving charge. Enlist its application. **05**

c. Enlist any five properties of Electromagnetic waves. **05**

d. Point charge Q=0.5 μC placed at origin, find electric field intensity at (0,3,4)m . **05**

e. Define gradient operator. Derive the relation between $\bar{E}$ and the electric potential. **05**

Q 2 a) Define magnetic Potential. State how is magnetic potential analogous to electric potential? General vector potential $\bar{A}$=10sinθ $\overline{a_\theta}$, in spherical system. Find magnetic flux density $\bar{B}$ at (2,π/2,0) **10**

Q 2 b) Formulate wave equation from Maxwell's equation. Solve it for perfectly conducting media. **10**

Q 3 a) An infinite long current filament is placed along z-axis. The magnetic field intensity at point P(6,8,0) is 10 (-1.6$\overline{a_x}$,+1.2$\overline{a_y}$) A/m. Find current through the filament. **10**

Q 3 b) Derive the expression for magnetic field intensity due to finite and infinite wire carrying current I. **10**

Q 4 a) Derive Maxwell's second equation in integral and point form. **10**

Q 4 b) Find $\bar{D}, \bar{B}$ *and* $\bar{H}$ displacement current density in free space, given $\bar{E} = E_m \sin(\omega t - \beta z)\overline{a_y}$. **10**

Q 5 a) Discuss the phenomenon of electric polarization in dielectric medium. **10**

Q 5 b) Derive the Poisson's and Laplace equation. In Cartesian co-ordinate a potential is a function of x only. At $x = -2\ cm, V = 25\ V\ and\ E = -1.5 \times 10^3 \overline{a_x}\ V/m$ throughout the region. Find V at x=5 cm. **10**

Q 6 a) Derive electric field intensity due to an infinite plane having density $\rho_s \left(C/m^2\right)$. **10**

Q 6 b) State & explain coulomb's law in electrostatics. **10**

A Charge $Q_1 = -20\mu C$ is placed at P(-6,4,6) m and a charge $Q_2 = 50\mu C$ is placed at R(5,8,-2) m in free space. Calculate the exerted force on $Q_2 by\ Q_1$ in vector form.

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