

Time: 3 Hours

Note :

- Question No.1 is compulsory.
- Solve ANY THREE questions from the remaining five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

- Q. 1** Solve ANY FOUR questions from following. (Each question carries 5 marks)
- a) Show that for sinusoidally varying field the conduction current and the displacement currents are always displaced from each other by 90° in time. (05)
- b) Prove that "The line integral of the magnetic field around some close loop is equal to the sum of the currents which pass through the loops". (05)
- c) State and describe Biot Savart Law. (05)
- d) Given $\vec{A} = \vec{a}_x + 2\vec{a}_y - 3\vec{a}_z$ and $\vec{B} = 2\vec{a}_x - \vec{a}_y + \vec{a}_z$. Determine, (05)
- Projection of \vec{B} on \vec{A}
 - The smaller angle between \vec{A} and \vec{B} .
- e) How is magnetic potential analogous to electric potential? (05)
- Q. 2** a) Draw rectangular, cylindrical and spherical co-ordinate system and explain differential element dl , differential surface ds and differential volume dv for all coordinate system (10)
- Q. 2** b) Show that the \vec{E} due to infinite sheet of charge at a point is independent of the distance of that point from the plane containing the charge. (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 $10(-1.6\vec{a}_x + 1.2\vec{a}_y) A/m$. Find current through the filament. (10)
- Q. 3** b) Derive the Poisson's and Laplace equation. In Cartesian co-ordinate a potential is a function of x only. At $x = -2 \text{ cm}$, $V = 25 \text{ V}$ and $\vec{E} = -1.5 \times 10^3 \vec{a}_x \text{ V/m}$ throughout the region. Find V at $x=5 \text{ cm}$. (10)
- Q. 4** a) Derive expression for magnetic field intensity due to infinite & finite wire carrying current I. (10)
- Q. 4** b) Find \vec{D} , \vec{B} and \vec{H} displacement current density in free space, given $\vec{E} = E_m \sin(\omega t - \beta z) \vec{a}_y$. (10)
- Q. 5** a) Discuss the phenomenon of electric polarization in dielectric medium. (10)
- Q. 5** b) State the Maxwell's equations for time varying fields in integral and point forms. Also explains the physical significance of each equation. (10)
- Q. 6** a) Formulate wave equation from maxwell's equation. Solve it for perfectly conducting media. (10)
- Q. 6** b) Consider a pair of point charges in free space: charge $q = -300 \mu\text{c}$ is located at $(2, 4, 5) \text{ m}$ and charge $Q = 10 \mu\text{c}$ is located at $(1, 1, 3) \text{ m}$. what is the force magnitude on q. (10)