Duration: 3hrs **[Max Marks: 80]**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

Q1. Answer any Four from the following [20]

a. Define scalar and vector quantity. Also state coulomb's law.

b. Prove that the electric flux passing through any closed surface is equal to the total charge enclosed by that surface.

c. A uniform line charge of 1 ηC is situated along x-axis between the points (-500,0)mm and (500,0)mm. Find the electric scalar potential V at (0,1000)mm.

d. Explain Lorentz's force equation for moving charge. Enlist it's application

e. Moist soil has a conductivity of 10^{-3} S/m and εr = 2.5. find Jc and Jd where, E = 6.0 x 10^{-6}sin(9.0 x 10^{9}t) V/m.

Q 2. A. Show that the $\vec{E}$ due to infinite sheet of charge at a point is independent of the distance of that point form the plane containing the charge. [10]

B. In the region 0<r<0.5 m, in cylindrical coordinates the charge density is $\vec{J}$ = 4.5 e^{-2r} $\overrightarrow{az}$(A/m2) and J = 0 elsewhere. Use Ampere's law to find $\vec{H}$. [10]

Q 3. A. Discuss the phenomenon of polarization in dielectric medium. Also discuss how it gives rise to bond charge densities. [10]

B. Derive the Poission's and Laplace equation. In Cartesian co-ordinate a potential is a function of x only. At $x = -2\ cm, V = 25\ V\ and\ \vec{E} = -1.5 \times 10^{3}\overrightarrow{a_x}\ V/m$ throughout the region. Find V at x=5 cm. [10]

Q 4 A. Derive the set of Maxwell's equations for static fields. [10]

B. Define Biot-Savart's Law. Derive the expression for magnetic field intensity due to infinite wire carrying current I. [10]

Q 5 A. Explain the concept of Magnetic scalar potential [10]

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

Q 6. A. Formulate wave equation from Maxwell's equation for dielectric medium. [10]

B. 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. [10]

****