Time: 3 Hours **Max. Marks: 80**

Note: (1) Question number 1 is compulsory.
(2) Solve any THREE out of remaining.
(3) Assume suitable data if necessary.
(4) Figures to the right indicate full marks.

Q.1 Attempt any **FOUR**

(a) Derive Laplace's and Poisson's equations. **(5)**

(b) Explain ground wave propagation. Which type of polarization is used for ground wave? **(5)**

(c) Explain the Dirichlet-type, Neumann-type and mixed boundary conditions. **(5)**

(d) Explain the radiation intensity, directivity and directive gain of the antanna. **(5)**

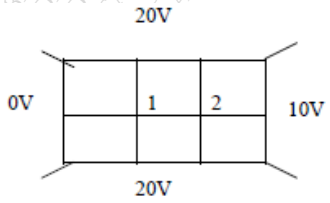
(e) State and explain Coulomb's law. Point charges 1mC and -2mC are located at (2,3,-1)m and (- 2,-1,4)m respectively. Calculate the electric force on a 10nC charge located at (0,3,1)m. **(5)**

Q. 2 **(a)** Derive Maxwell's equation in integral & Point form for time varying field. **(10)**

(b) Define and explain skin depth. Derive the expression for the skin depth. Calculate the skin depth and the velocity of propagation for a uniform plane wave at a frequency of 150MHz traveling in aluminum. ϵ_r=1, μ_r=1, σ=3.5x10^7 S/m. **(10)**

Q.3 **(a)** Explain Poynting vector. Derive Poynting theorem and describe significance of each term. **(10)**

(b) Use the finite difference method to calculate the potentials at nodes 1 and 2 in the potential system shown in figure using iteration method and band matrix method. **(10)**



Q.4 **(a)** Derive the expression for radiation resistance in far field region of an infinitesimal dipole. **(10)**

(b) Find the directive gain and D if $U(\theta,\phi) = 10\sin\theta\sin^2\phi$, $0<\theta<\pi$, $0<\phi<2\pi$. **(5)**

(c) An antenna has a field pattern given by $E(\theta) = \sin^2 2\theta$ for $0<\theta<\pi$. Find the half power beamwidth and the first null beamwidth.

Q.5 **(a)** Explain sky wave propagation. **(5)**
Calculate the skip distance for flat earth with MUF of 20 MHz if the wave is reflected from a height of 200km where the maximum value of refractive index of the earth is 0.95.

(b) What is line of sight propagation? Obtain expression for range of line of sight for space wave propagation in terms of antenna's transmitting and receiving heights. **(10)**

Q.6 Attempt any **TWO**

(a) Explain folded dipole antenna and its applications. **(10)**

(b) Explain the concept of retarded fields. **(10)**

(c) Derive the expressions for propagation constant, attenuation constant, phase-shift constant, velocity and intrinsic impedance for a wave propagating in a perfect conductor. **(10)**

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