Q. P. Code : 13678

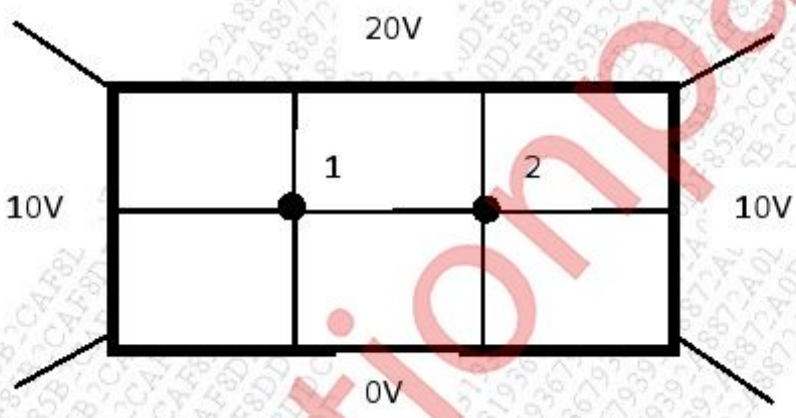
(3 Hours) **[Total Marks : 80**

N.B. : (1) Question no.1 is compulsory
(2) Solve any three questions from Question no 2 to Question no 6
(3) Assume suitable data if necessary
(4) Figures on the right indicate the marks

1. Attempt any four:
   a) Derive Laplace's and Poisson's equations. 5
   b) Starting with Maxwell's equations derive the wave equation for a wave propagating in free space. 5
   c) Define and explain radiation intensity, directive gain, beam width and directivity of an antenna. 5
   d) Define critical frequency, MUF and OWF. A high frequency radio link has to be established between two points on the earth 3000km away. If the reflection region of the ionosphere is at a height of 200km and has a critical frequency of 10MHz, calculate the MUF of the given path. 5
   e) Explain the concept of retarded potentials. 5

2. a) Derive the boundary conditions for the electric and magnetic field at a dielectric-dielectric boundary. 10
   b) An infinite uniform line charge with a density of 20nC/m is located along the z-axis and a surface charge density of 0.1nC/m^2 exists on the plane z=3. Find **E** at P(1,2,5)m. 10

3. a) Use the Iterative finite difference method and the band matrix method to calculate the potentials at nodes 1 and 2 in the potential system shown in figure below. 10



   b) Define polarization of an electromagnetic wave. Explain linear, circular and elliptical polarization. 10

4. a) State Poynting theorem. Derive the Poynting vector and explain the power terms involved in the derivation. 10
   b) Find the transmission and reflection coefficients at a boundary for normal incidence. For region 1 $\varepsilon_{r1}=9$, $\mu_{r1}=1$ and $\sigma_1=0$. Region 2 is free space. Assume perpendicular polarization. 5
   c) An electric field in a medium which is source free is given by $\mathbf{E}=1.5\cos(10^8t-\beta z)\mathbf{a}_x$ V/m. Obtain **D, B, H.** Assume free space medium. 5

5. a) Derive an expression for the radiation resistance of an infinitesimal dipole antenna and explain its significance. 10
   b) Explain the effect of imperfection of earth, curvature of earth, effect of interference zone and shadowing effect of hills and buildings on space wave propagation. 10

6. Write short notes on:
   a) Folded dipole antenna 7
   b) Skin depth 6
   c) Wave propagation in dispersive media 7
