Q.P. Code: 16425

[Time: Three Hours] **[Marks:80]**

Please check whether you have got the right question paper.

N.B:
1. Question **No. 1** is **compulsory.**
2. Attempt **any three out of the remaining five**
3. Draw neat diagrams wherever necessary.
4. Assume data, if missing, with justification
5. Figures to the Right indicate full marks.

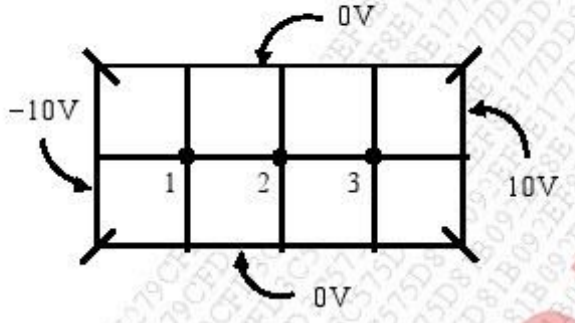
Q1. **Attempt ANY FOUR out of the FIVE**

(a) Compare parallel polarization and perpendicular polarization. **[05]**

(b) A zero potential reference is at r=10m and a point charge of Q=0.5 nC is placed at origin. Find potential at r=5m and r=15m. **[05]**

(c) Explain ducting effect. Under what conditions does this effect take place? **[05]**

(d) Determine the potential at the free nodes in the potential system of the following figure using Finite Difference Method (Band Matrix Method). **[05]**



(e) Explain the difference between conduction and displacement current with the aid of Maxwell's Equations **[05]**

Q2. **(a)** Derive boundary conditions for electric and magnetic field for a dielectric-dielectric interface stating its significance. **[8+2]**

(b) The plane z = 0 marks the boundary between free space and a dielectric medium with εr = 40. The electric field next to the interface in free space is $\bar{E} = 13\hat{a}_x + 40\hat{a}_y + 50\hat{a}_z$ V/m. Determine the electric field on the other side of the interface. **[05]**

(c) Define Polarization of a wave. What are the different kinds of Polarization? State the conditions to achieve Circular polarization. **[2+1+2]**

Q3. **(a)** Why do we use Numerical Techniques to solve the problem? Compare FDM, FEM and MOM. **[3+2]**

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(b) Solve Laplace's equation **[5]**

$\nabla^2 V = 0,\ 0 \le x \le 1;\ 0 \le y \le 1$ with

$V(x,1) = 45x(1-x)$

$V(x,0) = V(0,y) = V(1,y) = 0$

Assume mesh size as 0.5.

(c) Obtain reflection coefficient and transmission coefficient of perpendicularly polarized wave incident on a dielectric-dielectric boundary with oblique incidence. Define the Brewster angle for this case. **[8+2]**

Q4. **(a)** Derive the relation between MUF and skip distance **[5]**

(b) If a high frequency communication link is to be established between two points on the earth 2000 km away, and the reflection region of the ionosphere is at height of 200 km and has critical frequency of 5 MHz, calculate MUF for the given path. **[5]**

(c) Circular loop conductor carrying current of 1A is placed in the xy-plane centred at origin. Find expression for the magnetic field intensity at any point on the z – axis. **[10]**

Q5. **(a)** Define loss tangent? How does it classify lossless dielectrics, lossy dielectric and good conductor? **[2+3]**

(b) Derive wave equation for free space **[5]**

(c) Four like charges of 40 μC each are placed at four corners of a square. The square diagonal is 12m. Find the force on 200 μC charge located at 5m above the centre of the square. **[10]**

Q6. **(a)** Find the force due to two point charges Q_1=4 mC and Q_2=2 mC located at A(3,2,-1) and on a charge Q_3=20 nC located at C(0, 3, 1). **[5]**

(b) Define skin depth. Some unknown material has a conductivity of 10^6 mho/m and a permeability of 4π x 10^-7 H/m. Calculate the skin depth for the material at 1 GHz. **[5]**

(c) Explain the formation of inversion layer in troposphere. **[5]**

(d) Explain the working of an Electromagnetic Pump. **[5]**

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