Q.P. CODE: 36048

NOTE :

1. Question No.**1**. is **compulsory**. Attempt any **four** out of **five** in it.
2. Attempt any **three** out of remaining **five**.
3. Assume suitable data, wherever **necessary** and **justify** the same.
4. Figures to the right indicate marks.

1. A) Compare MOM, FEM and FDM. **(5)**

B) Given the potential $V = 2x^2y - 5z$ (V) and a point P (-4, 3, 6), find **(2+2+1)**
   a) Electric field intensity at P
   b) Electric flux density at P
   c) Volume charge density at P

C) State the Maxwell's equations for good dielectric in integral and point form. Also state their significance. **(5)**

D) With the help of neat schematic diagram, explain the working of an Electromagnetic Pump. **(5)**

E) Explain Super refraction. **(5)**

2. A) Two extensive homogeneous isotropic dielectrics meet on plane $z = 0$. **(5+5)**
For $z > 0$, $\varepsilon_{r1} = 4$ and for $z < 0$, $\varepsilon_{r2} = 3$.
A uniform electric field $\vec{E}_1 = 5\hat{a}_x - 2\hat{a}_y + 3\hat{a}_z$ (kV/m) exists for $z \geq 0$. Find,
   a) $\vec{E}_2$ for $z \leq 0$.
   b) The angles E_1 and E_2 make with the interface.

B) State Poynting theorem. Derive its final expression and explain the meaning of each term. **(2+5+3)**

3. A) What is ionosphere? Describe its various layers. Which layers are present during day and night time? Where maximum attenuation of electromagnetic waves takes place inside the ionosphere? **(10)**

B) State and derive FRISS transmission equation. **(10)**

4. A) Determine the potential at the free nodes in the potential system of Fig.1. using Finite Difference Method (Band Matrix Method). **(10)**

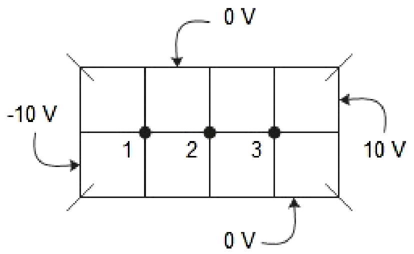

Fig.1.

B) Derive Helmholtz equations for Magnetic field in free space. **(5)**

C) For the normal incidence, determine the amplitudes of reflected and transmitted $\vec{E}$ and $\vec{H}$ at interface of two regions at $z = 0$. **(5)**
Given: Incident $E_i = 1.5 \times 10^{-3}$ (V/m); $\varepsilon_{r1} = 8.5$; $\mu_{r1} = 1$; $\sigma_1 = 0$. Second region is free space.

5. A) Explain formation of duct and condition for duct propagation. **(10)**

B) Obtain an expression for MUF in terms of d, H and f_c. **(5+5)**
If a high frequency communication link is to be established between two points on the Earth 2000 km away, and the reflection region of ionosphere is at height of 200 km and has critical frequency of 5 MHz, then calculate the MUF for the given path.

6. A) Explain the formation of inversion layer in troposphere. **(5)**

B) Define critical frequency as a measure of ionospheric propagation and determine critical frequency for reflection at vertical incidence if the maximum value of electron density is 1.24×10^6 per CC. **(2+3)**

C) Consider a two element mesh as shown in Fig.2. Using FEM determine the potentials at free nodes. **(10)**

Node	(x, y)
1	(0.8, 1.8)
2	(1.4, 1.4)
3	(2.1, 2.1)
4	(1.2, 2.7)

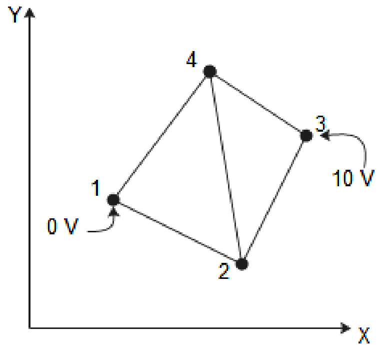

Fig.2.