(3 HOURS) **TOTAL MARKS:80**

N.B
1. Question No. 1 is compulsory.
2. Solve **any three** questions from remaining five questions.
3. Draw neat diagrams wherever necessary.
4. Assume suitable data if required.

Q 1 Answer **any four** of the following: (20)

a) Three equal point charges of 2μC are located at (0,0,0)m, (2,0,0)m and (0,2,0)m respectively in free space. Find out net force on Q4 = 5μC at (2,2,0)m.

b) Derive the wave equation for time varying Harmonic Fields in free space.

c) Compare MOM, FDM and FEM.

d) Explain Beam Width of an antenna.
An antenna has a field pattern given by $E(\theta)= \cos^2 \theta$ for $0^o \leq \theta \leq 90^o$. Find its Half Power width.

e) Define Critical Frequency and MUF. Calculate the critical frequency where the maximum value of n is 0.9 with a MUF of 10MHz.

Q 2

a) Given $V= 2x^2y-5xz$, find: V, **E , D** and ρ_v at P(-4,3,6)m. (10)

b) Given $\vec{E}$ =1.5 cos(10^8t-βz) $\overrightarrow{a_x}$ V/m , Obtain **B, H** and **D**. Assume $\varepsilon_r=1$ and $\mu_r=1$, $\sigma=0$ (10)

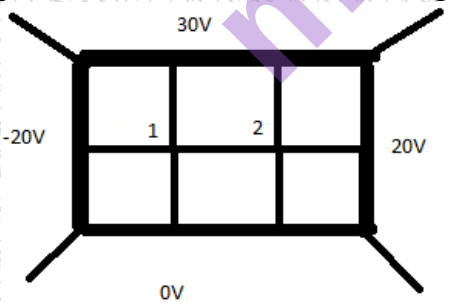
Q 3

a) Derive the boundary conditions for Electric and Magnetic fields at the boundary of two dielectric media. (10)

b) In free space, a plane wave with $\overrightarrow{H_i}$= 10cos(10^8t-βz) $\overrightarrow{a_x}$ mA/m is incident normally on a lossless medium with $\varepsilon=\varepsilon_0$, $\mu=\mu_0$ in region $z\geq0$. Determine H_r, E_r for the reflected wave and H_t, E_t for the transmitted wave. (10)

Q 4

a) Use the Iterative finite difference method and band matrix method to calculate potential at nodes 1 and 2 in the figure shown below: (10)



b) State Poynting Theorem and derive an expression for the Poynting vector. Explain the power terms mentioned in the derivation.

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Q 5

a) An electric field strength of 10μV/m is to be measured at an observation point $\Theta=\pi/2$, 500km from a half wave dipole antenna operating in air at 50 MHz. What is the length of the dipole? If the transmission line with $Z_O=75\Omega$ is connected to the antenna, determine Γ and standing wave ratio using Smith Chart. (10)

b) A distortion less line has Z_O =50 Ω, α = 50 Np/m, v =0.6c where c is the speed of light in vacuum. Determine R, L, G, C and λ at 100MHz. (10)

Q 6

a) Explain the factors affecting the field strength of space wave signal. (05)

b) Explain the concept of retarded potential. (05)

c) Derive the relationship between effective area and Directivity. (05)

d) Write the generalized Maxwell's Equations in point form and integral form. (05)