Duration :3hrs **Max.Marks:80**

N.B. (1) Question No. 1 is compulsory.
(2)Attempt any three questions out of the remaining five.
(3)Figures to the right indicate full marks.
(4)Assume suitable data if required and mention the same in answer sheet

1. Solve any four : **20**
a) State and Explain Gauss's law with its mathematical expression?
b) Prove that $E = -\nabla V$?
c) Find the force F at P(1,1,1) caused by four identical 3 nC charges located at $P_1(1,1,0)$, $P_2(-1,1,0)$ $P_3(-1,-1,0)$, $P_4(1,1,0)$?
d) Define reflection coefficient and voltage standing wave ratio with mathematical expression?
e) State and Explain Biot-Savart Law?

2. (a) A transmission line having characteristic impedance of 50 Ω is terminated with an impedance of (25+j50)Ω. Find the following using the smith chart: **10**
- Reflection coefficient
- VSWR
- Input impedance of line whose length is 0.3λ
- Return loss in dB

(b) Derive Laplace & Poisson's equation? **10**

3. (a) State Maxwell's equation for time varying fields in point and integral form and explain its significance? **10**
(b) State Poynting theorem. Derive mathematical expressions for the Poynting theorem and explain the meaning of each term? **10**

4. Write short note on: **20**
a) Applications of Electromagnetics
b) Magnetic Vector Potential
c) Radio frequency Identification
d) Skin Depth

5. (a) Aircraft antenna radiates Electric field in air ($\sigma = 0$, $\mu = \mu_0$, $\varepsilon = \varepsilon_0$) which is $E=25\cos(10^9 t+0.33x)a_y\ KV/m$ find out following terms related with this EM System: **10**
- Propagation constant (k)
- Phase Velocity
- Intrinsic Impedance (η)
- Average Poynting Power
- Magnetic Field ($\bar{H}$)

(b) Derive the expression for the Helmholtz equation? **10**

6. a) Derive the boundary conditions for dielectric and dielectric boundary? **10**
b) A boundary exists at Z =0 between two dielectrics $\epsilon_r = 3$ in region Z<0 and $\epsilon_r = 5$ in region Z>0. If the electric field in region Z<0 is E_1= 20ax+40ay+100az. Find electric fields in other mediums? **10**

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