

Duration: 3 Hours

Marks : 80

- 1] Question no. 1 is Compulsory
- 2] Attempt any three questions out of remaining questions
- 3] Assume suitable data if require

- Q. 1 Attempt any four 20**
- a) Explain Wave equation for free space.
  - b) Calculate Divergence and Curl of  $\vec{F} = r \cos \varphi \vec{a}_r + rz^2 \vec{a}_\varphi$  Units
  - c) Derive Faraday's Law with suitable applications.
  - d) Derive Laplacian's Equation for charge free dielectric region.
  - e) Explain Reflection Coefficient of Transmission lines.
  - f) Explain Gauss's Law in detail with applications.
  - g) Derive relationship between Electric field and Voltage.

- Q. 2**
- a) Derive magnetic field provided by infinite thin filament carrying current  $I$  suspended on 'z' axis. Also, provide significance over short filament. 10
  - b) Calculate input impedance of the lossless transmission line terminated by load impedance of  $Z_L = 100 + 100j \Omega$  in  $Z_0 = 50 \Omega$  system with length of  $l = 0.35\lambda$  with  $f = 3GHz$ , air as dielectric for transmission (Either by theoretical method or by Smith chart). 10

- Q. 3**
- a) Find out total Electric field at Origin because of following charge distributions: 10
    - Point charge of  $20nC$  placed at  $(-1, -2, -3)$
    - Point charge of  $50nC$  placed at  $(-2, -3, -4)$
    - Uniform infinite line charge of  $2nC/m$  placed at  $x = -5, z = -6$
    - Uniform infinite surface charge of  $0.5nC/m^2$  placed at  $z = -5$
  - b) Explain Point and Integral format of Time Varying field Maxwell's Equation with appropriate examples. 10

- Q. 4**
- a) If plane interface between two perfect dielectric mediums is located at  $z = 0$ . A 4GHz uniform planar wave travelling along z axis is incident from region 1,  $z \leq 0$  onto region 2,  $z \geq 0$ . The wavelength in dielectrics are  $\lambda_1 = 6cm$  and  $\lambda_2 = 4cm$ . Both the materials are non-magnetic. What are the percentage of energy on boundary is: 10
    - Reflected
    - Transmitted
    - Standing wave ratio in region 1
  - b) Aircraft antenna radiates Electric field in air ( $\sigma = 0, \mu = \mu_0, \epsilon = \epsilon_0$ ) which is  $\vec{E} = 25 \cos(10^9t + 0.33x) \vec{a}_y$  KV/m find out following terms related with this EM System: 10
    - Propagation constant (k)
    - Phase Velocity
    - Intrinsic Impedance ( $\eta$ )
    - Average Poyting Power
    - Magnetic Field ( $\vec{H}$ )

Q. 5

- a) Two plates of cylindrical capacitor describe by their radius  $\rho_1 = 1mm$  &  $\rho_2 = 1mm$  holding voltage of  $V_1 = 1V$  and  $V_2 = 100V$  find out  $\vec{E}$  in capacitor, also prove that dielectric of capacitor dose not carries any charge. 10
- b) Derive Poynting Vector and explain effects of medium parameters on EM power with suitable diagram 10

Q. 6

Write short note on

- a) Super Conductivity
- b) Helmholtz's Equation
- c) Wave equation for transmission line
- d) Electrical Discharge

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