

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 $\vec{E} = 25 \cos(10^9 t + 0.33x) \vec{a}_y$ KV/m find out following terms related with this EM System: 10
 - Propagation constant (k)
 - Phase Velocity
 - Intrinsic Impedance (η)
 - 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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