

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

- a) Explain Wave equation for free space.
- b) Calculate Divergence and Curl of $\vec{F} = r \cos \phi \vec{a}_r + rz^2 \vec{a}_\phi$ 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

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:

- Reflected
- Transmitted
- Standing wave ratio in region 1

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:

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

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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