B.E. / B.Tech. (Electronics & Communication / Telecommunication Engineering)
Model Curriculum Semester-V

ET506M - Electromagnetic Waves

P. Pages : 2 **GUG/W/24/13927**

Time : Three Hours * 5 5 3 9 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Assume suitable data wherever necessary.
3. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) What are the losses due to mismatching in transmission lines. Explain in details. **8**

b) A 600Ω lossless transmission line is fed by a 50Ω generator if the line is 200 meter long and terminated by load of 500Ω. Determine in d_{BS}. **8**

i) Reflection loss ii) Transmission loss iii) Return loss

OR

2. a) Explain- **8**

i) Single stub matching ii) Double stub matching

Enumerate the advantages and disadvantages of each of these methods.

b) Define the following terms and their physical significance- **8**

i) Attenuation function ii) Characteristic impedance

iii) Phase function iv) Phase velocity

as applied to a transmission line

3. a) A 2mC positive charge is located in vacuum at $p_1(3,-2,-4)$ and a $5\mu c$ negative charge is at $P_2(1,-4,2)$. **8**

i) Find the vector force on the negative charge

ii) What is the magnitude of the force on the charge at P_1.

b) Derive the mathematical expression for boundary condition between two perfect dielectrics. **8**

OR

4. a) The spherical region $0\angle r\angle 10\,cm$. contains a uniform volume charge density. **8**

$\rho_v = 4\mu c/m^3$

i) Find $Q_{enclosed}$ $0\angle r\angle 10\,cm$. ii) Find D_r $0\angle r\angle 10$

b) Transform the following vector to spherical co-ordinates. The vector is $\bar{A} = 5\bar{a}x$ and point $P(r=4,\ \theta=25,\ \phi=120)$. **8**

5. a) State and prove ampere's circuital law. **8**

b) Solid monomagnetic conductor of circular cross-section has its length along z axis It carries a current of 50A. The radius of conductor is 6mm. **8**

Find

i) $\bar{B}$ at $\rho = 7mm$ ii) $\bar{B}$ at $\rho = 5mm$

iii) The total magnetic flux per unit length inside the conductor.

OR

6. a) State and prove Poynting theorem. Also state the unit. **8**

b) Explain maxwell's equations for static fields (point form and integral form). **8**

7. a) Derive the mathematical expression of wave propagation in free space. **8**

b) A plane electromagnetic wave having a frequency of 5mHz has an average Poynting vector of $1w/m^2$. If the medium is lossless with relative permeability 2 and relative permittivity 3. **8**

Find-

i) The velocity of propagation ii) The wavelength

iii) The impedance of the medium iv) The rms electric field E.

OR

8. a) Derive the mathematical expression of wave propagation in conducting medium. **8**

b) The electric field of a uniform plane wave propagating is sea water $\sigma = 4 mho/m$, $C = 80 \in_0$ and $\mu = \mu_0$ in the positive z direction is given at- **8**

$Z = 0, \bar{E} = \cos\left(5\times10^4 \pi t\right)\hat{a}x\ V/m$.

Calculate

i) The instantaneous power flow per unit area normal to the Z direction as a function of Z.

ii) Find average power flow per unit area normal to Z direction as function of Z.

9. a) Explain the propagation of waves in rectangular waveguide. **8**

b) What is circular wave guide. Explain it with mathematical expression also state which mode is dominant mode in circular wave guide. **8**

OR

10. a) A rectangular waveguide measures $2\times4.5cm$ internally with a 9GHz signal propagated in 1%. **8**

Find-

i) The cut off wavelength ii) The guide wavelength

iii) The group and phase velocity iv) The characteristics wave impedance

b) What do you understand by the terms cut-off wavelength, dominant mode, guide wavelength, phase velocity, group velocity and wave impedance obtain the mathematical relations for each one of these and their inter relationship. **8**

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