

TE-SEM (CETRA)

(REV)

Ethamby
Eryg.

May 2014

15105114

QP Code : MV-18401

(3 Hours)

[Total Marks : 100

- N. B. : (1) Question No. 1 is compulsory.
(2) Attempt any four questions from Q. No. 2 to 7.
(3) Vector notation should be used wherever necessary.
(4) Assumptions made should be clearly stated.

1. (a) Derive wave equations for homogeneous unbounded source free medium starting with Maxwell's equations. 5
(b) Derive Poisson's and Laplace's equations. 5
(c) State the characteristics of Smith Chart. 5
(d) In a medium characterized by 5
 $\sigma = 0, \mu = \mu_0$ and $\epsilon = \epsilon_0$.
 $\vec{E} = 20 \sin(10^8 t - \beta z) \hat{a}_y$ V/m
Find β and \vec{H} .
2. (a) Derive boundary conditions for electric and magnetic fields at the boundary of two dielectric media. 10
(b) For an electromagnetic wave prove that $\vec{E} \cdot \vec{H}$ and $\vec{E} \times \vec{H}$ gives the direction of propagation of the wave. 10
(c) Determine γ and η at 100 MHz for a medium in which $\mu_r = 1, \epsilon_r = 10, \sigma = 0$. At what velocity will an EM wave travel in this medium? 10
3. (a) State and prove Poynting theorem. Explain the integrals involved in the statement. 10
(b) Explain various types of electromagnetic interferences. 10
4. (a) Derive the expressions for the reflection and transmission coefficients in case of reflection from perfect dielectric at normal incidence. 10
(b) Explain Brewster angle. Derive the expression for it. 5
(c) Determine the amplitudes of the reflected and transmitted E and H fields at the interface of two regions at $z = 0$. 5
Given : Incident $E_i = 1$ mV/m, $E_{r1} = 3.5, \mu_{r1} = 1, \sigma_1 = 0$.
Region 2 is free space.
5. (a) A 50Ω transmission line is to be matched to a load of $50 + j75\Omega$ using a short circuited stub. Use Smith Chart to design the minimum length of the stub and minimum distance of the stub from the load. 8
(b) Explain the use of a loss-less transmission line as circuit elements at UHF. 7
(c) Find the input impedance, VSWR and reflection coefficient at 0.6λ from the load $Z_L = 60 - j30\Omega$. Given : $Z_0 = 50\Omega$. 5

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6. (a) Explain potential functions for sinusoidal radiation oscillations. 5
- (b) For silver, $\sigma = 3 \text{ MS/m}$. At what frequency will the depth of penetration, δ , be 1 mm? 5
- (c) Define polarization of a wave Explain the types of polarization. 10
7. Write a short note on :-
- (a) The need of electromagnetic compatibility 7
- (b) Surface impedance of a conductor 7
- (c) Wave propagation in dispersive media. 6
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