



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (ECE)-N/SUPPLE/SEM-8/EC-804E/2010

2010

MICROWAVE CIRCUITS AND SYSTEM

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

- i) Voltage standing wave ratio occurs due to
 - a) superimpose of incidents & transmitted waves
 - b) for a matched load condition
 - c) superimpose of incident & reflected waves.
- ii) If a signal is incident at E-plane arm, it is divided in two other arms of
 - a) equal magnitude in opposite phase
 - b) equal phase & equal magnitude
 - c) same phase and same magnitude.



- iii) Magic Tee is a
- a) one-port network
 - b) two-port network
 - c) three-port network
 - d) four-port network.
- iv) A load impedance in a transmission line is $100 + j 200 \Omega$ and characteristic impedance is 100Ω . The normalized impedance is
- a) $1 + j 2 \Omega$
 - b) $10,000 + j 20,000 \Omega$
 - c) $1 + j 200 \Omega$.
- v) If the reflection co-efficient in a transmission line is 1, then
- a) signal is totally reflected
 - b) signal is totally transmitted
 - c) signal is totally absorbed by matched load.
- vi) Magic Tee is commonly used for
- a) mixing purpose
 - b) duplexing
 - c) impedance measurement
 - d) all of these.



vii) V.S.W.R is

a) $\frac{1+|\rho|}{1-|\rho|}$

b) $\frac{|\rho|-1}{|\rho|+1}$

c) $\frac{1+|\rho|}{|\rho|-1}$

[ρ = reflection co-efficient]

viii) The transmission line is said to be lossless

- a) if the conductors have zero conductivity
- b) dielectric between the conductor has infinite conductivity
- c) conductors have infinite conductivity & dielectric between the conductor has zero conductivity.

ix) The reflection co-efficient of a transmission line for a load impedance Z_4 is

a) $\frac{Z_4 + Z_0}{Z_4 - Z_0}$

b) $\frac{Z_4 - Z_0}{Z_4 + Z_0}$

c) $\frac{Z_4 + Z_0}{Z_0 - Z_4}$.



x) The transmission co-efficient of a transmission line in terms of reflection co-efficient (ρ) is

- a) $1 + \rho$
- b) $1 - \rho$
- c) $\frac{1}{\rho}$

xi) V.S.W.R. has minimum value

- a) zero
- b) half
- c) one.

xii) Which transmission line is ideal for handling high powers ?

- a) Co-axial line
- b) Microstrip
- c) Strip line
- d) Rectangular wave guide.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is transmission line ? Derive voltage and current equation. 1 + 4

3. Draw and discuss about *E*-plane Tee & Magic Tee.



4. Why is signal flow graph necessary in microwave network ?
Discuss about four basic rules for decomposition of microwave network.
5. What is the relation between impedance matrix & scattering matrix ?
6. Define multiport network. A two-port network is known to have the following scattering matrix.

$$[S] = \begin{bmatrix} 0.15 \angle 0^\circ & 0.85 \angle -45^\circ \\ 0.85 \angle 45^\circ & 0.20 \angle 0^\circ \end{bmatrix}$$

Determine if the network is reciprocal and lossless. If port 2 is terminated with a matched load, what is the return loss seen in port 1 ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. What are the different types of power divider & directional coupler ? Discuss about different types of directional coupler.

5 + 10



8. Why is scattering matrix necessary in microwave network ?

Discuss about scattering matrix, impedance & admittance

matrix of a N -port network.

3 + 12

9. a) A $\frac{\lambda}{8}$ section of a lossless line is terminated in a load

$25 + j 50 \Omega$. If $Z_0 = 100 \Omega$, find Z_{in} .

7

[Z = input impedance, Z_0 = characteristic impedance]

b) Define strip lines & microstrip line and also define

reflection co-efficient of a transmission line.

8

10. a) What is series & shunt tuning ?

4

b) Match a load impedance $Z_L = 100 + j 80 \Omega$ to a 50Ω line

using a single series open circuit stub assuming that

the load impedance is matched at 2 GHz consists a

resistor and inductor in series.

11



11. a) Discuss about periodic structure of a microwave filter. 10

b) Consider a load resistance $R_L = 100 \Omega$ to be matched to a 50Ω line with a quarter wave transfer. Find the characteristic impedance of matching section. 5

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