

Name :

Roll No. :

Invigilator's Signature :

**CS/B.Tech/ECE/SEM-8/EC-804E/2013
2013**

MICROWAVE CIRCUITS & SYSTEMS

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.*

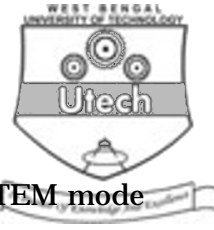
GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) For handling of high microwave power, the best medium is
 - a) Coaxial line
 - b) Rectangular line
 - c) Strip line
 - d) Microstrip line.
- ii) Wavelength of electromagnetic wave in a waveguide
 - a) is inversely proportional to the phase velocity
 - b) is greater than that in free space
 - c) is directly proportional to the phase velocity
 - d) depends only on the waveguide dimensions and free space wavelength.
- iii) The advantage of strip line over waveguide is
 - a) its power handling capacity is higher
 - b) smaller size
 - c) smaller bandwidth
 - d) low cost.



- iv) Mode in a Microstrip line is a
- a) TEM mode
 - b) Quasi TEM mode
 - c) TE mode
 - d) TM mode.
- v) An E-plane Tee is a waveguide in which the axis of its side arm is
- a) parallel to the E-field
 - b) perpendicular to the E-field
 - c) parallel to H-field
 - d) none of these.
- vi) For a distortionless transmission line
- a) $R/C = L/G$
 - b) $R/L = G/C$
 - c) $G/C = L/R$
 - d) $R = G = L = C = 0$.
- vii) λ distance on a transmission line corresponds to a
- a) 90° movement on the Smith chart
 - b) 180° movement on the Smith chart
 - c) 360° movement on the Smith chart
 - d) 720° movement on the Smith chart.
- viii) The effective aperture area and the directive gain of an antenna are related as
- a) $G = 4\pi A / \lambda^2$
 - b) $A = 4\pi G / \lambda^2$
 - c) $G = A / 4\pi \lambda^2$
 - d) $A = G / 4\pi \lambda^2$
- ix) Side lobe of an antenna pattern causes
- a) reduced bandwidth
 - b) reduced antenna gain
 - c) ambiguity in direction finding
 - d) increase antenna gain.



- x) The maximally flat filter is preferred over the Chebyshev filter, as it
- needs fewer reactive elements
 - has got sharper out of band attenuation
 - has less delay distortion
 - provides equal ripple response in the pass band.
- xi) Impedance transformation over a broad band in microwave is effected with
- a quarter wave transformer
 - an isolator
 - a tapered transmission line
 - an iron-core transformer.

GROUP – B

(Short Answer Type Questions)

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

- What are the advantages of microstrip line over strip line ?
 - Draw the Electric and Magnetic field lines of a strip and microstrip line. $2 + 3$
- Determine the generalized S matrix of an N port network.
- Mention the steps to design the microwave filter using image parameter method.
- Compute the mathematical expression for location and length of a single shunt short circuited stub using analytical solution.
- Write down and explain the S matrix of 90° hybrid and 180° hybrid directional coupler. $2\frac{1}{2} + 2\frac{1}{2}$



GROUP - C
(Long Answer Type Questions)

Answer any *three* of the following.

$3 \times 15 = 45$

7.
 - a) Define periodic structure.
 - b) Describe passband and stopband characteristics of periodic structure.
 - c) Explain the k - β diagram of periodic structure. $3 + 7 + 5$
8. Discuss the method of Even and Odd mode analysis and illustrate your answer with the help of a suitable example.
9.
 - a) A load impedance of 200 ohm is to be matched to the generator of 50 ohm impedance using a quarter wave transformer. Find the characteristic impedance and length of the transmission line, if the frequency of operation is 1 GHz.
 - b) State the inherent drawback of this type of impedance matching.
 - c) Discuss how this limitation can be overcome.
 - d) Discuss the steps involved in single stub matching load impedance to the system of a generator and transmission line. $4 + 1 + 4 + 6$
10.
 - a) Derive Friis power transmission formula.
 - b) A microwave terrestrial link of 30 km long is operating at 4 GHz with radiated power of 1000 W through a parabolic dish having maximum gain of 40 dB. The receiver uses similar antenna. Find the 'free space loss' and the 'received power'. $7 + 8$
11. Write short notes on any *three* of the following : 3×5
 - a) Magic Tee
 - b) Microwave filter
 - c) S parameter
 - d) Directional coupler
 - e) Circulator.