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Paper Code : OEROB802B Microwave Integrated Circuits

UPID : 008401

Time Allotted : 3 Hours

Full Marks : 70

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer *any ten* of the following :

[1 x 10 = 10]

- (I) Progress in _____ and other related semiconductor material processing led to the feasibility of monolithic microwave integrated circuits.
a) GaAs b) Silicon c) Germanium d) GaAlAs
- (II) The effective di-electric constant of a microstrip line
a) is equal to one
b) is equal to the permittivity of the material
c) cannot be predicted
d) lies between 1 and the relative permittivity of the microstrip line
- (III) Which mode of propagation is supported by a strip line?
- (IV) T- junction is an example of
a) 2 port network
b) 3 port network
c) 4 port network
d) None of the mentioned
- (V) The mode used in the laboratory bench is _____
a) dominant mode
b) degenerate mode
c) any one of the above two
d) none of the above
- (VI) For the capacitors in MMICs, the insulating dielectric film used is
a) Air b) SiO₂ c) Titanium d) GaAs
- (VII) The effective di-electric constant of a microstrip line of width 5 mm and thickness 8 mm and with relative permittivity of 2.6 is
a) 2.6 b) 1.97 c) 1 d) 2.43
- (VIII) If the phase velocity in a stripline is 2.4×10^8 m/s, and the capacitance per unit length of a micro-stripline is 10 pF/m, then the characteristic impedance of the line is
a) 50 Ω b) 41.6 Ω c) 100 Ω d) None of the mentioned
- (IX) If a device is passive and contains no anisotropic elements, then the device is called _____ network.
a) reciprocal
b) non reciprocal
c) lossless
d) lossy
- (X) Low VSWR method can be used to measure VSWR up to _____
a) ten b) five c) three d) none
- (XI) MMICs have higher circuit flexibility as compared to other microwave integrated fabrication methods.
a) True
b) False
- (XII) If a microwave network is lossless, then S matrix of the microwave network is:
a) Unitary
b) Symmetric
c) Identity matrix
d) Zero matrix

Group-B (Short Answer Type Question)

Answer *any three* of the following :

[5 x 3 = 15]

2. What is meant by ion implantation? Why is it preferred over diffusion process? [5]
3. Discuss the advantages and limitations of microstrip lines. [5]
4. Briefly explain the function of Fin line. [5]
5. How crosstalk can be avoided in microstrip transmission lines? [5]
6. What are the different measurement techniques of s-parameters? [5]

Group-C (Long Answer Type Question)

Answer *any three* of the following :

[15 x 3 = 45]

7. a) Explain the process of epitaxial growth in IC fabrication process with neat diagram. [10+5]
 b) Make a comparative study between thick and thin film technologies in connection with MMIC fabrication.
8. a) Write short note on quasi-TEM mode in microstrip lines. [5+5+5]
 b) What do you understand by effective dielectric constant? Explain with examples.
 c) Cite some examples of microstrip discontinuities. Mention their impact on microstrip lines.
9. a) Consider a microstrip transmission line with the following parameters: [10+5]
 Width (W) = 3 mm
 Substrate thickness (h) = 0.8 mm
 Relative permittivity of substrate (ϵ_r) = 4.2
 Calculate the characteristic impedance (Z_0) of the microstrip line.
 b) What do you understand by coplanar waveguide? Mention some of its applications.
10. a) What is microwave coupler? [5+5+5]
 b) What are the different types of couplers?
 c) Mention few applications of microwave couplers.
11. a) Distinguish between low frequency measurement and microwave measurement. [5+10]
 b) With the help of a neat sketch, briefly explain the functions of different blocks of a microwave bench.

*** END OF PAPER ***