Roll No. 15EEBEC036   [Total No. of Pages : 4

5E5025

5E5025

B.Tech. V Semester(Main/Back) Examination, Nov./Dec. - 2017
Electronics & Communication Engineering
5EC5A Microwave Engg. - I

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 26

Instructions to Candidates :

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.

Unit - I

1. a) Discuss the following in a rectangular waveguide,
   i) Degenerate mode
   ii) Dominant mode

   (4 +4 = 8)

   b) An air-filled rectangular waveguide of inside dimensions 7×3.5 cm operates in the dominant TE_{10} mode.
   i) Find the cutoff frequency.
   ii) Determine the phase velocity of the wave in the guide at a frequency of 3.5 GHz.
   iii) Determine the guided wavelength at the same frequency.

   (2 + 3 + 3 = 8)

OR

1. a) A shielded stripline has the following parameters
   Dielectric constant of the insulator, $\epsilon_r = 2.56$

                   Strip width, $w = 25$ mils
                   Strip thickness, $t = 14$ mils
                   Shield depth, $d = 70$ mils

   i) The K factor.
   ii) The fringe capacitance.
   iii) The characteristic impedance of the line.

   (2 + 2 + 2 = 6)

b) A loss less parallel stripline has a conducting strip width w. The substrate dielectric separating the two conducting strips has a relative dielectric constant $\in_{rd}$ of 6.0 (B_eO) and a thickness d of 4.0 mm.

Calculate:

i) The required width, w of the conducting strip in order to have a characteristic impedance of 50Ω.

ii) The strip-line capacitance.

iii) The strip-line inductance.

iv) The phase velocity of the wave in the parallel stripline.

(2½ × 4 = 10)

Unit - II

2. a) Derive the expression for average power flowing into the port-n of a n-port network, in terms of parameters proportional to incident wave and outgoing wave. (8)

b) Derive the following in terms of S-parameters when the ports are matched terminated in two port network.

i) Insertion loss.

ii) Transmission loss.

iii) Reflection loss.

iv) Return loss. (2 × 4 = 8)

OR

2. Discuss the following properties of S-parameters.

i) Zero property of [S] matrix.

ii) Unity property of [S] matrix.

iii) Symmetric property of [S] matrix.

iv) Phase shift property of [S] matrix.

(4 × 4 = 16)

5E5025 (2)

Unit - III

3. Discuss the [S] matrix of a directional coupler. A symmetric direction coupler with infinite directivity and a forward attenuation of 20 dB is used to monitor the power delivered to a load Z_l, as per fig (1) Bolometer-1 introduces a VSWR of 2.0 on arm 4; bolometer-2 is matched to arm 3. If bolometer-1 reads 8mW and bolometer-2 reads 2mW, find (a) the amount of power dissipated in the load Z_l; (b) the VSWR on arm 2.
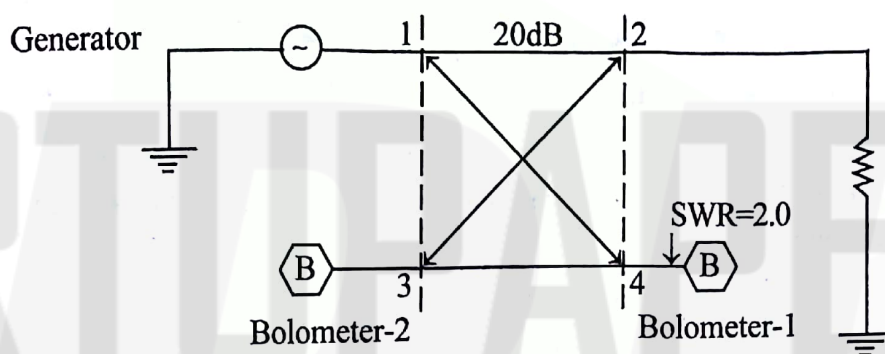
(4 + 6 + 6 = 16)

OR

3. With the help of a diagram, explain the following microwave components,

   i) Wilkinson Power Divider

   ii) Ring Resonator

   iii) Backward wave coupler

   (5 + 5 + 6 = 16)

Unit - IV

4. a) With the help of diagram, discuss an arrangement to measure low microwave power within 1 to 10 mW range. (8)

   b) Draw and explain the block diagram of set-up for the measurement of VSWR at the input of the component under test. (8)

OR

4. a) What are the types of network analysers. Explain any one of them with the help of suitable block diagram. (8)

   b) Discuss how measurements are made using a noise-figure meter. (8)

5. a) In MMIC, a planar resistor has the following parameters,

Resistive film thickness, $t = 0.1 \mu m$.

Resistive film length, $l = 10$ mm

Resistive film width, $w = 10$ mm

Sheet resistivity of gold film, $\rho = 2.44 \times 10^{-8} \Omega-m$.

Calculate the planar resistance and also draw the diagram of a thin film resister.

$(5 + 3 = 8)$

b) An interdigitated capacitor fabricated on a GaAs substrate has the following parameters,

Number of fingers, $N = 8$

Relative dielectric constant of GaAs, $\in_r = 13.10$

Substrate height, $h = 0.254$ cm

Finger length, $l = 0.00254$ cm

Finger base-width, $w = 0.051$ cm

Compute the capacitance.

(8)

OR

5. a) Describe the MMIC techniques and also list the basic materials for MMIC.(8)

b) Explain the photolithography process with the help of suitable diagram. (8)

◆◆◆◆