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Question Paper Code : 41222

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Seventh Semester

Electronics and Communication Engineering

EC 1402 A — MICROWAVE ENGINEERING

(Regulation 2008)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention the limitations in measuring Z, Y and ABCD parameters at microwave frequencies.
2. Differentiate between symmetry network and reciprocal network.
3. How does an isolator differ from an attenuator?
4. Mention the application of E plane and H plane tee.
5. A reflex Klystron is operating at 10 GHz with 600 V beam voltage. If the repeller voltage is 250 V, determine the optimum repeller space for $1\frac{3}{4}$ mode.
6. Define velocity modulation.
7. Define Gunn effect. In which materials the Gunn effect is observed?
8. Name the applications of parametric amplifier.
9. List the scales on a VSWR meter.
10. Enumerate the significance of tunable detector.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Obtain 'S' matrix of a two port network with mismatched load. (6)
(ii) Compare [S], [Z] and [Y] matrices. Obtain the relationship between Y-Z and ABCD parameters with S parameters. (10)

Or

- (b) The scattering matrix of a two - port microwave network is given below:

$$[S] = \begin{bmatrix} 0.10 \angle 0^\circ & 0.90 \angle -45^\circ \\ 0.90 \angle 45^\circ & 0.3 \angle 0^\circ \end{bmatrix}$$

Find out:

- (i) If the network is lossless. (4)
- (ii) If the network is reciprocal. (4)
- (iii) The return loss if port z is terminated in a matched load; and (4)
- (iv) The return loss if port z is terminated in a short circuit. (4)
12. (a) Describe the principles of operation of a 3-port circulator with a neat sketch. Derive the S- matrix for the circulator, when all the ports are matched. Write down the S- matrices for a clock wise and a counter clockwise circulator.

Or

- (b) (i) Prove that a TEE junction can not have all the three arms matched. (8)
- (ii) Explain the working of magic tee with neat sketch. (8)
13. (a) Describe how velocity modulation is converted to current modulation in klystron amplifier. A reflex klystron has Beam voltage = 1000 V repeller voltage = -150V, and resonant frequency = 80 GHz, distance between cavity and repeller is 6cm. Compute.
- (i) Electron velocity
- (ii) DC electron transit time.

Or

- (b) Draw the diagram of TWT amplifier and explain how it works as an amplifier. Compare this with klystron amplifier.
14. (a) Explain the structure working of Gunn diode and mention its merits, demerits and applications.

Or

- (b) Explain the working principle of following devices.
- (i) Tunnel diode (8)
- (ii) Parametric amplifier. (8)
15. (a) How are microwave measurements different from low frequency measurements? Explain the double minimum methods of measuring VSWR.

Or

- (b) With a neat block diagram, explain the power and impedance measurements in a microwave system.