Reg. No. ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 21197

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

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.   Define a reciprocal network.

2.   The impedance matrix of a certain microwave circuit is $[Z] = \begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$.
     Determine the corresponding scattering matrix.

3.   Using the scattering matrix of an E or H plane tee, outline its basic properties.

4.   What is Faraday Rotation? How does it originate and what are its uses in various device?

5.   A reflex Klystron is operating at 10 GHt with 600 V beam voltage. If the repeller voltage is 250 V, determine the optimum repelles space for $1^{3}/_{4}$ mode.

6.   Define velocity modulation.

7.   State the basic differences between a low – frequency transistor and a microwave transistor.

8.   Define transit time.

9.   A generator feeds a rectangular wave guide (0.9 cm × 0.4 cm) operating in the TE_{10} mode. When terminated in a short circuit the two successive minima are found to be separated by 2.4 cm, find the operating frequency.

10. Define Q factor of a cavity.

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:

$$[S] = \begin{bmatrix} 0.10 \underline{| 0°} & 0.90 \underline{| -45°} \\ 0.90 \underline{| 45°} & 0.3 \underline{| 0°} \end{bmatrix}$$

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) Elaborate on the following with necessary derivations and sketches:

    (i) Short circuit plunger. (5)

    (ii) Directional couplers. (6)

    (iii) Tuning screws. (5)

Or

    (b) A lossless T junction power divider has a source impedance of 50Ω. Find the output characteristic impedance so that the input power is divided in a ratio 2:1. Compute the reflection Co-efficient seen looking into the output ports.

13. (a) Compare the performance characteristics and applications of the following devices :

    (i) Klystron amplifier.

    (ii) TWT amplifier.

    (iii) Magnetron

    (iv) Klystron oscillator.

Or

    (b) A 250 kW pulsed cylindrical magnetron is operated with the following parameters : Anode voltage = 25 kV; peak anode current = 25 A; magnetic induction = 0.035 T; radius of cathode = 4.0 cm and radius of the anode = 8.0 cm. Calculate : (i) the efficiency of magnetron (ii) the cyclotron frequency (iii) the cut off magnetic field and (iv) the cut-off voltage.

14. (a) Discuss the mounting of IMPATT device in :

     (i) Co – axial and   (8)

     (ii) Wave guide configuration.   (8)

Or

(b) (i) What do you understand by transferred electron effect? Explain. (6)

     (ii) Calculate the frequency of oscillations for a stable domain mode for a $5\,\mu m$ long GaAs gunn device. What is the minimum electron concentration? (10)

15. (a) (i) How are microwave measurements different from the low frequency measurements? (6)

     (ii) Explain with the help of a neat diagram the various methods used for low and medium power measurements. (10)

Or

(b) Enumerate the following :

     (i) Impedance measurement (5)

     (ii) Frequency measurement (5)

     (iii) Measurement of cavity Q. (6)

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