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**Question Paper Code : 11283**

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

Seventh Semester

Electronics and Communication Engineering

080290059 — MICROWAVE ENGINEERING

(Regulation 2008)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the conditions for the minimum radius of curvature in order to have small reflections in E and H bends.
2. Mention the applications of E and H plane Tee junctions.
3. Write the important difference between TWT and Klystron amplifiers.
4. Define convection current.
5. Write the applications of slotted lines.
6. Differentiate return and reflection losses.
7. An IMPATT diode has the following parameters: carrier drift velocity =  $2 \times 10^7$  cm/s and drift region length =  $6 \mu\text{m}$ . Determine the resonant frequency.
8. What are the different modes of operation of a Gunn diode?
9. A coplanar strip line carries an average power of 100 mW and a peak current of 40 mA. Determine the characteristic impedance of the coplanar stripline.
10. What are the factors causing losses in parallel striplines?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the properties of the S-matrix of reciprocal microwave networks and lossless microwave junctions with necessary equations. (10)
- (ii) Draw and Explain the operation and applications of a two hole directional coupler and also write its S-matrix. (6)

Or

- (b) (i) Prove that it is not possible to construct a perfectly matched, lossless reciprocal three port junction. (8)
- (ii) Derive the S-matrix of a magic Tee and discuss the applications of a magic Tee. (8)
12. (a) (i) Explain the operation of a two cavity Klystron amplifier with necessary diagrams and expressions for output power and efficiency. (12)
- (ii) A reflex Klystron operates under following conditions: beam voltage ( $v_0$ ) = 500 V, spacing between repeller and cavity (L) = 1 mm, Effective shunt resistance ( $R_{sh}$ ) = 15 K $\Omega$  and the frequency ( $f_r$ ) = 9 GHz. If the tube is oscillating at 9 GHz at the peak of the  $n = 2$  (i.e.,  $1\frac{3}{4}$ ) mode, determine the repeller voltage. Give that the electron charge is  $1.6 \times 10^{-19}$  C and the electron mass  $9.1 \times 10^{-31}$  kg. (4)

Or

- (b) (i) Draw and explain the principle and operation of cylindrical magnetron with neat diagrams and expressions for its efficiency. (10)
- (ii) A helix TWT operates with a beam current of 4mA, beam voltage of 2 KV and the characteristic impedance of the helix is 20 $\Omega$ . Calculate the dB power gain if the normalized circuit length is  $N = 50$  and frequency is 8 GHz. (6)

13. (a) (i) Explain the methods of low and high VSWR measurements briefly. (10)
- (ii) Discuss the applications of vector network analyzer. (6)

Or

- (b) (i) Explain the measurement of S-parameters with a neat block diagram. (8)
- (ii) Discuss the methods of measuring return loss with necessary diagrams. (8)

14. (a) (i) Compare the principle of transferred electron devices and avalanche transit time devices. (8)
- (ii) Draw and explain the operation of TRAPATT diodes and discuss the important differences between IMPATT and TRAPATT diodes. (8)

Or

- (b) (i) Describe the Manley-Rowe power relations for a parametric amplifier with necessary diagram and equations. (8)
- (ii) Explain the principle and operation of parametric up converter and negative resistance parametric amplifier with necessary diagrams and expressions for the noise figure and bandwidth. (8)
15. (a) (i) Draw a microstrip line and discuss its characteristics impedance and applications. (8)
- (ii) A gold parallel strip line has the following parameters: relative dielectric constant of polyethylene ( $\epsilon_{rd}$ ) = 2.25, strip width (w) = 25 mm and separation distance (d) = 5 mm. Calculate the characteristics impedance of the strip line, strip line inductance and capacitance and phase velocity. (8)

Or

- (b) (i) Give a brief note on the losses and quality factor of microstrip lines. (10)
- (ii) A shielded strip line has the following parameters: relative dielectric constant of the polystyrene = 2.56, strip width = 0.7 mm, strip thickness = 1.4 mm and shield depth = 3.5 mm. Calculate the characteristics impedance of the line. (6)
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