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BT-7/D-18 37011

MICROWAVE ENGINEERING

ECE-407-E (Opt. I)

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) When the dominant mode is propagated in an air-filled rectangular, the guide wavelength for a frequency of 9 GHz is 4 cm. Calculate breadth of the guide. **10**

   (b) Derive the expressions of calculate the Q-factor for a rectangular cavity resonator. **10**

2. Explain the following :

   (a) Dielectric Constant Measurement

   (b) Frequency Measurement. **10+10=20**

Unit II

3. (a) A two cavity klystron amplifier has DC voltage for acceleration of electron equals to 1000 V, DC beam resistance is 40 kΩ, DC current 25 mA, frequency of operation is 3 GHz, gap spacing in either cavity is 1 mm, spacing between the two cavities is 4 cm and effective shunt impedance including the beam loading is 30 kΩ. Find :

   (i) Input gap voltage to give maximum output voltage

   (ii) Voltage gain neglecting beam loading in output cavity

   (iii) Efficiency of the amplifier. **10**

   (b) Explain the high frequency limitations of conventional vacuum tubes. **10**

4. (a) For Travelling Wave Tube (TWT) derive the expressions for axial electric field induced in the helix slow wave structure. **10**

   (b) Explain the π-mode oscillations in cylindrical magnetron. **10**

Unit III

5. (a) Prove the unitary and zero property of the S-matrix with necessary expressions. **10**

(b) Explain the working of H-plane Tee and derive its S-matrix with numerical values by assuming the that port 3 (series arm) is perfectly matched ? **10**

6. (a) Explain the operation of Faraday Rotation Isolator with detailed description. **10**

(b) List the basic characteritics of a circulator and discuss the operation of 4-port circulator with necessary diagram and s-matrix. **10**

Unit IV

7. (a) Explain the negative differential resistance phenomenon in context to GUN diode. **10**

(b) A M-Si-M BARITT diode has relative dielectric constant for Si is 11.8, donor concentration $N = 2.8 \times 10^{21}\ m^{-3}$ and silicon length L is 6 μm. Calculate the :

(i) Breakdown Voltage

(ii) Breakdown Electric Field. **10**

8. (a) Explain the operation, constructional details with diagram of IMPATT diode. **10**

(b) Explain the working of parametric amplifiers. **10**