

Roll No.

Total Pages : 03

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 $40 \text{ k}\Omega$, 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 $30 \text{ k}\Omega$. 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 characteristics 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 $N = 2.8 \times 10^{21} \text{ m}^{-3}$ 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