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Total Pages : 3

**BT-8/M-20**

**38140**

**MICROWAVE ENGINEERING**

Paper–ECE-404N

Option–I

Time Allowed : 3 Hours]

[Maximum Marks : 75

**Note** : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

**UNIT-I**

1. (a) A rectangular air filled copper waveguide with dimensions 0.9 inch  $\times$  0.4 inch cross section and 12 inch length is operated in the dominant mode at 9.2 GHz. Determine :
  - (i) cut off frequency
  - (ii) guided wavelength
  - (iii) phase velocity
  - (iv) characteristic impedance. 4 $\times$ 2=8
- (b) Define the Quality factor. Derive relationship between loaded and unloaded quality factors. 7
2. Explain the following :
  - (a) Insertion Loss Measurements.

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- (b) RF Substitution method for Attenuation measurements. 7+8=15

### UNIT-II

3. (a) Explain, how inter-electrode capacitance affects the performance of conventional vacuum tubes at high frequency. 7
- (b) Explain the working of Multicavity Klystron and derive expressions for beam current density. 8
4. (a) Derive the equation of Hull cut off voltage for cylindrical magnetron. 9
- (b) A helix travelling wave tube is operated with a beam current of 30 mA, beam voltages of 3kV, circuit length is 50, frequency of operation is 10 GHz and characteristics impedance of  $10\Omega$ .
- Find :
- (i) the gain parameter
- (ii) the output power gain
- (iii) four propagation constants. 3×2=6

### UNIT-III

5. (a) Prove that the three ports of a lossless passive Tee junction, when reciprocal in nature cannot be matched simultaneously. 7
- (b) The S-parameters of a two port network are  $S_{11} = 0.26 - j0.16$ ,  $S_{12} = S_{21} = 0.42$  and  $S_{22} = 0.36 - j 0.57$ . Calculate insertion loss, transmission loss, reflection loss and return loss. 4×2=8

6. (a) Explain the working of a precision variable attenuator and derive its S-matrix. 8
- (b) Explain the working of a H-plane Tee and derive its S-matrix with numerical values by assuming that the port 3(side arm) is perfectly matched. 7

#### UNIT-IV

7. (a) An IMPATT diode operates with carrier drift velocity ( $V_s$ ) of  $1.5 \times 10^7$  cm/s, length of drift region (L) is  $8\mu\text{m}$ , maximum operating current ( $I_{\text{max}}$ ) equals to 180 mA, maximum operating voltage ( $V_{\text{max}}$ ) = 90 Volts and efficiency is 10%. Calculate :
- (i) the maximum CW output power in watts
- (ii) the frequency of output power in GHz. 2×4=8
- (b) Explain Manley Rowe power relation in context to parametric amplifier. 7
8. (a) Explain the working of BARITT diode with its constructional details. 8
- (b) Explain high field domain formation in GUNN diode. 7