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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 × 0.4 inch cross section and 12 inch length is operated in the dominant mode at 9.2 GHz. Determine :

   (i) cut of frequency

   (ii) guided wavelength

   (iii) phase velocity

   (iv) characteristic impedance. 4×2=8

   (b) Define the Quality factor. Derive relationship between loaded and unloaded quality factors. 7

2. Explain the following :

   (a) Insertion Loss Measurements.

(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 10Ω.

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 1.5×10^7 cm/s, length of drift region (L) is 8μm, maximum operating current (I_{max}) equals to 180 mA, maximum operating voltage (V_{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