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BT-7/M21 47011

MICROWAVE ENGINEERING

Paper–ECE-407 E

Option–II

Time allowed : 3 Hours **Maximum Marks : 100**

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

UNIT-I

1. (i) An air filled rectangular copper waveguide with dimensions 2×1 cm^2 operates in the dominant mode at rate of 1 hp. The signal frequency is 30 GHz. What is the peak value of the electric field occurring in the waveguide? 10

   (ii) Define the Quality Factor. Differentiate between loaded and unloaded quality factors? On what factors the value of a quality factor depends? 10

2. Explain the followings :

   (i) Microwave Power Measurements. 10

   (ii) Dielectric Measurements. 10

UNIT-II

3. (i) Explain the working of Multicavity klystron and derive expressions for beam current density. 10

   (ii) A reflex klystron is operated at 9 GHz with V_0 = 600 V, repeller spacing of 1 mm, R_{sh}= 15KΩ and N = 1¾. Calculate :

   (a) the repeller voltage

   (b) the dc current necessary to produce microwave gap voltage of 200V

   (c) the maximum efficiency. Assume βo = 1. 10

4. (i) Explain the working of cylindrical magnetron with its constructional details. 10

   (ii) A Helix travelling wave tube operates with V_0 = 4kV, I_0 = 4 mA, f = 10GHz, Z_0 = 25 Ω, N = 50. Compute :

(a) gain parameter C

(b) power gain in dB. 10

UNIT-III

5. (i) Explain the design procedure of microwave low pass filter for coaxial π and T sections. 10

(ii) Explain the working of Magic Tee and derive its S-matrix with numerical values by assuming that any two ports are perfectly matched. 10

6. (i) What do you mean by an Attenuator? Explain the working of a precision variable attenuator and derive its S-Matrix. 10

(ii) Write the scattering matrix for an ideal 4 port circulator and explain how a four port circulator can be used as a 3-port circulator? 10

UNIT-IV

7. (i) Explain the GUNN effect and give the structure configuration of GUNN diode? 10

(ii) An IMPATT diode has a pulsed operating voltage of 120V and pulsed operating current of 0.8A. The efficiency of operation is 15%. Find :

(a) the output power

(b) the duty cycle if the pulsed width is 0.01 ns and the frequency is 10GHz. 10

8. (i) Explain the operation, constructional details with diagram of BAR1TT diode. 10

(ii) Compare the CW power, pulsed power, efficiency and noise figure of TRAPATT, IMPATT and BARITT diodes. 10

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