

- (b) Explain high field domain formation in GUNN diode and describe its properties ? 10
(c) Compare the physical structures of IMPATT and TRAPATT diodes ? 4

8. (a) Write a note on Parametric Amplifier and derive necessary expressions ? 7

- (b) An up converter parametric Amplifier has the following parameters :

Ratio of output frequency over signal frequency = 25

Figure of merit = 10

Factor of merit figure = 0.4

Diode temperature = 350°K

Calculate :

- (i) Power gain in dB ?
(ii) Noise figure in dB ?
(iii) Bandwidth ? 3×3=9

- (c) Discuss in brief the operation of BARITT diode. 4

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MICROWAVE ENGINEERING

ECE-407-E

Time : Three Hours] [Maximum Marks ? 100

Note : Attempt Five questions in all, selecting at least one question from each Section. All questions carry equal marks.

Section I

1. (a) Give structural description of co-planar wave guide. What are its basic types and give its advantages ? 8
(b) An air filled circular cavity has a length of 2.3 cm and radius of 1.15 cm. Find the resonance frequencies for modes TM_{010} and TE_{111} ? 5
(c) Describe various methods of excitation and coupling of resonator cavities ? 7
2. (a) Explain any two methods to measure microwave power using necessary block diagrams. 5+5

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- (b) Calculate the VSWR when the distance between half power points is 1 mm. Assume the wave is in dominant mode and given that the dimensions of guide are 4×2.5 cm and frequency is 10 GHz ? 5
- (c) Compare the Slotted line and Magic Tee methods for impedance measurement ? 5

Section II

3. (a) Derive the expressions for Bunching Process in a two cavity Klystron Amplifier ? 10
- (b) Derive expressions for output power of a four cavity Klystron's amplifier ? 4
- (c) Find the power gain in dB of the TWT having $V_0 = 10$ kV, $I_0 = 500$ mA, $f = 10$ GHz, $Z_0 = 25\Omega$ and an interaction space of 20 cm length ? 6
4. (a) Describe the Wave Modes in TWT and derive necessary expressions for the same ? 7
- (b) Derive expressions for Hull Cut-off voltage for Cylindrical Magnetron with necessary diagram ? 7
- (c) A linear magnetron is operating in π -mode and has the following specifications $N = 10$, $V_0 = 18$ kV, $f = 3$ MHz, $B_0 = 0.2$ wb/m², $d = 5$ cm. Determine angular velocity of electron, the radius at which radial forces due to electric and magnetic fields become equal and opposite ? 6

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Section III

5. (a) Prove that, for a reciprocal junction the scattering matrix is symmetrical provided the equivalent voltages have been chosen so that power into port n is given by $\frac{1}{2}IV_n I^2$? 6
- (b) Derive Return loss, Transmission loss and Insertion Loss in terms of S-parameter ? $3 \times 2 = 6$
- (c) Determine the S-matrix of an ideal lossless match terminated Directional Coupler with coupling of 10 dB and directivity of 30 dB ? 8
6. (a) Describe working of Faraday Rotation Isolator by giving its structural details using necessary diagram ? 8
- (b) Explain the properties of Magic TEE and derive S-matrix of an Ideal magic Tee ? 5
- (c) Explain working of Hybrid Ring using necessary structural details with diagrams and derive its S-matrix ? 7

Section V

7. (a) A GUNN diode is working in transit time modes at 12 GHz. The domain of charges moves at 10^7 cm/sec speed. Calculate :
- (i) Length of Device ?
- (ii) In what modes device can work at 10 GHz and 14 GHz ? 6

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