

R18

Code No:157CM

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, July/August - 2023

MICROWAVE AND OPTICAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) What are the limitations of conventional tubes at microwave frequencies? [2]
- b) What is the electron bunching in Klystron tube? [3]
- c) How to separate the Pi-Mode in Magnetron? [2]
- d) Give the characteristics of Gunn Diode. [3]
- e) What is the Time parameter for TED's? [2]
- f) State the working principle of Gyrator. [3]
- g) State the properties of scattering matrix. [2]
- h) State the different methods used for Microwave power measurement. [3]
- i) What is the difference between LASER and LED? [2]
- j) What are the advantages of WDM? [3]

PART – B

(50 Marks)

- 2.a) Explain the construction, operation, operating characteristics of reflex klystron oscillator with a neat diagram.
- b) A two cavity amplifier klystron has Beam voltage of $V_0 = 900V$, Beam current $I_0 = 30mA$, Frequency $f = 8GHz$, Gap spacing in either cavity $d = 1mm$, Spacing between centers of cavities $L = 4mm$, Effective shunt impedance $R_{sh} = 40k\Omega$. Determine the electron velocity, dc electron transit time, input voltage for maximum output voltage and voltage gain in decibels. [6+4]

OR

- 3.a) Draw the equivalent circuit of a Reflex Klystron and explain.
- b) A reflex klystron operates at the peak of the $n = 2$ mode. The dc power input is 40 mW and $V_i/V_0 = 0.278$. If 20% of the power delivered by the beam is dissipated in the cavity walls, find the power delivered to the load. [6+4]
- 4.a) What is Hull-voltage in a magnetron? Explain its significance.
- b) Derive the criterion for classifying the modes of operation for Gunn effect diodes. [5+5]

OR

- 5.a) Explain the two-valley model theory and give the data for two-valleys in GaAs.
- b) Discuss the principle of operation of TRAPATT diode with suitable diagram. [5+5]

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- 6.a) Discuss the important parameters of ferrite devices.
b) With the help of diagrams, clearly explain the principle and operation of rotary phase shifter. [5+5]

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OR

- 7.a) Explain the construction and working of waveguide phase shifters.
b) With the help of appropriate diagram, explain the working of an isolator. What is the S-matrix of the isolator? [5+5]

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OR

- 8.a) Explain the operation of circulator with a neat diagram and derive its s-matrix.
b) Using slotted line, draw a typical microwave bench setup for measurement of unknown load and explain. [5+5]

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- 9.a) Why are S - parameters used at microwave frequencies explain. Give the properties of S parameters and Derive S - matrix for series Tee using the properties of S parameters.
b) Compare the power ratio and RF substitution methods of measuring attenuation provided by the microwave component. [6+4]

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- 10.a) Draw and explain the refractive index profile and ray transmission in multimode step index and single mode step index fibers.
b) Describe any two types of Losses in Optical Fiber Communication System. [5+5]

OR

- 11.a) Explain the link power budget with example.
b) Explain the operation, principle and implementation of WDM with a neat diagram.[5+5]

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