Code No157CM

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, December-2023/January-2024
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) Differentiate between O-type and M-type microwave tubes based on their operational principles. [2]
b) What is the role of Reentrant cavities in Two Cavity Klystrons? [3]
c) Define the fundamental function of a magnetron in generating microwaves. [2]
d) Outline a technique used to separate the PI-mode in a magnetron. [3]
e) Name one characteristic property of ferrite materials used in microwave applications. [2]
f) State one characteristic difference between E-plane and H-plane tees. [3]
g) Name one distinct feature of a directional coupler utilizing the Bethe hole design. [2]
h) Define one common error encountered in microwave measurements. [3]
i) Give the principle of phtotodetection. [2]
j) Compare and contrast LEDs and LASERs in terms of their operation and applications in optical communication. [3]

PART – B

(50 Marks)

2.a) Explain the concept of velocity modulation in Two Cavity Klystron tubes and how it contributes to amplification or oscillation.
b) Describe the construction and components of a TWT, focusing on the arrangement and function of the helix, electron gun, input/output couplers, and collector. [5+5]

OR

3.a) Draw and explain in detail equivalent circuit of a Reflex Klytron.
b) Provide mathematical expressions or derivations explaining the relationships between input signals, output power, and efficiency in O-type tubes. [5+5]

4.a) Discuss the historical development and fundamental principles behind magnetrons, highlighting their significance in microwave technology.
b) Describe the principle of operation of Gunn Diodes based on the Gunn effect, elucidating how it leads to microwave signal generation. [5+5]

OR

5.a) Describe the different modes of resonance in cylindrical magnetrons and focus on PI-mode operation, explaining its significance in generating microwave power.

b) Elaborate the fundamental principle behind IMPATT devices, elucidating how they generate microwave oscillations. [5+5]

6.a) Explain the principles and applications of probe, loop, and aperture-based coupling mechanisms in microwave systems.

b) Explore the importance of matched loads in waveguide systems and their role in reducing reflections and optimizing performance. [5+5]

OR

7.a) Describe different types of waveguide attenuators, such as resistive card and rotary vane attenuators, and explain their mechanisms of attenuating microwave signals.

b) Detail the principles of operation and applications of ferrite-based components like gyrators and isolators in microwave systems. [5+5]

8.a) Describe the scattering matrix of a circulator, discussing how it reflects the directional flow of signals and its role in signal isolation.

b) Explain the Time Domain Reflectory method used for measuring attenuation in microwave systems, discussing techniques for precise measurement. [5+5]

OR

9.a) Explain the scattering matrix (S-matrix) representation of a Magic Tee, detailing its elements and their significance in understanding signal flow and power distribution.

b) Elaborate the methods and instruments used to measure the quality factor (Q) of microwave cavities, discussing its significance in cavity resonators. [5+5]

10.a) Detail the principles of light propagation in optical fibers, including total internal reflection and modes of transmission.

b) Explain the principles and types of light detectors used in optical systems, such as photo diodes and photo detectors. [5+5]

OR

11.a) Discuss the concept of a link budget in optical fiber systems, covering losses, power margins, and signal strength considerations.

b) Describe the working principles and applications of LASERs in optical communications. [5+5]

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