Code No.: R22EC701PC	R22	H.T.No.			8	R						

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
IV–B. TECH–I–Semester End Examinations (Regular) - December- 2025
MICROWAVE AND OPTICAL COMMUNICATIONS
(ECE)

[Time: 3 Hours] **[Max. Marks: 60]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 10 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A **(10 Marks)**

1.	a)	State the principle and operation of a Traveling Wave Tube (TWT).	[1M]
	b)	Differentiate between Two-Cavity and Multi-Cavity Klystrons.	[1M]
	c)	Write short notes on Gunn effect.	[1M]
	d)	Differentiate between IMPATT diode and TRAPATT diode based on their operating principle and efficiency.	[1M]
	e)	Define an attenuator.	[1M]
	f)	Differentiate between E-plane Tee and H-plane Tee in terms of their field configurations and applications.	[1M]
	g)	List the main components of a Microwave Bench setup and state the function of any two.	[1M]
	h)	Define VSWR. What is the relationship between VSWR and Reflection Coefficient (Γ)?	[1M]
	i)	List the types of optical Detectors used in optical systems.	[1M]
	j)	Differentiate between Single-Mode and Multimode Fibers.	[1M]

PART-B **(50 Marks)**

2.	a)	Explain the working principle and performance characteristics of a Reflex Klystron oscillator.	[5M]
	b)	Derive the relationship between Repeller Voltage and frequency of oscillation.	[5M]
		OR	
3.	a)	Describe the operation of a Traveling Wave Tube with suitable diagram.	[5M]
	b)	Evaluate the factors affecting the gain and bandwidth of TWT amplifiers.	[5M]
4.		Derive the Hull cut-off and Hartree conditions. Analyze how these conditions influence the efficiency and stability of oscillations.	[10M]
		OR	
5.		Explain the operation of Gunn diodes in terms of their physical principles, modes of operation, and frequency capabilities.	[10M]
6.		With the help of neat sketches, explain the working principles of Resistive Card and Rotary Vane Attenuators. Analyze how each type achieves variable attenuation and discuss their practical applications in microwave measurements.	[10M]
		OR	
7.		Explain the working principle of Ferrite Isolators based on Faraday Rotation. Evaluate the role of ferrite composition and biasing magnetic field in achieving non-reciprocal behavior. How does this improve system stability in microwave circuits?	[10M]
8.		Derive the S-matrix for a Magic Tee and explain how it satisfies the properties of lossless and reciprocal networks.	[10M]
		OR	
9.		Explain the method for measuring VSWR using a Microwave Bench setup. Evaluate the influence of experimental errors and precautions required for accurate determination of high VSWR and impedance.	[10M]

10.a) Explain the principle of light propagation through an optical fiber with a neat diagram. Derive the condition for acceptance angle. [5M]

b) Compare step-index and graded-index optical fibers in terms of core structure, light propagation, and dispersion. [5M]

OR

11.a) Discuss the main losses in optical fibers (absorption, scattering, bending). Analyze how these losses affect system performance and how they can be minimized. [5M]

b) Explain the working principles of optical sources (LEDs, LASERs). [5M]

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