Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025	
Date: 08-12- 2025	**Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B.Tech.	
Course Code: ECE3022	**Course Name:** Fundamentals of Photonics	
Semester: V	**Max Marks:** 100	**Weightage:** 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	**12**	**14**	**12**	**14**	**24**	**24**

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	State the laws of Refraction.	**2 Marks**	**L1**	**CO1**
2.	List the properties of coherent light source.	**2 Marks**	**L1**	**CO2**
3.	What is Electro-Optic Modulation?	**2 Marks**	**L1**	**CO2**
4.	State the transverse resonance condition in optical waveguides.	**2 Marks**	**L1**	**CO3**
5.	What is the Maxwell’s equation in a source-free region?	**2 Marks**	**L1**	**CO4**
6.	Write the expression for power decay, P(Z).	**2 Marks**	**L1**	**CO4**
7.	List any two building blocks of an optical network.	**2 Marks**	**L1**	**CO5**
8.	Define photoconductive effect.	**2 Marks**	**L1**	**CO5**
9.	What is a micro-ring resonator?	**2 Marks**	**L1**	**CO6**
10.	Define critical coupling	**2 Marks**	**L1**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Define interference and explain, using the double-slit experiment, how the position of bright fringes is calculated. Support your answer with the fringe pattern diagram.	**10 Marks**	**L2**	**CO1**
	b.	Describe the necessity of optical amplifiers and discuss the different optical amplifiers (Erbium-doped fibre amplifier, Semiconductor optical amplifier, Raman amplifier) used in photonic systems	**10 Marks**	**L3**	**CO2**
Or					
12.	**a.**	Describe and compare spherical, cylindrical, and plane wavefronts with neat sketches. Explain the relationship between the wave normal and propagation direction.	**10 Marks**	**L2**	**CO1**
	b.	Describe the necessity of optical modulators and discuss the different optical modulators (Electro-optic modulator, Acousto-optic modulator and Magneto-optic modulator) used in photonic systems	**10 Marks**	**L3**	**CO2**

13.	**a.**	Describe the concept of guided modes in a dielectric waveguide and explain in detail the transverse resonance condition required for guided-wave propagation, using appropriate field diagrams.	**10 Marks**	**L2**	**CO3**
	b.	Derive the general field solutions for TEM modes in a symmetric rectangular waveguide and discuss the expression and significance of the cut-off frequency for these modes.	**10 Marks**	**L3**	**CO4**
Or					
14.	**a.**	Describe the step-by-step process for fabricating a buried waveguide using the ion-exchange technique, with neat sketches.	**10 Marks**	**L2**	**CO3**
	b.	Describe in detail the different types of losses in optical waveguides.	**10 Marks**	**L3**	**CO4**

15.	**a.**	Differentiate between the access, metro, and core optical networks.	**10 Marks**	**L2**	**CO5**
	b.	Explain the construction, and working principle of an Avalanche Photodiode (APD) with neat diagrams.	**10 Marks**	**L3**	**CO5**
Or					

16.	**a.**	Describe the key parameters used to characterize a photodetector and discuss how each parameter influences device performance.	**10 Marks**	**L2**	**CO5**
	b.	Explain the construction, working mechanism of a photoconductor with the help of diagrams	**10 Marks**	**L3**	**CO5**

17.	**a.**	Interpret the structure, resonance condition, and operation of a Fabry–Perot resonator with suitable diagrams.	**10 Marks**	**L2**	**CO6**
	b.	Compare various optical cavity types and describe how Fabry–Perot and ring resonator geometries influence mode confinement and Q-factor.	**10 Marks**	**L3**	**CO6**
		Or			
18.	**a.**	Interpret the structure and operation of a micro-ring resonator.	**10 Marks**	**L2**	**CO6**
	b	Explain how under-coupling, critical coupling, and over-coupling conditions affect power transfer, resonance depth, and the performance of add/drop filters.	**10 Marks**	**L3**	**CO6**