SRM Institute of Science and Technology
College of Engineering and Technology

DEPARTMENT OF ECE

SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu

Academic Year: 2021-2022 (EVEN)

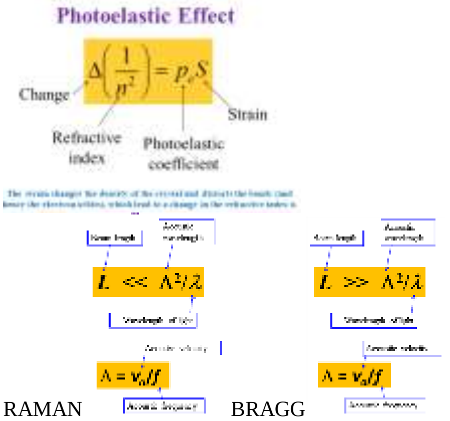
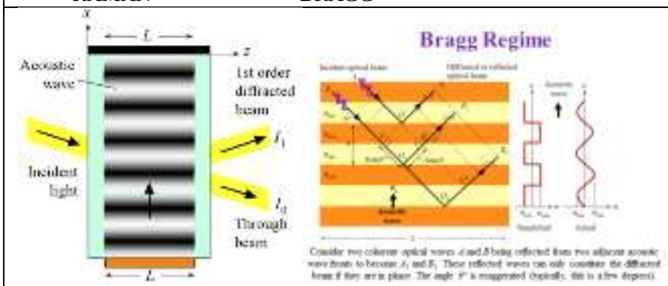
Mode of Exam
OFFLINE
SET A

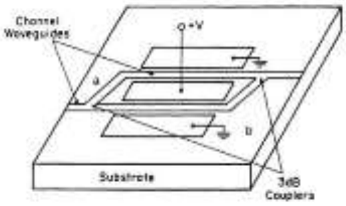
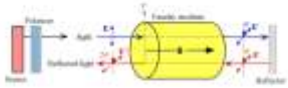
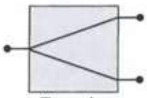
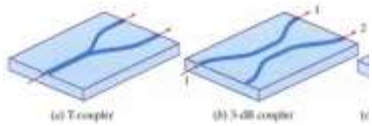
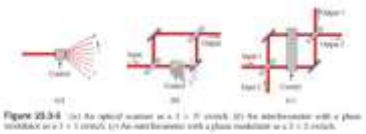
Test: CLAT- 3 **Date:** 21-6-2022
Course Code & Title: 18ECE322T – OPTOELECTRONICS **Duration:** 08:00 – 09:40 PM
Year & Sem: II / 4th Sem **Max. Marks:** 50

Course Articulation Matrix with PI:

	18ECE322T- Optoelectronics		Program Outcomes (POs)																								PSO		
COs	Course Outcomes	BL	1	PI	2	PI	3	PI	4	PI	5	PI	6	PI	7	PI	8	PI	9	PI	10	PI	11	PI	12	PI	1	2	3
CO-1:	Define the basic concepts of optics and semiconductor optics.	1	3	1.4.1	-		-		-																				1
CO-2:	Demonstrate the working principle of various photonic sources and display devices.	3	3	1.2.1	3	2.1.2	-		2	4.1.1																			3
CO-3:	Analyze the principle and operation of various detectors and noise associated with it.	4	-		3	2.1.3	2	3.1.1	3	4.1.2																			3
CO-4:	Interpret the various optoelectronic modulators, switches, and interconnects.	3	3	1.3.1	2	2.2.1	3	3.2.1	-																				2
CO-5:	Apply the concepts of integrated optoelectronic components and its application in various fields.	3	3	1.4.1	-		3	3.2.2	3	4.2.1																			3

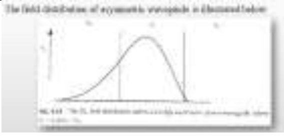
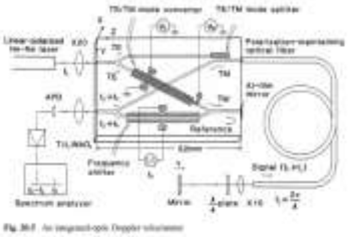
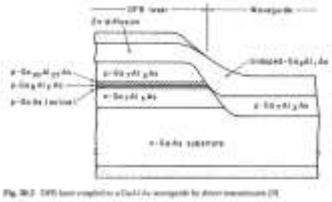
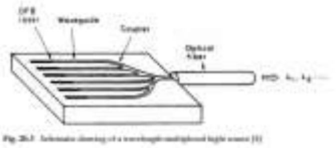
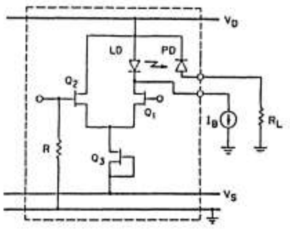
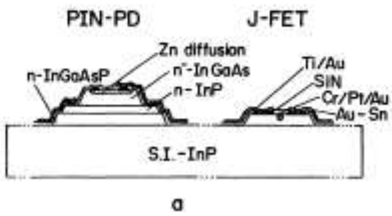
Part – A
(10 x 1 = 10 Marks)
Instructions: Answer ALL the Questions

Q. No	Question	Marks	BL	CO	PO	PI
1	(B) Pockels effect	1	1	4	1	1.3.1
2	(C) Modulating the diffraction angle	1	2	4	1	1.3.1
3	(B) 330nm	1	2	4	1	1.3.1
4	(D) 3dB coupler	1	1	4	3	3.2.1
5	(A) Lack of compactness and parasitic effects from leads and connectors	1	2	4	1	1.3.1
6	(D) Higher than	1	1	5	1	1.3.1
7	(A) Phased-array antennas	1	2	5	1	1.3.1
8	(B). High power laser	1	1	5	3	3.2.1
9	(C). OEIC Velocitimeter	1	2	5	3	3.2.1
10	(D) LiNbO3	1	1	5	3	3.2.1
	Part – B (4 x 10 = 40 Marks)					
	SECTION B1 Instructions: Answer ANY 2 Questions					
11		5	4	4	1	1.3.1
		5	3	4	1	1.3.1

12	 $LiNbO_3$ based Mach-Zehnder type single mode waveguide modulator (3M) Explanation on constructive and destructive interference concept (2M)	5	3	4	3	3.2.1
	Faraday Effect (Rotation)  The sense of rotation of the optical field **E** depends only on the direction of the magnetic field for a given medium (given Verdet constant). If light is reflected back into the Faraday medium, the field rotates a further θ in the same sense to come out as **E**' with a 2θ rotation with respect to **E**. ………..(3M) alculate the Faraday rotation angle for a 3 cm cavity operated at 0.9T when exposed to 630 nm Laser source. Given verdet constant 60 rad/T-m. Theta=VBL ………………………..(1M) Ans: 1.62 rad or 92.81 Degree……..(1M)	5	3	4	4	4.2.1
13	 T-coupler  3-dB coupler or  (2M) • Key specifications of optical couplers $$\text{Insertion Loss(dB)} = 10\log\frac{P_{in}(mW)}{P_{out}(mW)}$$ $$\text{Excess Loss(dB)} = 10\log\frac{P_{port1}(mW)}{P_{port2}(mW) + P_{port3}(mW)}$$ (3M)	5	3	4	3	3.2.1
	 (2M) *Switch Characteristics* A switch is characterized by the following parameters: ▪ *Size* (number of input and output lines) and *direction(s)*, i.e., whether data can be transferred in one or two directions. ▪ *Switching time* (time necessary for the switch to be reconfigured). ▪ *Propagation delay time* (time taken by the signal to cross the switch). ▪ *Throughput* (maximum data rate that can flow through the switch). ▪ *Switching energy* (energy needed to activate and deactivate the switch). ▪ *Power dissipation* (energy dissipated per second in the process of switching). ▪ *Insertion loss* (drop in signal power introduced by the connection). ▪ *Crosstalk* (undesired power leakage to other lines). ▪ *Blocking probability*. Probability that a connection cannot be established because of a conflict with another connection. ▪ *Physical dimensions*. This is important when large arrays of switches are built. (3M)	5	3	4	1	1.2.1
	SECTION B2 **Instructions: Answer ANY 2 Questions**					

14	**Need for Integration**
	• Input – output isolation not provided in optics
	• Difficult to focus multiple beams in a parallel system
	• Hence, logical to couple electronic and photonic devices (**Optoelectronic integration**)
	• **Electrical interconnect media** adversely affected by
	  • Increase in reactance
	  • Reflections due to impedance mismatch at higher frequencies
	• **Multilevel board technology** fail to perform at GHz range (3M)
	Hybrid Integration **Monolithic Integration** (2M)
		5	2	5	1	1.3.1

	 (3M)	5	3	5	3	3.2.1

	 (2M)					
15	 Figure (2M) Explanation (3M)	5	4	5	1	1.3.1
	  Figure (2M) Explanation (3M)	5	4	5	1	1.3.1
16	 Figure (2M) Explanation (3M)	5	4	5	3	3.2.1
	 Figure (2M) Explanation (3M)	5	4	5	3	3.2.1