SEMESTER S7

OPTOELECTRONIC DEVICES

Course Code	**PEEVT 756**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To provide an insight over the working principles and performance parameters of various optoelectronics devices used for optical networks and communication

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Fundamentals of Semiconductor Optoelectronics** Optical processes in semiconductors: electron-hole generation and recombination, Absorption, Auger recombination, Heat generation and dissipation, Heat sources.Various light production mechanisms,Indirect band gap materials, Semiconductors used for optical Applications, Basic principle of LED and LASER, Spontaneous emission and Stimulated Emission, Coherence of sources.	**9**
2	**Optical Sources** Construction and Operation of LEDs, Heterojunctios, Surface Emitter and Edge Emitter LEDs, Characteristics of LEDs, LASERs, Threshold Condition for lasing, Line Broadening Mechanisms, Fabry-Perot Lasers, Distributed Feedback(DFB) Lasers, Distributed Bragg Reflector(DBR) Lasers, Vertical Cavity Surface Emitting Lasers (VCSELs), In-Fibre Lasers.	**9**

3	**Optical Detectors** Principle of Photo Detection,Working of LDR, PN diode, PIN diode, Avalanche Photodiode (APD), Characteristics of APD, Resonant Cavity Photo detector, Photo Transistor, Quantum efficiency, Responsivity, Noise in Photo detectors, Thermal Noise, Dark Current, Shot Noise, Quantum limit of Optical Detection.	**9**
4	**Optoelectronic Devices and Modulator** Optoelectronic ICs, Advantages, Liquid Crystal Display, Structure, TFT display, Structure, Polymer LED, Organic LED, Optical Modulators using PN junction, Electro-Optic Modulators, Acousto-Optic Modulators, Raman-Nath Modulators, Optical switching and Logic devices,Optical Memory. Solar Cells: basic working principle, VI Characteristics, Different types of solar cells, Dye sensitized solar cells (DSSC), Perovskite Solar cells.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand physics of optical processes in semiconductors.	**K2**
CO2	Distinguish different optical sources used in optoelectronic applications.	**K3**
CO3	Analyse different types of photo detectors based on their performance parameters	**K3**
CO4	Explain various optical modulators and optoelectronic devices.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**											**2**
CO2	**3**											**2**
CO3	**3**		**2**		**2**							**2**
CO4	**3**		**2**		**2**							**2**

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Light Sources and Lasers	Mark Csele,	Wiley-Interscience,	2004
2	Solid State Lasers	W.Koechner,M.Bass	Springer,	2003
3	Photonics Optical Electronics in modern communication	Yariv,	Oxford University Press,	6/e , 2006.
4	Understanding Optical Communications,	Harry J R Dutton	IBM	1/e 1998

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Organic Light-Emitting Diodes,	Alastair Buckley	Woodhead,	2013 6,
2	Solar Cell Device Physics	Stephen J Fonash	Elsevier	2/e, 2010

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/113/104/113104012/
2	https://archive.nptel.ac.in/courses/115/102/115102026/
3	https://www.youtube.com/watch?v=WWjldCmRteg
4	https://archive.nptel.ac.in/courses/113/106/113106065/