COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC469	OPTO ELECTRONIC DEVICES	3-0-0-3	2016

Prerequisite: NIL

Course objectives:

- To know the physics of absorption, recombination and photoemission from semiconductors.
- To analyse different types of photo detectors based on their performance parameters.
- To discuss different LED structures with material properties and reliability aspects.
- To explain optical modulators and optical components
- To illustrate different types of lasers with distinct properties.

Syllabus:

Optical processes in semiconductors – LASERS- Nitride light emitters- White-light LEDs- Optical modulators - optical switching and logic devices, optical memory- Optical detection - Optoelectronic ICs - Introduction to optical components

Expected outcome:

The students will be able to:

i. Explain the property of absorption, recombination and photoemission in semiconductors.
ii. Illustrate different types of lasers with distinct properties.
iii. Explain different LED structures with material properties.
iv. Analyse different types of photo detectors.
v. Explain optical modulators and optical components.

Text Books:

1. Pallab Bhattacharya: Semiconductor Optoelectronic Devices, Pearson, 2009
2. Yariv, Photonics Optical Electronics in modern communication, 6/e ,Oxford Univ Press,2006.

References:

1. Alastair Buckley, Organic Light-Emitting Diodes, Woodhead, 2013.
2. B E Saleh and M C Teich, Fundamentals of Photonics:, Wiley-Interscience, 1991
3. Bandyopadhay, Optical communicatoion and networks, PHI, 2014.
4. Mynbaev, Scheiner, Fiberoptic Communication Technology, Pearson, 2001.
5. Piprek, Semiconductor Optoelectronic Devices, Elsevier, 2008.
6. Xun Li, Optoelectronic Devices Design Modelling and Simulation, Cambridge University Press, 2009

Course Plan

Module	Course content (42hrs)	Hours	End Sem. Exam Marks
I	Optical processes in semiconductors – electron hole recombination, absorption, Franz-Keldysh effect, Stark effect, quantum confined Stark effect, deep level transitions, Auger recombination heat generation and dissipation, heat sources.	7	15%
II	Lasers – threshold condition for lasing, line broadening mechanisms, axial and transverse laser modes, heterojunction lasers, distributed feedback lasers, DBR lasers, quantum well lasers, tunneling based lasers, modulation of lasers.	7	15%

FIRST INTERNAL EXAM			
III	Nitride light emitters, nitride material properties, InGaN/GaN LED, structure and working, performance parameters, InGaN/GaN Laser Diode, structure and working, performance parameters. White-light LEDs, generation of white light with LEDs**,** generation of white light by dichromatic sources, **,**generation of white light by trichromatic sources**,** temperature dependence of trichromatic, 7generation of white light by tetrachromatic and pentachromatic sources, white-light sources based on wavelength converters.	9	**15%**
IV	Optical modulators using pn junction, electro-optical modulators, acousto-optical modulators, Raman-Nath modulators, Franz-Keldysh and Stark effect modulators, quantum well electro-absorption modulators, optical switching and logic devices, optical memory.	5	**15%**
SECOND INTERNAL EXAM			
V	Optical detection – PIN, APD, modulated barrier photodiode, Schottky barrier photodiode, wavelength selective detection, micro cavity photodiodes. Optoelectronic ICs, advantages, integrated transmitters and receivers, guided wave devices. Working of LDR, liquid crystal display, structure, TFT display, structure, polymer LED, organic LED.	7	**20%**
VI	Introduction to optical components, directional couplers, multiplexers, attenuators, isolators, circulators, tunable filters, fixed filters, add drop multiplexers, optical cross connects, wavelength convertors, optical bistable devices.	7	**20%**
END SEMESTER EXAM			

Question Paper Pattern

The question paper shall consist of three parts. Part A covers modules I and II, Part B covers modules III and IV, and Part C covers modules V and VI. Each part has three questions uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 50% for theory and 50% for logical/numerical problems, derivation and proof.