

# OPTOELECTRONICS (THEORY)

Pre-requisite: Engineering Physics

Credit Hours 03

Contact Hours 48

## RECOMMENDED BOOKS

Harold Kolimbiris, "Fibre Optics Communications," First Edition, 2004, Prentice Hall, latest edition.

## REFERENCE BOOKS

John M. Senior, "Optical Fibre Communications: Principles and Practice", Prentice Hall, latest edition

## OBJECTIVE OF COURSE

This course provides a complete overview of the wide variety of different semiconductor optoelectronic devices employed in light wave systems and networks. Topics include a variety of different subjects Including a detailed discussion of the design and operation of optical LEDs, the basic physics and operation of lasers and photo detectors, details of the basic physics and operation of solar cells, the operation of quantum well electro-absorption modulators and electro-optic modulators, and the design and operation of optoelectronic integrated circuits. Emphasis is on the underlying device physics behind the operation and design of optoelectronic devices

S.NO	CLO/PLOS MAPPING	DOMAIN	PLO
01	<b>Explain</b> basic concepts of optics and their use in optoelectronics.	C1	01
02	<b>Compare</b> various kinds of semiconductor materials used in optoelectronics and develop detailed knowledge of laser operating principles and structures.	C1	
03	<b>Apply</b> knowledge of lasers, fibers, fiber detectors, and led diodes used in optoelectronic devices	C2	

## COURSE CONTENTS

### Optics Review

- Snell's Law
- Numerical Aperture
- Total internal reflection
- Fresnel Equations
- Dispersion
- Pulse broadening and distortion

- Resonant cavities
- Electronic and Optical Properties of Materials
- Optical Processes in Semiconductors

### **Lasers**

- Operating Principles
- Lasers: Structures and properties
- Spontaneous and stimulated emission
- Population inversion
- Light emitting diodes and laser diodes
- operating characteristics and typical structures
- Types of laser diodes (monomode/tunable) such as DBR and DFB.
- Pumping process
- 3- and 4-level lasers

### **Photodetectors**

- Quantum Phenomenon.
- Light Detectors
- Principles of photo-detection
- Types of semiconductor photodiodes.
- Analog / Digital Modulation and corresponding opto-electronic circuits
- Photo detection
- Optoelectronic Integrated Circuits for Communication (OEICs)

### **Wave guides and couplers**

- Optical Industry Interconnects
- Importance of optics in communications systems
- Optical communications systems and its requirements
- Dielectric slab optical waveguide
- Optical fibre waveguide
- Optoelectronics applications
- Gain spectra
- Optoelectronic sensors
- Opto-electronics in energy and telecommunications such as photo-voltaic devices and wavelength division multiplexing.