COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC472	INTEGRATED OPTICS & PHOTONIC SYSTEMS	3-0-0 -3	2016

Prerequisite: EC303 Applied Electromagnetic Theory, EC405 Optical Communication

Course objectives:

- To discuss basic goals, principles and techniques of integrated optical devices and photonic systems
- To explain operation and integration of various optoelectronic devices in an integrated optical system
- To study about various components like optical waveguides, optical couplers, design tools, fabrication techniques, and the applications of optical integrated circuits.
- To introduce some of the current state-of-the-art devices and systems.

Syllabus: Review of Electromagnetics: Maxwell's equations, optical waveguides and devices, Waveguide Fabrication Techniques, Electro-Optic Waveguides, Polymer Waveguide Device, Losses in optical wave guide, Wave guide input and output couplers, coupled mode theory, Light Propagation in Waveguides, FFT-BPM, FD-BPM, Electro-Optic Modulators: Types, Integrated semiconductor laser, integrated semiconductor optical amplifier, integrated optical detectors, applications of optical integrated circuits, devices and systems for telecommunications, microwave carrier generation by optical techniques, photonic crystals, nanophotonic device.

Expected outcome:

The student will have an in depth knowledge of

i. Devices that are basic components of integrated optics and photonic systems including Optical wave guides, optical couplers, Lasers, Detectors and modulators
ii. Light propagation in waveguides
iii. The fabrication process of Optical Integrated devices
iv. Applications of Optical Integrated devices
v. Nano photonic devices

Text Books:

1. Lifante, Integrated Photonics: Fundamentals, John Wiley 2003
2. Robert Hunsperger, Integrated optics :Theory and technology 6/e Springer, 2009

References:

1. H. Nishihara, M. Haruna, and T. Suhara, Optical Integrated Circuits, McGraw-Hill Professional, 1989.
2. KeicoIizuka, Elements of photonics, John Wiley, 2002 .
3. Pappannareddy, Introduction to light wave systems,Artech House,1995

RELATED LINKS

Website of IEEE photonics society: www.ieee.org/photonics.

Course Plan

Module	Course content (42hrs)	Hours	End Sem. Exam Marks
I	Review of Electromagnetics , Maxwell's equations - Wave equation	3	15%
	Analysis of optical waveguides and devices- Planar waveguides, chanel waveguides, graded index waveguides.	4	

II	Waveguide Fabrication Techniques -substrate materials for optical IC , Epitaxially Grown Waveguides- Electro-Optic Waveguides	4	**15%**
	Types of Polymers-Polymer Waveguide Devices, Optical Fiber Waveguide Devices	3	
FIRST INTERNAL EXAM			
III	Losses in optical wave guide, measurement of losses. Wave guide input and output couplers, types of couplers, coupling between wave guides,	4	**15%**
	Optical Fiber Couplers and Splitters, coupled mode theory	3	
IV	Light Propagation in Waveguides: The Beam Propagation Method-Fresnel Equation - Fast Fourier Transform Method (FFT-BPM) - Solution based on discrete fourier transform - Method Based on Finite Differences (FD-BPM), Boundary Conditions	7	**15%**
SECOND INTERNAL EXAM			
V	Electro-Optic Modulators - Basic Operating Characteristics- The Electro-Optic Effect,Mach-Zehnder Modulator, acousto-optic modulator,	4	**20%**
	Integrated semiconductor laser, integrated semiconductor optical amplifier, integrated optical detectors, structures.	3	
VI	Applications of Optical Integrated Circuits-Spectrum Analyser-Temperature and High Voltage Sensors,	3	**20%**
	Devices and Systems for Telecommunications- Microwave Carrier Generation by Optical Techniques, - Photonic Crystals-Nanophotonic Device.	4	
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.