CO - PO MATRIX

Paper – 6: PHOTONICS

Offered to: M.Sc.(PHYSICS)	Course Code: 22PH2D3
Course Type: DSE	Course: Photonics
Year of Introduction: 2022	Year of offering: 2023
Year of Revision: 2022	Percentage of Revision: Nil
Semester: II	Credits: 4
Hours Taught: 60 hrs. per Semester	Max.Time: 3 Hours

Course Description: Photonics course deals with light generation, amplification, guiding, manipulation, and detection for harvesting information. This course introduces some of the fundamental aspects of photonics excluding generation and detection

Course Objectives:

1. To understand the theoretical concept on integrated optics.

2. To understand the basic concepts of optical signal processing.

3. To learn the theoretical concept of Photonic crystals and optical communications

4. To learn the latest developments in photonics and its applications

5. To understand the modulation of light for optical modulation.

Course Outcomes: At the end of this course, students should be able to:

CO1: Understand the theoretical concept of photonics for various applications.

CO2: Analyze the light-matter interactions

CO3: Analyze the ability to formulate problems related to photonic structures

CO4: Analyze the properties of optoelectronic devices.

CO5: Understand processes that help to manipulate the fundamental properties of light

	CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
22PH2D2	CO1	H					L	M
	CO2	H					L	M
	CO3	H	H				L	M
	CO4	H	M				L	M
	CO5	H	H	M			L	M

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**Integrated Optics** Introduction–Planar wave guide–Channel wave guide–Y-junction beam splitters and couplers- FTIR beam splitters – Prism and grating couplers –Lens wave guide – Fabrication of integrated optical devices - Integrated photodiodes – Edge and surface emitting laser – Distributed Bragg reflection and Distributed feedback lasers - Wave guide array laser.(CO1)	12
II	**Optical Signal Processing** Introduction-Effect of lens on a wavefront, Fourier transform properties of a single lens, Optical transfer function, Vanderlugt filter, Image spatial filtering, Phase-contrast microscopy, Pattern recognition, Image de-blurring, Photonic switches, Optical transistor, Optical Gates- Bistable systems, Principle of optical Bistability, Bistable optical devices, Self electro-optic effect device.(CO2)	12
III	**Photonic Crystals** Basics concepts, Theoretical modeling of photonic crystals, Features of photonic crystals, Methods of fabrication, Photonic crystal optical circuitry, Nonlinear photonic crystals, Photonic crystal fibers, Photonic crystals and optical communications, Photonic crystal sensors. (CO3)	12
IV	**Optoelectronic devices** Quantum well, Quantum dot and Super lattices; LED materials, Device configuration and efficiency, Light extraction from LEDs, LED structures-single heterostructures, double heterostructures, Device performances and applications, Quantum well lasers; Photodiode and Avalanche photodiodes (APDs), Laser diodes-Amplification, Feedback and oscillation, Power and efficiency, Spectral and spatial characteristics.(CO4)	12
V	**Modulation of Light** Electro-optic effect, Pockels and Kerr effects, Electro-optic phase modulation, Electro-optic amplitude modulation, Acousto-optic effect, Acousto-optic modulation, Raman-Nath and Bragg modulators: deflectors and spectrum analyzer, Magneto-optic effect, Faraday rotator as an optical isolator. Advantages of optical modulation.(CO5)	12

TextandReferenceBooks:

1. Optical Guided Wave Signal Devices, R.SymsAndJ.Cozens. Mcgraw Hill, 1993.

2. Optical Electronics, AGhatak and K. Thyagarajan, Cambridge University Press, New Delhi, 1991

3. Fundamentals of Photonics, B.E.A. Saleh and M.C. Teich, John Willy and Sons,1991

4. Introduction to Fourier Optics, Joseph W. Goodman, McGraw-Hill, 1996.

5. Nanophotonics, P.N.Prasad, Wiley Interscience, 2003.