Course Type	Course Code	Name of Course	L	T	P	Credit
OE	PHO400	NANO ELECTRONICS AND NANO PHOTONICS	3	0	0	9

Course Objective
To provide a broad knowledge of light-matter interaction and behavior of electronic transport properties in the materials at the nanoscale dimension.
Learning Outcomes
Upon successful completion of this course, students will: ● Learn behavior of light at nanometer scale, and light interaction with nanoscale objects. ● Learn behavior of electron transport in the nanoscale metals and semiconductors ● Provide the idea of exploring possible technologies with optical and electronic properties at nanoscale.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introduction to Nanoscience and Nanotechnology**	2	This unit will introduce the nanotechnology and its implications to the students.
NANOELECTRONICS			
2	**Basic Idea:** Quantum Mechanics and Quantum Statistics in nanomaterials. Electron energy bands in nanostructure, quantum confinement, 0D to 3D functional nanomaterials and hybrids.	5	This unit will provide the basic knowledge to understand the electrons behavior at nanomaterials and how it is drastically different from the bulk counterpart.
3	**Electron transport in nanostructures:** Introduction (from classical electronics to nanoelectronics), Electron transport in nanostructures.	3	This unit describe the electron transport properties and their dependences in the dimensional properties of the nanomaterials.
4	**Nanoelectronic Devices: Few examples from** Resonant-tunneling diodes, Single-electron-transistor, optoelectronics devices, Nano-electromechanical system, Nanoelectronics for molecular biology: next generation DNA sequencing etc.	10	The unit will introduce several electronic devices that exploit electrons transport properties at nanometer scale
NANOPHOTONICS			
5	**Introduction to Nanophotonics:** Optics at Nanoscale, the behavior of Photons and Electrons at low dimensions (nanostructures). Beyond the diffraction limit (the breaking through the diffraction limit)- a layman's concept of a nanophotonics and its true nature, Maxwell's equations and their revelations, fundamentals of optical near field.	8	This unit will provide the basic knowledge of optics and how it is different at nanoscale dimension.
6	**Foundations of Nanophotonic Devices:** Excitation energy transfer – Device operation: nanophotonic AND gate & nanophotonic OR gate-Interconnection with photonic devices.	7	This unit provide the fundamental understanding of the light-matter interaction at nanometer scale in nanophotonic devices.
7	**Nanophotonic Devices: Few examples from** Quantum emitters and detectors, Surface plasmons in nanostructures, Concept of SERS, Photonic crystal, Optical micro-resonators, Cavity enhanced absorption spectroscopy, nanoparticles for bioimaging applications.	7	This unit introduces several optical platform for their application in Photonic devices particularly in developing light emitters, detectors, optical sensors.
	Total	**42**	

Textbooks:

1. Introduction to Nanoelectronics, Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, Cambridge University Press (2008).
2. Nanophotonics, Paras N. Prasad, John Wiley & Sons (2004).

Reference Books:

1. Nanotechnology for Microelectronics and Optoelectronics, J.M. Martínez-Duart, R.J. Martín-Palma, F. Agulló-Rueda, Elsevier (2006).
2. Principles of nano-optics, Lukas Novotny and Bert Hecht, Cambridge University Press (2006).
3. Cavity enhanced Spectroscopy and Sensing, Edited by G. Gagliardi and H. P. Loock, Springer (2014).