Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD502	Nanophotonics	3	0	0	3

Course Objective

The objective of the course is to provide the fundamental concepts of optical effects in nanoscale systems and coupled light-matter systems, particularly as they apply to semiconductor nanostructures and microcavities.

Learning Outcomes

On successful completion of this module, students will be able to:

- Understand Basics of quantum mechanics and electrons in solids
- Acquire the knowledge of principles of nanoplasmonics
- Understand the principles and applications of the interaction of light with periodic nanostructures.

Module No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Basics of quantum mechanics: quantum particles and EM wave, wavelengths and dispersion laws, density of states, uncertainty relation, wave function and Schrödinger equation, quantum particle in complex potentials. Wave mechanics and wave optics: propagation over wells and barriers, propagation through potential barriers, Evanescent waves and tunneling.	12	Acquire an understanding of the essential quantum mechanics
2	Electrons in solids (periodic structure): Bloch waves, electron band structure, Brillouin zones, quasi particles (holes, excitons, polaritons), defect states, quantum confinement effects, quantum wells, wires and dots. Semiconductor nanocrystals, electron-hole states, absorption spectra, luminescence, applications e.g., QD laser, nonlinear optics, electro-optical properties.	12	Develop an understanding about the behavior of electrons in solids and light matter interaction
3	Nano-plasmonics: optical properties and response of metal nanoparticles, size-dependent absorption and scattering, metal dielectric nanostructures, electromagnetic fields near metal nanoparticles, optical response of metal-dielectric core-shell nano-composites.	09	Understand the principles of nanoplasmonics
4	Light in periodic structure: concept of photonic crystals, Bloch waves and bandstructure in 1-D periodic structures, 3-D multilayer slabs, band gap and band structures in 2-D and 3-D lattices, multiple scattering theory of periodic structures, nonlinear optics and photonic crystal.	09	Obtain the knowledge periodic nanostructures and their optical properties
	Total	**42**	

Textbook:

1. Introduction to Nanophotonics, Sergey V. Gaponenko, Cambridge University Press, 2010.

Reference Books:

1. Fundamentals of Quantum Mechanics For Solid State Electronics and Optics, C. L. Tang, Cambridge University Press, 2009.
2. Principles of Nano-Optics, Lukas Novotny and Bert Hecht, Cambridge University Press, 2012.
3. Principles of Nanophotonics,MotoichiOhtsu, Kiyoshi Kobayashi, Tadashi Kawazoe, Takashi Yatsui, and Makoto Naruse, CRC Press, 2008.