

PH502 Optics/Photonics

Credit: (3-0-0-3)

Approval: Approved in 2nd Senate

Prerequisites: Foundations of Electrodynamics & Quantum mechanics

Students intended for: B.Tech

Elective or Core: elective

Semester: Odd/Even

Course objective:

In this course, applications of light in modern technologies will be introduced. The main focus will be on the wave and particle nature of light, transmission, detection and interaction of light, optical information propagation and different applications of photonic technologies. The main topics covered in the course include optical fibres, wave guides, polarization of light, interference and diffraction of light, lasers, detectors, photonic crystals, metamaterials, light emitting diodes, quantum dots and solar cells. The concepts of modulation of light through the electro-optic and acousto-optic effects will also be included.

Course content:

- Electromagnetic Optics: electromagnetic theory of light, electromagnetic waves in vacuum & dielectric media, absorption and dispersion, pulse propagation in dispersive media, Metamaterials [6 lectures]
- Polarization Optics: polarization of light, reflection and refraction, optics of anisotropic media, Optics of liquid crystals, polarization devices. [5 lectures]
- Guided wave Optics: electromagnetic waves in dielectric layered media, photonic crystals, waveguides, resonators, plasmonics. [5 lectures]
- Fiber Optics: electromagnetic waves in fiber, Attenuation and dispersion, photonic crystal fibers. [5 lectures]
- Semiconductor Optics: quantization of electromagnetic field, quantum states of light, photon statistics, interaction of photons with charge carriers, light emitting diodes, laser diodes, microcavity lasers. [6 lectures]
- Detection of light: theory of photo detection, photodetectors, photodiodes, avalanche photodiodes, noise in photodetectors. [5 lectures]
- Acousto and Electro Optics: interaction of light and sound, acousto-optic devices, Principles of electro optics, electro optics of anisotropic media, electro optics of liquid crystals. [5 lectures]
- Optical fiber communication: fiber Optic components, optical fiber communication system, modulation and multiplexing, fiber optic networks. [5 lectures]

Text Book:

Optical Electronics by A.K. Ghatak, K. Thyagarajan ([Cambridge University Press](#))

References:

Principles of Optics by Max Born, Emil Wolf (Cambridge University Press)

Fundamentals of Photonics by Saleh & Teich (Wiley-Interscience)