



Birla Institute of Technology & Science, Pilani
Hyderabad Campus

First Semester 2022 - 2023

Course Handout (Part II)

Date: 11/08/2023

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. : **PHY F213**
Course Title : **Optics**
Instructors : **Kannan Ramaswamy**
Instructor-in-charge : **KANNAN RAMASWAMY**

Scope and Objective:

Optics has found its way in many fields such as arts and sciences, modern communications and even medical technology. The development of Optics as a subject has rich history starting from the days of Galileo, Newton, and to modern optics where ideas from quantum mechanics are interwoven with concepts from Optics. In this course, we will start with a discussion on Geometrical optics followed by concepts from Wave optics. The emphasis of this course will be a thorough understanding of the optical phenomena as reflected in experiments with support from essential mathematical formulations.

Broader Learning outcomes: At the end of the course students must gain knowledge on the following points -

- Corpuscular nature of light and its drawbacks and how wave nature of light could explain many experimental observations
- Fermat's principle and its use in certain situations and explain phenomenon like mirage
- Explain image formation by spherical surfaces in a quantitative manner. They should be able to obtain the position of nodal points in an optical system
- Quantitative analysis of interference and diffraction phenomena
- Quantitative analysis of polarization

Text Book:



Optics, Ajay Ghatak, 7th ed., McGraw-Hill (2021)

Reference Books:

1. Optical Physics, Ariel Lipson, Stephen G. Lipson and Henry Lipson, 4th ed., Cambridge University Press (2011)
2. Optics, Eugene Hecht, Pearson, M. Pearson (2008)

Course Plan:

No of Lectures	Learning Objectives	Topics to be covered	Reference to text book
1	Brief history of light	The corpuscular model of light; Young's double slit experiment; The wave model	Chapter 1
2	Fermat's Principle	Law of reflection and refraction from Fermat's principle	Chapter 2 (2.1 and 2.2)
3-5	Huygens's principle	Fundamental ideas of waves; Huygens's theory; rectilinear propagation; Huygen-Fresnal principle	Chapter 10 (10.1 – 10.3; 10.4.1-10.4.3)
6-11	Fourier theory	Periodic functions as Fourier series; Fourier transforms; Representations of the Dirac delta function; Fourier integral theorem and Fourier transforms; Convolution; Correlation function	Chapters 7 and 8
12-17	The scalar diffraction theory	The scalar wave theory of diffraction; The Huygens-Kirchhoff diffraction integral;	Lecture notes
18-21	Fresnel diffraction	Fresnel half period zones; The zone plate	Chapter 19 (19.1-19.3) and lecture notes
22-26	Fraunhofer diffraction	Single-slit diffraction pattern; Diffraction by a circular aperture; the diffraction grating	Chapters 17 and 18 (17.1-17.8); 18.1-18.2 and lecture notes
27-28	Two beam interference by division of wave front	Interference of light waves; The Lloyd's mirror arrangement; Phase change on reflection	Chapter 13 (13.1 – 13.6; 13.11, 13.12)
29-30	Interference by division of amplitude	Newton's rings; Michelson interferometer	Chapter 14 (14.1-



			14.3);14.10-14.11
31-32	Multiple-beam interferometry	The Fabry-Perot Interferometer	Chapter 15 (15.1-15.4)
33-34	Coherence	Spatial and temporal coherence	Chapter 16 (16.1-16.3)
35 - 37	The Matrix Method in paraxial optics	The matrix method; Unit plane; Nodal planes; System of two lenses	Chapter 4
38-40	Polarization and double refraction	Malu's law; production of polarized light; the phenomenon of double refraction; analysis of polarized light	Chapter 21 (21.1-21.7)

Component	Duration	Weightage (%)	Date & Time	Nature
Mid-Semester Examination	90 min	30	14/10 - 2.00 - 3.30PM	Open Book
Assignment and Quizzes (Spontaneous and announced)		30		Closed Book
Comprehensive Examination	180 min	40	21/12 FN	Closed Book

Chamber Consultation Hour: 5 pm to 6 pm on Monday, Wednesday, and Friday in A-203

Notices: Notices and solutions of Tests & Final Comprehensive Examination will be displayed on the Physics Notice Board and will also be uploaded in the CMS.

Make-up Policy: Make-up will be given only in genuine cases with **prior permission** from the Warden & IC. *No Make – ups for Quizzes.*

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
PHY F213

