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# 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:**

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| **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) |

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| **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**