# BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE
INSTRUCTION DIVISION
FIRST SEMESTER 2016-2017

Course Handout (Part II)

Date: 2.8.2016

**Course No**.   : PHY F213
**Course Title**  : OPTICS
**Instructor-in-charge**:   DEBASHIS BANDYOPADHYAY

## Course Description:
The course will cover Geometrical optics, Crystal optics, Diffraction, Fiber optics and the recent trends of research in the optical physics.

## Scope and objective of the course:

The objective of the course is to give an introduction to basic phenomena in optics and the techniques used to deal with them. The recent development of the subject and its application in the research level will be discussed. Course will assume a basic knowledge of optics at the level of the core Physics courses. The course will also provide theoretical background for the optics experiments done in ELECTROMAGNETISM & OPTICS LAB. (PHYF214).

## Text Book (TB):
Optics: Ajoy Ghatak, 5th Edition, Tata McGraw Hill (2012)

## Reference Books (RB):
1.  **RB1**: Introduction to Electrodynamics, David J. Griffiths, 3rd Ed., Pearson, 1999.
2.  **RB2**: Fundamentals of Optics by F.A. Jenkins & H. E. White: 4th Edition, Mc-Graw Hill Book Co.

## 1.   Course Plan:

| Lecture No. | Learning Objectives | Topics to be covered | Reference Chap./ Sec. # |
|---|---|---|---|
| 1 | Introduction | Wave model & corpuscular models of light (self-studies). | 2.1-2.6 |
| 2-3 | Fermat's Principle and its applications in ray optics | Fermat's Principle and its applications in laws of reflection and refraction, Ray paths and ray equations. | 3.1-3.4 |
| 4-7 | Matrix methods in paraxial optics | Matrix methods in paraxial optics, Unit planes, Nodal planes etc. | 5.1-5.5 |
| 8-9 | Aberrations | Chromatic & monochromatic aberrations, Distortions. | 6.1-6.4 |
| 10-13 | Maxwell's equations and Electromagnetic waves, Electromagnetic waves in matter | Propagation of EM waves in linear medium, Reflection and transmission, Absorption and dispersion, Origin of refractive index, Rayleigh Scattering, Normal & anomalous dispersion, Cauchy's formula. | RB1(9.1, 9.3 and 9.4); 7.6 |
| 14-15 | Group velocity and pulse dispersion | Phase velocity and group velocity, Group velocity of a wave packet, Propagation in a Non-dispersive and dispersive medium, | 10.1-10.3 |
| 16 | Huygens' principle and Applications | Huygens' theory to study refraction & reflection, Huygens' principle in inhomogeneous media | 12.1-12.5 |
| 17-18 | Superposition of sinusoidal waves | General representation, Graphical method, Complex representation | 13.5-13.7 |
| 19-20 | Interference by division of wavefront | Double slits interference, Fresnel's two mirror arrangement, Fresnel bi-prism, Lloyd's mirror, Phase change on reflection | 14.5-14.8, 14.11-14.12 |
| 21-22 | Interference by division of amplitude | Interference by a plane film of constant thickness, cosine law, Non-reflecting film, Interference due to a film with variable thickness, Newton's ring, | 15.7, 15.8, 15.10 |

| 23-24 | Multiple beam interferometry | Effect of multiple reflections from a plane film, Fabry-Perot etalon | 16.3-16.5 |
| 25-26 | Fraunhofer diffraction | Single and double slit diffraction, Grating, Resolving power of grating and prism | 18.2, 18.6-18.8 |
| 27-28 | Fresnel diffraction | Fresnel's half-period zones, diffraction by a circular aperture | 20.2-20.3, 20.4.1 |
| 29-30 | Polarization & Double refraction | Malus' law, Double refraction, Optical activity | 22.1-22.8 |
| 31-33 | Fiber Optics I | Basic concepts and ray optics considerations | 27.1,27.3-27.4, 27.5,27.7 |
| 34-37 | Fiber Optics II | Basic waveguide theory and concept of modes | 28.1-28.5 |
| 38-40 | Fiber Optics III | Single mode fiber | 29.1-29.3 |

2. **Evaluation scheme:**

| Component | Duration | Weightage (%) | Date, Time & Venue | Remarks |
|---|---|---|---|---|
| Mid Semester Exam. | 90 mins. | 30 | 7/10  2:00 - 3:30 PM | Closed Book |
| Tutorials/Assignments | | 30 | *** | Closed Book |
| Comprehensive Exam. | 3 hrs. | 40 | 12/12  FN | Closed book (20%) and  Open book (20%) |

3. **Chamber Consultation hour:** To be announced in class.
4. **Notices:** All notices concerning this course will be displayed on the Physics Dept. notice board only.
5. **Make-up policy:** Very strict! Only for genuine reasons such as hospitalization or being out of station with prior permission.

Instructor-in-charge
PHY F213