Kurukshetra University Kurukshetra
Undergraduate Programs
Course: CC-4/MCC-6

Session: 2023-24	
Part A - Introduction	
Subject	Physics
Semester	4th
Name of the Course	**Waves and Optics**
Course Code	B23-PHY-401
Course Type: (CC/MCC/MDC/CC-M/ DSEC /VOC/DSE/PC/AEC/VAC)	CC/MCC
Level of the course (As per Annexure-I	100-199
Pre-requisite for the course (if any)	Appeared or passed the 3rd sem (B.Sc. Physical Science/ equivalent)
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Have understanding of Interference - by Division of Wave front, by Division of Amplitude and Interference due to transmitted light & reflected light 2. Learn about Huygens-Fresnel's theory, diffraction at a straight edge and at a circular aperture, diffraction due to a narrow slit and due to a narrow wire. Understand and explain the Fraunhoffer diffraction, dispersive power of grating, Rayleigh's criterion and resolving power of telescope & a grating 3. Understand the theories and laws of polarization along with understanding of the production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light 4. Understand and appreciate the applications of Lasers in developing LED, Holography, in materials processing, in Medicine, Industry and Military. Have the idea of optical fibres, their properties and principle of propagation of electromagnetic waves through optical fibres 5. Understand various optical phenomena, principles, workings and applications optical instruments through Experiments

Credits	Theory	Practical	Total
	3	1	4
Contact Hours	3	2	5

Max. Marks:100 **Internal Assessment Marks:30** **End Term Exam Marks: 70**	**Time:3hrs**

Part B- Contents of the Course

Instructions for Paper- Setter

1.Nine questions will be set in total.

2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.

3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.

4. 20% numerical problems are to be set.

5. Use of scientific (non-programmable) calculator is allowed.

Unit	Topics	Contact Hours
I	**INTERFERENCE** **Interference by Division of Wave front:** Young's double slit experiment, Coherence, Conditions of interference, Fresnel's biprism and its applications to determine the wavelength of sodium light and thickness of a mica sheet, phase change on reflection. **Interference by Division of Amplitude:** Plane parallel thin film, production of colors in thin films, classification of fringes in films, Interference due to transmitted light and reflected light, wedge shaped film, Newton's rings	11
II	**DIFFRACTION** Fresnel's diffraction: Huygens-Fresnel's theory, Fresnel's assumptions, rectilinear propagation of light, diffraction at a straight edge, rectangular slit and diffraction at a circular aperature. Diffraction due to a narrow slit, diffraction due to a narrow wire. Fraunhoffer diffraction: Single slit diffraction, double slit diffraction, plane transmission grating spectrum, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of telescope and a grating	11
III	**POLARIZATION** Polarization: Polarisation by reflection, refraction and scattering, Malus Law, Phenomenon of double refraction, Huygens's wave theory of double refraction (Normal and oblique incidence), Analysis of polarized Light. Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light. Optical activity, Fresnel's theory of optical rotation, Specific rotation, Polarimeters (half shade and Biquartz)	11

IV	**Lasers:** Basic concept of absorption and emission of radiations, amplification and population inversion; Main components of lasers: (i) Active Medium (ii) Pumping (iii) Optical Resonator; Properties of laser beam: Monochromaticity, Directionality, Intensity, Coherence (Spatial & Temporal coherence); Metastable state, Excitation mechanism and Types of Lasers (He-Ne Laser & Ruby Laser), Applications of Lasers **Fibre optics:** Optical fibres and their properties, Principal of light propagation through a optical fibre, Acceptance angle and numerical aperture, Types of optical fibles: Single mode and multimode fibres, Advantages and Disadvantages of optical fibres, Applications of optical fibres, Fibre optic sensors: Fibre Bragg Grating	12
	Practicum 1 To determine Refractive index of the material of a prism using sodium source. 2 Determination of wave length of sodium light using Newton's Rings. 3 To determine the dispersive power and Cauchy constants of the material of a prism using Mercury discharge source. 4 To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source. 5 Determination of wavelength of sodium light by using a diffraction grating. 6 Resolving power of a telescope. 7 Resolving power of a prism. 8 Resolving power of a grating . 9 Comparison of Illuminating Powers by a Photometer. 10 Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter. 11 Ordinary and extra ordinary refractive indices for calcite or quartz. 12 To find the equivalent focal length of a lens system by nodal slide assembly. **Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination.**	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory (20 Marks)** • Class Participation: **05 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum (10 Marks)** • Class Participation: **Nil** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam: **Nil**		**End Term Examination : 50 Marks** **20 Marks**
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Principles of Optics, M. Born and E. Wolf, Pergamaman Press
2. Optics by Ajoy Ghatak, 2008, Tata McGraw Hill
3. Fundamentals of Optics, Jenkins and White, McGraw Hill Book Co. Ltd., New Delhi
4. Optics, K.D. Muller, University Science Books, Mill ally California
5. An Introduction to Interferometery, Tolansky, John Wiley & Sons, New Delhi
6. Polarized Light Production and Use, Shurcliff, Harward University Press, Cambridge, M A (USA)
7. Lasers and Non-Linear Optics, B.B.Laud, New Age International (P) Ltd., Publishers, New Delhi
8. Lasers, Principles, Types and Applications, K.R. Nambiar, New Age International (P) Ltd., Publishers, New Delhi
9. Laser, Theory & Applications by K. Thyagarajan and A.K. Ghatak, Macmillan India limited
10. A textbook of optics by N. Subrahmanyam and Brijlal, S. Chand & Company
11. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
12. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
13. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
14. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
15. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
16. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House