SLC (University of Delhi)

Shyam Lal College

LESSON PLAN

Name of Teacher	**DR. MONICA GAMBHIR**	**Department**	**Physics**
Course	**B.Sc. (Physical Science)**	**Semester**	**IV (Sec C and Sec D)**
Paper	**Waves and Optics**	**Academic Year**	**2023-2024**

Learning Objectives

The physics and mathematics of wave motion underlie many important phenomena. The water wave on the sea, the vibration of a violin string, etc. can all be described similarly. Light too displays wave-like properties.

1. The course is aimed at equipping the students with the general treatment of waves.
2. This begins with explaining ideas of oscillations and simple harmonic motion and goes on to look at the physics of travelling and standing waves.
3. This understanding applies to a more elaborate analysis. Further, it considers a number of phenomena in which the wave properties of light are important such as interference, diffraction, with emphasis of examples as seen in daily life.

Learning Outcomes

On completion of this course, the student will be able to:

1. Understand simple harmonic oscillation and superposition principle.
2. Understand the superposition of a range of collinear and mutually perpendicular simple harmonic motions and their applications.
3. Understand the concept of normal modes in stationary waves: their frequencies and configurations.
4. Understand interference as a superposition of waves from coherent sources derived from the same parent source.
5. Demonstrate understanding of interference experiments: Young's double slit, Fresnel's biprism, Llyod's mirror, Newton's rings
6. Demonstrate basic concepts of diffraction: Superposition of wavelets diffracted from apertures
7. Understand Fraunhofer diffraction from apertures: single slit, double slit, grating
8. Demonstrate fundamental understanding of Fresnel diffraction: Half period zones, diffraction of different apertures

Week No./ Period	Theme/ Curriculum	No. of Lectures
1. 18 Jan – 27 Jan 2024	**Unit 1:** Simple harmonic motion (SHM). Superposition of Two Collinear Harmonic Oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).	2
2. 29 Jan-3 Feb 2024	Superposition of two perpendicular harmonic oscillations: Graphical and analytical methods. Lissajous figures with equal and unequal frequencies and their uses.	2
3. 5 Feb-10 Feb 2024	Superposition of two harmonic Waves: Standing (stationary) waves in a string; normal modes of stretched strings.	2

4. 12 Feb-17 Feb 2024	**Unit – II** Interference: Division of amplitude and division of wavefront; Young's double slit experiment: width and shape of fringes;	2
5. 19 Feb-24 Feb 2024	Fresnel's biprism; Lloyd's mirror; Phase change on reflection: Stokes' treatment;	2
6. 26 Feb-2 March 2024	Interference in thin films: parallel and wedge-shaped films.	2
7. 4 March-9 March 2024	Fringes of equal inclination (Haidinger fringes); Fringes of equal thickness (Fizeau Fringes);	2
8.11 March-16 March 2024	Newton's rings: Measurement of wavelength and refractive index.	2
9. 18 March-23 March 2024	Unit – III Diffraction: Fraunhofer diffraction: Single slit, double slit	2
10. 24 March-31 March 2024	**Mid-Semester Break, Assignment to be given for Internal Assessment**	
11. 1 Apr-6 Apr 2024	double slit, diffraction grating, Class Test to be taken	2
12. 8 Apr-13 Apr 2024	Fresnel diffraction: Fresnel's assumptions. Fresnel's half-period zones for plane wave.	2
13. 15 Apr-20 Apr 2024	Explanation of rectilinear propagation of light; Fresnel's diffraction pattern of a straight edge,	2
14. 22 Apr-27 Apr 2024	a slit and a wire using half-period zone analysis	2
15. 29 Apr-4 May 2024	Numerical and Doubt Solving Week on Optics and Waves	2
16. 6 May-11 May 2024	Revision from Old Question papers	2
12 May 2024	**Dispersal of Classes, Preparation Leave, and Practical Examination Begin**	
Books	**Essential Reading:** 1) Vibrations and Waves, A. P. French, 1st edition, 2003, CRC press. 2) The Physics of Waves and Oscillations, N. K. Bajaj, 1998, Tata McGraw Hill. 3) Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill. 4) Fundamental of Optics, A. Kumar, H. R. Gulati and D. R. Khanna, 2011, R. Chand Publications. 5) Optics, A. Ghatak, 6th edition, 2017, McGraw-Hill Education, New Delhi 6) The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.	
Online Resources: https://www.digimat.in/nptel/courses/video/115106119/L01.html https://archive.nptel.ac.in/courses/115/107/115107131/ https://egyankosh.ac.in/handle/123456789/72690		