Course Code	Course Name	Credits
26PH003	WAVES AND OPTICS	04

Course Objectives

- To acquire the knowledge of Simple Harmonic Motion (SHM), its mathematical formulation, and applications in physical systems.
- To understand the concepts of damped and forced oscillations, resonance, and their significance in mechanical and electrical systems.
- To apply the principles of wave motion to analyze the characteristics of transverse and longitudinal waves.
- To understand the central concepts and basic formalisms of interference, diffraction.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Acquire skills allowing the student to identify and apply formulas of optics and wave physics using course literature.
- Identify and illustrate physical concepts and terminology used in optics and to be able to explain them in appropriate detail.
- Make approximate judgements about optical and other wave phenomena when necessary.
- Acquire skills allowing the student to organise and plan simpler laboratory course experiments and to prepare an associated oral and written report.

Unit 1 - Simple Harmonic Motion (11 Hrs.)

Simple Harmonic Motion - Differential Equation of SHM - Graphical Representation of SHM - Simple & Compound Pendulum - Kater's Pendulum -Lissajous' Figures - Composition of Two Simple Harmonic Vibrations of Equal Time Periods Acting at Right Angles - Uses of Lissajous' Figures.

Unit 2 – Damped and Forced Oscillations (12 Hrs.)

Free Vibrations- Undamped Vibrations- Damped Vibrations- Damped SHM in an Electrical Circuit- Forced Vibrations - Resonance and Sharpness of Resonance - Phase of Resonance - Examples of Forced and Resonant Vibrations.

Unit 3 - Wave Motion (13 Hrs.)

Propagation in Wave Motion - Characteristics of Wave Motion - Transverse Wave Motion - Longitudinal Wave Motion – Definitions - Relation between Frequency and Wavelength - Properties of Longitudinal Progressive Waves - Equation of Simple Harmonic Wave - Differential Equation of Wave Motion.

Unit 4 – Interference (13 Hrs.)

Light waves and its properties – Interference – Young's Double Slit Experiment – Conditions for sustainable interference - Fresnel biprism – Determination of wavelength – Interference in thin films -due to reflected and transmitted light – Newton's Rings – Michelson's Interferometer-Theory and its applications.

Unit 5 - Diffraction (11 Hrs.)

Fresnel's assumptions - Fresnel's explanation of rectilinear propagation of light - Zone plate – construction and theory - Diffraction at circular aperture and straight edge - Fraunhofer diffraction - Diffraction at single and double slit - Plane transmission grating - theory and applications - Rayleigh's criterion for resolving power.

Reference Books:

1. Lal, B., & Subrahmanyam. N. (2023). Waves and Oscillations (Second Revised Edition). Vikas Publishing House Pvt. Ltd.
2. AjoyGhatak, Optics, 6th Edition, McGraw Hill Education (India) Private Limited, 2017.
3. Subrahmanyam, N., Lal, B., &Avandhanulu, M. N. (2018). A textbook of Optics, (24th Ed.). S. Chand Publishing.

Websites and eLearning Sources:

1. https://onlinecourses.nptel.ac.in/noc24_ph44/preview
2. https://youtu.be/OtzD-KjNPyI?si=l6Sr-k_o0gXMUTqe
3. https://youtu.be/0Anh9HthWgQ?si=8evb9_w8_ib386Zr

COs and Bloom's Taxonomy Mapping – 26PH003		
Course Outcomes	**On completing U.G. program the students will be able to**	**BTL**
CO1	Recall and describe the principles of oscillations and wave motion, including SHM and wave propagation.	K1, K2
CO2	Apply wave theory to solve problems involving interference, diffraction, and resonance phenomena.	K3
CO3	Analyze wave behavior and optical phenomena using mathematical and graphical methods.	K4
CO4	Evaluate the performance of optical systems and interpret experimental observations.	K5
CO5	Design and conduct experiments related to wave optics and analyze the results.	K6

BTL K1 and K2 – remembering and understanding, K3- Applying, K4 – Analyse, K5- Evaluate and K6- Create

Relationship Matrix – 26PH003													
Course Outcomes	**Programme Outcomes (POs)**						**Programme Specific Outcomes (PSOs)**						**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	
CO1	3	2	1	1	1	1	3	2	2	1	1	1	1.58
CO2	3	3	2	2	1	1	2	2	3	2	2	1	2.00
CO3	2	2	2	1	1	1	2	1	2	2	2	1	1.58
CO4	3	2	3	2	2	1	2	2	3	3	3	1	2.33
CO5	2	2	3	1	2	2	2	2	3	2	3	3	2.17
												Total	1.93

Mean Score: 3- High, 2- Medium/Moderate, 1-Low