

• **PHSGCOR04T - Waves and Optics**

Waves and Optics	
60 Lectures	4 Credits
Superposition of Two Collinear Harmonic oscillations	4 Lectures
Linearity & Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).	
Superposition of Two Perpendicular Harmonic Oscillations	2 Lectures
Graphical and Analytical Methods. Lissajous Figures with equal and unequal frequency and their uses.	
Waves Motion- General	7 Lectures
Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.	
Fluids	6 Lectures
<p>Surface Tension: Synclastic and anticlastic surface - Excess of pressure - Application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature.</p> <p>Viscosity: Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of viscosity of a liquid with temperature lubrication.</p> <p>Qualitative discussion on water waves.</p>	
Sound	6 Lectures
<p>Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria.</p>	
Wave Optics	3 Lectures
Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.	
Interference	10 Lectures

Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.

Michelson's Interferometer

3 Lectures

Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index, and Visibility of fringes.

Diffraction

14 Lectures

Fraunhofer diffraction- Single slit; Double Slit. Multiple slits and Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

Polarization

5 Lectures

Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

Reference Books

- ▶ Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- ▶ Vibrations and Waves. A.P. French, 2003, CBS.
- ▶ Vibrations & Waves. G.C. King, 2009, Wiley.
- ▶ The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- ▶ General Properties of Matter. B. Brown, 1969, Springer Science.
- ▶ Classical Mechanics and General Properties of Matter. S.N. Maiti and D.P. Raychaudhuri, New Age
- ▶ Optics. E. Hecht, 2003, Pearson Education.
- ▶ Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
- ▶ Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- ▶ Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications
- ▶ University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley

• **PHSGCOR04P – Waves and Optics Lab**

Waves and Optics	
60 class hours	2 Credits
<p>List of Practical</p> <ol style="list-style-type: none"> 1. To determine the frequency of an electric tuning fork by Melde's experiment and verify $\lambda^2 - T$ law. 2. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method). 3. To determine refractive index of the Material of a prism using sodium source. 4. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source. 5. To determine wavelength of sodium light using Fresnel Biprism. 6. To determine wavelength of sodium light using Newton's Rings. 7. To determine dispersive power and resolving power of a plane diffraction grating. 8. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film. 9. Familiarization with: Schuster's focusing; determination of angle of prism. 10. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating. 11. To investigate the motion of coupled oscillators. 12. To determine the wavelength of sodium source using Michelson's interferometer. 	
<p>Reference Books</p> <ul style="list-style-type: none"> ▶ Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House. ▶ Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers ▶ A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi. 	