

## WAVES AND OPTICS

**Superposition of Collinear Harmonic oscillations:** Linearity and Superposition Principle. Superposition of two collinear oscillations (1) having equal frequencies and (2) having different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. (5 Lectures)

**Superposition of Two Perpendicular Harmonic Oscillations:** Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and their uses. (2 Lectures)

**Wave Motion - General:** 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. (7 Lectures)

**Wave Optics:** Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. (3 Lectures)

**Interference:** 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. (9 Lectures)

**Michelson's Interferometer:** (1) Idea of form of fringes (No Theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer. (4 Lectures)

**Diffraction:** Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula and its application to rectangular slit. (5 Lectures)

**Fraunhofer diffraction:** Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of a grating. (8 Lectures)

**Fresnel Diffraction:** Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. (5 Lectures)

### Reference Books

- Vibrations and waves, A. P. French, 1987, CBSPD.
  - Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
  - Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
  - Principles of Optics, Max Born and Emil Wolf, 7<sup>th</sup> Edn., 1999, Pergamon Press.
  - Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
  - The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
  - The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
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