Waves & Oscillations (PHYS-0232)
(For Science Majors)

Pre-Requisite: Comprehensive knowledge of HS level Mathematics. It is preferable that the student has taken the Mechanics and Relativity (PHYS-0132) course.

36 (Theory Lectures)
14 (Lab)

Oscillations [10 lectures]
Simple Harmonic Oscillators, Complex Representation, Energy, The Damped Oscillator: Underdamped Oscillations, Over-damped Oscillations, Critical Damping, Oscillator with external forcing, Resonance: Electrical Circuits, Sinusoidal Waves, Superposition of waves, Huygens' Principle, Phase velocity, Group Velocity,

Elastic Waves [4 lectures]
The wave equation, Longitudinal elastic waves, Transverse waves in stretched strings, Solving the wave equation, Plane waves, Spherical waves, Standing Waves, Waves in three dimensions.

Electromagnetic Waves [10 lectures]
Electromagnetic Radiation, Electric dipole radiation, Sinusoidal Oscillations, Energy density, flux and power, The vector nature of electromagnetic radiation: Linear polarization, Circular polarization, Elliptical polarization, Electromagnetic Spectrum. Maxwell's Equations, plane wave solutions.

Interference [4 lectures]
Young's Double Slit Experiment, coherence, Interference by division of wavefront and division of amplitude

Diffraction [4 lectures]
Single slit Diffraction Pattern, resolution, Chain of sources, Phased array, Diffraction grating

Polarization [4 lectures]

Natural Radiation, Producing polarized light, Scattering, Reflection, Birefringence or double refraction, Quarter wave plate, Partially polarized light

Experiments

1. Determination of the refractive index of the material of a lens and that of a liquid using a convex lens and a plane mirror.

2. Determination of the focal length of a concave lens by combination method.

3. Determination of the horizontal component of the Earth's magnetic field using a deflection and an oscillation magnetometer.