

352 PH 71 Oscillations and Optics 9 credits

Objective

The course aims at developing a clear understanding of the fundamental concepts in oscillations, sound and optics and the application in real life oscillatory, sound and optical systems, in communication and other applications.

Learning Outcomes: At the end of the course, student should be able to:

- Use mathematical tools to analyse simple oscillatory systems
- Determine or predict optical properties of optical systems or devices such as lens, thin films etc by employing fundamental principles and concepts of optics
- Describe the working principals of fiber optics and applications in communications.

Unit I. Oscillations

Simple Harmonic motion, Practical Oscillators and their applications, Free, damped and forced vibrations, Resonance, Quality Factor, Coupled oscillations; normal modes.

Unit II Sound:

Sound waves in a pipe, Energy of sound waves, The decibel scale, Sonomete, determination of A.C. frequency using sonometer, Determination of frequency using Melde's apparatus. Ultrasonics Production, Piezo electric method, magneto-striction method, detection, properties, applications; Acoustics of buildings, reverberation time, derivation of Sabine's formula, determination of acoustic absorption coefficient

Unit III Optics

Light sources and wave fronts, Huygens's principle, Fermat's principle of least time, Lens and Spherical mirrors, aberrations, methods of minimizing aberration, coma, astigmatism and curvature of field, Eye pieces: Huygen's and Ramsden eyepiece, location of cardinal points, determination of velocity of light - Kerr cell method. Air wedge –testing the planeness of a surface, Michelson Interferometer, types of fringes, Difference in wavelength of Sodium D1, D2 lines and thickness of a thin transparent plate; Multiple beam interference, Febry-Perot interferometer, formation of fringes; Holography recording and reconstruction; Fresnel's and Fraunhoffer diffraction, diffraction grating. Polarization: Nicol prism as polarizer and analyzer, Dichroic Polarizers, Quarter wave plate, Half wave plate, Babinet's compensator - Plane, elliptically and circularly polarized light, production and detection, Optical activity.

Unit IV Fiber Optics:

Fiber optic system; the fiber optic communication, basic principle, total internal reflection, acceptance angle and numerical aperture, types of optical fibers based on material, propagation (transmission) of light through an optical fiber, index profile, fiber configurations, difference between single mode fiber and multimode fiber - difference between step index fiber and graded index fiber, fiber optic communication link

Course Delivery Mode

Lecture (hrs)	Tutorial (hrs)	Assignment (hrs)	Independent Study (hrs)	Practical (hrs)
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Assessment: Coursework 40%, final examination 60%.

Suggested Readings

1. N. Subramaniam and Brijlal, 2005, "A Text Book of Sound", ChandS.& Co.
2. D. S. Mathur, 2000, "Elements of properties of matter" Chand, S& .Co
3. R. Murugesan, 2003, "Properties of matter" Chand, S& .Co.
4. Brijlal and N. Subramaniam, 2004, "Properties of Matter" Chand, S& .Co
5. R. Murugesan, 1999, "Properties of Matter and Acoustics", Chand&C.
6. French A.P. 2003, Vibrations and Waves, CBS Publishers & Distributors
7. Jenkins F. and White H.E. 1986, Fundamentals of Optics, McGraw-Hill, Kogakusha