Optics and Modern Physics

F.Y.B.Tech. (Semester I)

Course code: PH-19001 (OMP)

Teaching Scheme

Lectures : 3hrs/week

Practical: 2hrs/week

Examination Scheme

Test1: 20 & Test2: 20 marks

End-Sem Exam- 60

Unit 1 **[7 Hrs]**

Interference and Diffraction

Interference due to wedge shaped thin film (with derivation); conditions of minima maxima, Newton's rings, Applications of interference.

Fraunhoffer diffraction at a single slit; condition of maxima and minima, Plane diffraction grating (Diffraction at multiple slits) and applications based on diffraction.

Unit 2 **[7 Hrs]**

Polarization

Polarization of light, elliptical and circular polarization, quarter and half wave plate, Polarization by selective absorption; dichroism, polaroids (H and K), Polarization by double refraction, Nicol prism, Fresnel's theory of optical rotation, Kerr effect and magneto-optic kerr effect.

Unit 3 **[7 Hrs]**

Laser Physics

Introduction to laser, Laser and ordinary light, Laser beam characteristics, Spontaneous and stimulated emission of radiations, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping), Optical resonator, Ruby laser, He-Ne Laser, Semiconductor Laser, Nd-YAG Laser, Engineering applications of Laser (Fiber optics, Laser material interaction).

Unit 4 **[7 Hrs]**

Wave Mechanics

Matter waves, De-Broglie's concept of matter waves, Properties of matter waves, Heisenberg's uncertainty principle, Schrödinger's time dependent and time independent equations, Operators, Eigen values and Eigen functions, Expectation values, Physical significance of wave function.

Unit 5 **[7 Hrs]**

Electrons in Potential Well

Applications of Schrödinger's equation; Motion of a free particle, Electron in an infinite deep potential well (rigid box), Electron in a finite deep potential well (non-rigid box), concept of quantum tunneling, Linear Harmonic oscillator,

Unit 6 **[7 Hrs]**

Ultrasonics

Introduction to sound waves, Generation of sound waves, construction and working principle, types of ultrasound generators, Ultrasound transmission modes, Ultrasound imaging and instrumentation; Phonocardiograph, Echo ophthalmoscope, Ultrasound blood flow meter.

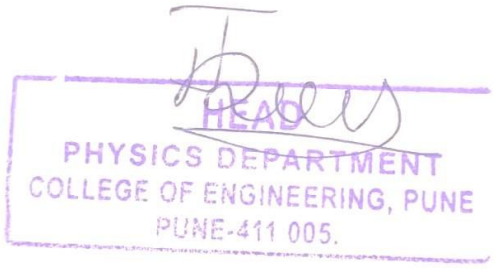
References:

1. Fundamentals of Optics, Francis A. Jenkins and Harvey E. White; Mc-Graw Hill International Edition.
2. A text book of Engineering physics, Avadhanulu and Kshirsagar, S. Chand Pub.
3. A Text Book of Optics, N. Subramanyam & Brijlal; (Vikas Publishing House Pvt. Ltd).
4. LASERS Theory and Applications, K. Thyagarajan, A. K. Ghatak; Macmillan India Ltd.
5. Concepts of Modern Physics, Arthur Beiser; Tata McGraw – Hill Edition.
6. Modern Physics, Jeremy Bernstein, Paul M. Fish bane, Stephen Gasiorowics; Pearson Education.
7. Quantum Mechanics, L. J. Schiff; Mc-Graw Hill International Edition.
8. PHYSICS (Volume I & II), Resnick Halliday and Krane; Willey India 5th Edition.

Course Outcomes:

Student will be able to:

- Analyze the intensity variation of light due to interference, diffraction and polarization.
- They will be able to implement these phenomena to design advanced optical instruments.
- Understand the principle, construction and working of lasers in order to implement Laser Technology in engineering field.
- Understand fundamentals of quantum mechanics and apply to one dimensional motion of particles.
- Understand the principle, production and transmission of ultrasonic waves and understand the working of various instruments based on ultrasonic.



Head

Physics Department