**BACHELOR WITH PHYSICS AS MAJOR**

**3rd SEMESTER**

**PHY322J: PHYSICS: WAVES AND OPTICS** **CREDITS: THEORY – 4, PRACTICAL: 2**

**THEORY (4 CREDITS: 60 HOURS)** **MAXIMUM MARKS: 100, MINIMUM MARKS: 36**

**Course Learning Outcomes:**

*After taking this course, the students will have understanding of the following core concepts and their applications to real physical systems:*

- *Simple harmonic motion, superposition principle and its application to find the resultant of superposition of harmonic oscillations.*
- *Concepts of vibrations in strings and different kinds of wave motion.*
- *Interference as superposition of waves from coherent sources.*
- *Basic concepts of Diffraction: Fraunhoffer and Fresnel Diffraction.*
- *Concepts of the polarization of light and Holography.*

UNIT – 1 (15 HOURS)

Simple Harmonic Oscillations. Differential Equation of SHM and its Solution. Mass- Spring system, Simple Pendulum and Compound Pendulum. Superposition of colinear Harmonic oscillations having equal frequencies and different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity.

UNIT – 2 (15 HOURS)

System with Two Degrees of Freedom: Coupled Oscillators. Normal Coordinates and Normal Modes. Energy Relation and Energy Transfer. Normal Modes of N Coupled Oscillators. Free Oscillations. Damped Oscillations: Damping Coefficient, Log Decrement. Forced Oscillations: Transient and Steady States, Amplitude, Phase, Resonance, Sharpness of Resonance, Power Dissipation and Quality Factor. Helmholtz Resonator.

UNIT – 3 (15 HOURS)

Fermat's principle and its application to obtain laws of reflection and refraction, matrix method in paraxial optics, cardinal points of an optical system, system of two lenses. Interference: Double slit experiment. Temporal and spatial coherence, localized fringes in thin films, fringes of equal thickness and equal inclination. Fresnel's biprism. Newton's rings, Michelson's interferometer, Principle of Fabry-Perot interferometer.

UNIT – 4 (15 HOURS)

Fraunhofer diffraction: Fraunhofer diffraction at one, two and N slits, diffraction grating, Rayleigh criterion of resolution, resolving power of grating.

Fresnel diffraction: Fresnel's half period zones, zone plate, Fresnel diffraction at circular

aperture, explanation of rectilinear propagation.

Polarization: plane, circular and elliptical polarizations-Production and analysis. Holography: Recording of hologram, reconstruction process, applications.

Text Books:


1. Vibrations And Waves, A.P. French, MIT Introductory Physics Series.
2. Waves and Oscillations, R.N. Chaudhuri. New Central Age International Publishers.
3. Optics, Ajoy Ghatak , McGraw Hill
4. Optics: From Fourier to Fresnel, Charles S. Adams, Ifan G. Hughes, University Oxford Press.


**PRACTICALS (2 CREDITS: 30 HOURS)** **MAXIMUM MARKS: 50**

**MINIMUM MARKS: 18**

1.To determine the Refractive Index of the Material of a glass Prism using Sodium Light.

2. To determine Dispersive Power of the Material of a glass Prism using Mercury Light

3. To determine the Resolving Power of a Prism.

4. To determine the value of Cauchy Constants of a material of a prism.

5. To determine wavelength of sodium light using Fresnel Biprism.

6. To determine wavelength of sodium light using Newton's Rings.

7. To determine the wavelength of Laser light using Diffraction of Single Slit.

8. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating

9. To determine the Resolving Power of a Plane Diffraction Grating.

10. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

11. To investigate the motion of coupled oscillators.

12. To study Lissajous Figures.

13. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde’s Experiment.

Books:


1. B.Sc. Practical Physics, C.L. Arora, S. Chand and Company Limited.
2. A textbook of Practical Physics, Indu Prakash, Ramakrishna, Kitab Mahal, New Delhi