Unit 5:

Kinetic theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean Free path, Transport Phenomena: Viscosity, Thermal Conductivity and Diffusion.

Theory of Radiation: Black body radiation, spectral distribution, concept of energy density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law. Wien's displacement law from Planck's law. **(8 Lectures)**

Expected learning outcomes: *On successful completion of this course, the students will have the skill and knowledge to, understand simple harmonic motion, phenomena of interference, diffraction, polarization, various thermodynamical processes, thermodynamical potentials, kinetic theory of gases and the process of blackbody radiation.*

Reference Books:

i. Fundamental of Optics, F. A. Jenkins and H. E. White,1976¸McGraw-Hill
ii. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
iii. Fundamentals of Optics, H.R. Gulati and D. R. Khanna, 1991, R. Chand Publication
iv. University Physics, F. W. Sears, M. W. Zemansky and H D Young13/e, 1986, Addison-Wesley
v. Thermal Physics, S Garg, R.Bansal and C. Ghosh,1993,Tata McGraw-Hill
vi. A Treatise on Heat, Meghnad Saha and B.N.Srivastava, 1969, Indian Press
vii. University Physics, Ronald Lane Reese, 2003, Thomson Books/Cole
viii. Thermal Physics, A. Kumar and S. P. Taneja, 2014, R. Chand Publications.

PHYDSM302T

WAVES & OSCILLATIONS, OPTICS AND THERMAL PHYSICS

Contact Hours: 45

Full Marks = 100 [ESE (70) CCA(30)]

Course objective: *The course aims at reviewing the concepts of waves and oscillations from a more progressive perspective and goes on to build new concepts. This course also aims at reviewing the basic concepts of thermodynamics, kinetic theory of gases, radiation and basic concepts of physical optics.*

Unit 1:

Oscillation: Superposition of Two Collinear Harmonic Oscillations: Linearity and Superposition Principle, (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods, Lissajous Figures with equal and unequal frequency and their uses.

Wave Motion: Transverse waves on a string, Travelling and standing waves on a string, Normal modes of a string, Group velocity, Phase velocity. **(10 Lectures)**

Unit 2:

Interference: Division of amplitude and division of wavefront, Young's Double Slit experiment, Lloyd's Mirror and Fresnel's biprism. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Interference in Thin Films: parallel and wedge-shaped films. Newton's Rings: measurement of wavelength and refractive index.
(8 Lectures)

Unit 3:

Diffraction: Fraunhoffer diffraction: Single slit; Double slit, Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

Polarization: Nicol Prism, Production and analysis of Plane Polarised light by Nicol Prism, Zone Plate, Half wave and quarter wave plate. **(9 Lectures)**

Unit 4:

Thermodynamic Description of system: Various thermodynamical processes, Applications of First law; General relation between C_p and C_v, Work done during Isothermal and Adiabatic processes, Reversible & Irreversible processes, Second law & Entropy, Entropy changes in reversible & irreversible processes, Carnot's theorem (Statement only)

Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal energy functions, Maxwell's relations & applications. **(10 Lectures)**

Unit 5:

Kinetic theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean Free path, Transport Phenomena: Viscosity, Thermal Conductivity and Diffusion.

Theory of Radiation: Black body radiation, spectral distribution, concept of energy density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law. Wien's displacement law from Planck's law. **(8 Lectures)**

Expected learning outcomes: *On successful completion of this course, the students will have the skill and knowledge to, understand simple harmonic motion, phenomena of interference, diffraction, polarization, various thermodynamical processes, thermodynamical potentials, kinetic theory of gases and the process of blackbody radiation.*

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