MJD Govt College Taranagar (Churu)
BSC II YEAR
Paper-I
SATISTICAL PHYSICS AND THERMODYNAMICS

STATISTICAL PHYSICS

UNIT-1

Phase space, micro and macro states, the statistical basis of thermodynamics:The mu(m) space representation, division of mu space into energy sheets and into phase cell of arbitrary size, Probability and thermodynamic probability, principle of equal a priori probabilities,probability distribution and its narrowing with increase in number of particles. The expressions for average properties. Constraints, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states. The monoatomic ideal gas, the barometric rela-tions.

UNIT-2

Some universal laws: Equilibrium before two sys-tems in thermal contact, bridge with macroscopic physics. Probability and entropy, Boltzmann entropy relation. Statistical interpretation of second law of thermodynamics. Boltzmann canonical distribution law and its applications; rigorous form of equipartition of energy.Transition to quantum statistics: 'h' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscil-lator. Indistinguishability of particles and its consequences, M.B., Bose-Einstein, and Fermi-Dirac statistics and their comparision,

THERMODYNAMICS

UNIT-3

The laws of thermodynamics: The Zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics,internal energy as state function and other applications. Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics Different versions of the second law, practical cycles used in internal combustion engines. Entropy,principle of increase of entropy. The thermodynamic scale of temperature;its identity with the perfect gas scale. Third law of thermodynamics.

UNIT-4

Thermodynamic relationships: Thermodynamic variables; extensive and intensive, Maxwell's general relations, application to Joule-Thomson cooling and adiabatic cooling in a general system, Van-der Waals gas,Clausius Clapeyron heat equation. Thermodynamic potentials and equilibrium of thermodynamic systems, relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

UNIT-5

Blackbody radiation: Pure temperature dependence. Stefan-Boltzmann law of radiation. Spectral distribution of blackbody radiation. Wien's displacement law, Rayleigh-Jean's law, the ultraviolet catastrophy,Planck's quantum postulates, Planck's law, complete fit with experiment.
Interpretation of behavior of specific heats of gases and solids at different temperature.

Paper- II
WAVES, ACOUSTICS AND KINETIC THEORY OF GASES

KINETIC THEORY OF MATTER

UNIT-1

Ideal Gas: Kinetic model, deduction of Boyle's law; interpretation of tempera-ture, estimation of rms speeds of molecules. Brownian motion,estimate of the Avogadro number. Equipartition of energy, specific heat of monatomic gas, extension to di-and triatomic gases, Behaviour at low temperatures. Adiabatic expansion of an ideal gas, application to atmospheric physics.Transport phenomena in gases: Molecular collisions, mean free path and col-lision cross sections. Estimates of molecular diameter and mean free path. Trans-port of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

UNIT -2

Real Gas: Van der Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, gas and vapour. Joule expansion of ideal gas, and of a Vander Waals gas, Joule coefficient, estimates of J-T cooling.Liquifaction of gases: Boyle temperature and inversion temperature.Principle of regenerative cooling and of cascade cooling, liquification of hydrogen and helium. Refrigeration cycles, meaning of efficiency.

UNIT-3

Maxwellian distribution of law of velocity and speed in an ideal gas :Distribution of speeds and of velocities, experimental verification,distinction between mean, rms and most probable speed and velocity values. Doppler broadning of spectral lines.Applied acoustics: The acousticity of a hall, reverberation period, Sabine's formula.

WAVES

UNIT-4

Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements. Waves over liquid surface: ripples.Group velocity and phase velocity, their measurements.Superposition of waves: Linear homogeneous equations and the superposition principle, nonlinear superposition and consequences.
Standing waves: Standing waves as normal modes of bounded systems,ex-amples, Harmonics and the quality of sound; examples. Chladni's figures and vibrations of a drum. Production and detection of ultrasonicwaves and applications.

ACOUSTICS

UNIT-5

Noise and Music: The human ear and its responses; limits of human audibility, intensity and loudness, bel and decibel the musical scale,temperament and musical instruments violin, sitar, flute, harmonium &tabla.Reflection, refraction and diffraction of sound:Acoustic impedance of a me-dium, percentage reflection and refraction at a boundary,Measurements of frequency and velocity, impedance matching for transducers, diffraction of sound, principle of a sonar system, sound rang-ing.

Paper-III
OPTICS

GEOMETRICAL OPTICS
UNIT-1

Fermat's Principle: Principle of extremum path and application to laws of reflection refraction.
General theory of image formation : Cardinal points of an optical system, general relationships, thick lens and lens combinations,Lagrange equation of magnification, telescopic combinations, telephoto lenses and eyepieces.

UNIT-2

Aberration in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses. Monochromatic aberrations and their reduc-tions; aplanatic points, oil im-mersion objectives,meniscus lens.Optical instruments: Entrance and exit pupils, need for a multiple lens eye-piece, common types of eyepieces Ramsden & Huygen's eyepiece.

PHYSICAL OPTICS
UNIT-3

Interference: The principle of superpositions, two-slit interference,coherence requirements for the sources, optical path retardations, lateral shift of fringes. Localised fringes Newton's ring; Interference in thin films.Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines, Fabry-Perot interferometer and etalon.

UNIT-4

Fresnel diffraction : Fresnel half-period, zones plates, straight edge,rectilinear propagation of light.
Fraunhofer diffraction: Diffraction at a slit, half-period zones. Phasor diagram and integral calculus methods, the intensity' distribution,diffraction at a circular aperture and a circular disc, resolution of images,Rayleigh criterion, resolving power of telescope and microscopic systems,outline of phase contract micros-copy.Diffraction gratings: Diffraction at N parallel slits, intensity distribution,plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings. Resolving power of a grating and comparison with resolv-ing powers of prism and of a Fabry-Perot etalon.

LASERS
UNIT-5

Laser systems : Purity of a spectral line, coherence length and coherencen in time, spatial coherence of a source, Einstein's A and B coefficients. Spontane-ous and induced emissions, conditions for laser action, population inversion, Ruby and He-Ne laser.Holography & Nonlinear optics : Hologram, construction and reproduction mathematical analysis, principle of self focusing, principle of fiber optics and types of optical fiber.

PRACTICALS

Section 'A'

1. Study of adiabatic expansion of a gas or Determination of 'g = Cp/Cv ratio of two specific heats of a gas by Clement & Desort's method.
2. Study of conversion of mechanical energy in to heat.
3. Study of temperature dependence of total radiation.
4. Application of resistance thermometry : Determine melting point of wax using platinum resistance thermometer.
5. Application of resistance thermometry : Determine temperature coefficient of resistivity using platinum resistance thermometer.
6. Application of thermo emf : Plot thermo emf versus temperature and find the neutral temperature and an unknown temperature.
7. Conduction of heat through poor conductor: Determine thermal conductivity of a poor conductor by Lee's method.
8. Experimental study of probability distribution for a two option system using a colored dice.
9. Determination of velocity of sound, using CRO microphone, speakers by standing waves.
10 Study of dependence of velocity of wave propagation on line parameters using torsional wave apparatus.
11 Study of variation of reflection coefficient with nature of termination using torsional wave apparatus.
12. Study of interference with two coherent sources of sound.
13. Determine the ballistic constant of a ballistic galvanometer/spot galvanometer.
14. Determine the charge senstivity of a ballistic galvanometer/spot galvanometer.
15. Determine the high resistance by leakage method using ballistic galvanometer
16. Determine the ratio of capacitance by using a De Sauty bridge
17. Determine the inductance of a coil by Anderson bridge
18. Determine the normal modes in coupled oscillator system
19. Study of Energy transfer in coupled oscillator system
20. Determine Planck's constant "h" by photo cell.
21. Determine the band gap of PN junction diode

Section 'B'

1. Determination of principal points of a combination of lenses.
2. Use of diffraction grating, find wavelength of main spectral lines of Hg source and its resolving power.
3. Determine resolving power limit of resolution of a telescope and study of various eye pieces, (any two).
4. Determine Angular dispersion of Prism
5. Polarization of light by reflection, verify Brewster 's law & law of Malus.
6. Study of optical rotation of plane of polarization of sugar//specific rotation of canesugar, using polarimeter.
7. Study of interference of light with Bi-prism and determine 'l'.
8. Use of Michelson's interferometer and determine dl, 'l' for sodium light.
9. Use of P.P. Etalon to determine of 'l,' for sodium light.
10. Study of laser as a monochromatic source with reference to interference.
11. Study of laser as a monochromatic source with reference to diffraction.
12. Determine the wavelength of sodium light by Newton's rings
13. Determine Peak and R.M.S value of voltage in a RC circuit with AC source
14. Characteristics of a transistor.(CB, CE)