KAKATIYA UNIVERSITY-WARANGAL-TELANGANA

Under Graduate Courses (Under CBCS 2025–2026 onwards)

B.Sc (PHYSICS) I Year, SEMESTER – II

Paper-II: Thermal Physics

w.e.f academic year (2025-26) (CBCS)

Total: 56 Hrs (4hrs/week)

UNIT–I

Kinetic theory of gases: (4 hrs)

Introduction-Deduction of Maxwell's law of distribution of molecular speeds, Transport Phenomena-Viscosity of gases-thermal conductivity – diffusion of gases.

Thermodynamics: (8 hrs)

Basics of Thermodynamics-Carnot's engine (qualitative)-Carnot's theorem-Kelvin's and Clausius statements-Thermodynamic scale of temperature-Entropy, physical significance-Change in entropy in reversible and irreversible processes-Entropy and disorder-Entropy of universe -Temperature-Entropy (T-S) diagram - Change of entropy of a perfect gas-change of entropy when ice changes into steam, Application of entropy in waste management.

UNIT–II

Thermodynamic potentials and Maxwell's equations: (8 hrs)

Thermodynamic potentials-Derivation of Maxwell's thermodynamic relations-Clausius-Clayperon's equation-Derivation for ratio of specific heats-Derivation for difference of two specific heats for perfect gas.

Low temperature Physics: (8 hrs)

Joule Kelvin effect-liquefaction of gas using porous plug experiment, Joule expansion-Distinction between adiabatic and Joule Thomson expansion-Expression for Joule Thomson cooling-Liquefaction of helium, Kapitza's method-Adiabatic demagnetization-Production of low temperatures -Principle of refrigeration, vapour compression type, Thermocouple-seebeck effect, Peltier effect and Thomson's effect.

UNIT–III

Quantum theory of radiation: (14 hrs)

Black body-Ferry's black body-distribution of energy in the spectrum of Black body-Wein's displacement law, Wein's law, Rayleigh-Jean's law-Quantum theory of radiation-Planck's law-deduction of Wein's law, Rayleigh-Jeans law, Stefan's law from Planck's law.

Measurement of radiation using pyrometers-Disappearing filament optical pyrometer-experimental determination–Angstrom pyro heliometers-determination of solar constant, effective temperature of sun.

UNIT–IV

Statistical Mechanics: (14 hrs)

Introduction, postulates of statistical mechanics. Phase space, concept of ensembles and some known ensembles, classical and quantum statistics and their differences, concept of probability, Maxwell-Boltzmann's distribution law - Molecular energies in an ideal gas - Maxwell-Boltzmann's velocity distribution law (qualitative), Bose-Einstein Distribution law- application to Photon energy, Fermi-Dirac Distribution law- free electron gas, comparison of three distribution laws.

NOTE: *Problems should be solved at the end of every chapter of all units.*

Reference/Suggested books

1) **Fundamentals of Physics**.byHalliday/Resnick/Walker.*C.Wiley India Edition 2007.*
2) **Second Year Physics –***Telugu Academy, Telangana*
3) **Modern Physics** by **R.**Murugeshan and Kiruthiga Siva Prasath (For Statstical mechanics) S. Chand & Co.
4) **Modern Physics** by G.Aruldhas and P. Rajagopal, *Eastern Economy Education.*
5) **Statistical Physics** by F.Reif Berkeley Physics Course.Volume-5,*The McGraw-Hill Companies.*
6) **An Introduction to Thermal Physics** by Daniel V. Schroeder.*Pearson Education Low Price Edition.*
7) **Thermodynamics** by R.C. Srivastava, Subit K. Saha & Abhay K. *Jain Eastern Economy Edition.*
8) **Modern Engineering Physics** by A.S.Vasudeva .*S.Chand & Co. Publications.*
9) **Feyman's Lectures on Physics** Vol. 1, 2, 3 & 4.*Narosa Publications.*
10) **Heat and Thermo dynamics**: K.W.Zeemansky.
11) **Introduction to statistical Mechanics**"by B.B. Laud (Macmillan 1981).
12) **Statistical Physics**" by F.Reif., (Mc Graw-Hill,1998)
13) **Statistical Physics"** by K.Haung., (Wiley Eastern 1988)

B.Sc (Physics) - I year, Semester - II
Paper–II: Thermal Physics Practical lab

No. of hours per week: 2

1) Determination of Co-efficient of thermal conductivity of a bad conductor by Lee's method.
2) Determination of Stefan's constant-Stefan's experiment.
3) Determination of Specific heat of a liquid by using Newton's law of cooling method.
4) Determination of heating efficiency of electrical kettle with varying voltages.
5) Cooling Curve of a metallic body (Null method).
6) Determination of temperature coefficient of resistance using resistance thermometer.
7) Study of conversion of mechanical energy to heat.
8) Determination of Specific heat of a solid (graphite).
9) Thermal expansion of solids
10) Calibration of thermo couple
11) Simulations for T-S diagram

***Note**: Minimum of **Eight** experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.*

Suggested Books

1) D.P.Khandelwal, "A laboratory manual for under graduate classes"(Vani Publishing House, New Delhi).
2) S.P.Singh,"Advanced Practical Physics"(Pragati Prakashan, Meerut).
3) Worsnop and Flint-Advanced Practical physics for students.
4) "Practical Physics" R.KShukla, Anchal Srivastava.