UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN PHYSICS
SYLLABUS WITH EFFECT FROM 2020-2021

BPS-CSC03

CORE-III: THERMAL PHYSICS
(Common to B.Sc.Physics with Computer Applications)

Lecture: 60 Hours Tutorial: 15 Hours Credits:4

Course Objective:

- To make the students understand the various thermo dynamical concepts and principles and to solve problems.

Learning Outcome:

Upon completion of the course students will be able to:

- Acquire knowledge of Heat and different measurement techniques in calorimetry.
- Use thermodynamic terminology correctly
- Explain fundamental thermodynamic properties
- Learn the basic aspects of kinetic theory of gases and the mean free path of molecular collision
- know about Vander Waals' equation of state and the Joule-Thomson effect

UNIT I :KINETIC THEORY OF GASES AND MEAN FREE PATH(12 Hours)

Review of results of kinetic theory of gases: (Pressure exerted by gas -rms, average and most probable speed-Equipartition Theorem – Heat capacities) - Distribution of molecular velocities in a perfect gas-Distribution of molecular speeds-Mean free path (Zeroth and First order)

UNIT II: TRANSPORT PHENOMENA AND REAL GASES (12 Hours)

Transport phenomena- Viscosity (Zeroth order approximation)- Effects of Temperature and Pressure on viscosity- Thermal Conductivity- Diffusion – Real gases -Deviations from Perfect gas behaviour- Regnault's Experiment – Vander Waals' equation of state – Discussion of Vander Waals' equation – Joule Experiment – Porous Plug experiment – Joule –Thomson Coefficient for Vander Waals' gas

UNIT III: THERMOMETRY AND CALORIMETRY (12 Hours)

Platinum resistance thermometer – Calendar and Griffith's bridge – Thermistor – Specific heat capacity – Specific heat capacity of solids – Dulong and Petit's law – Specific heat capacity of liquid – method of mixtures – Barton's correction – Specific heat capacity of gases – C_p and C_v by Regnault's and Callendar & Barne's methods – Variation of Specific Heat Capacity of Diatomic Gases

UNIT IV: FIRST AND SECOND LAW OF THERMODYNAMICS (12 Hours)

Thermodynamic system, surroundings, boundaries-State of system and Thermodynamic variables – Thermodynamic equilibrium- Processes- The Zeroth law and concept of temperature-origin of the first law- Internal energy-Basic thermal, mechanical and diffusive interactions-the first law-applications of first law(heat capacities of gas, adiabatic equation of state and lapse rate)- Enthalpy- Second law –Origin of second law - Heat engines –The Carnot cycle- Carnot cycle as refrigerator –Kelvin, Planck and Clausius statements-Carnot's theorem

UNIT IV: ENTROPY AND THERMODYNAMIC RELATIONS (12 Hours)

Entropy- Entropy change in reversible processes – Reversible heat transfer- Clausius inequality - Entropy change in irreversible process-the principle of increase of entropy- Joule's expansion-the entropy form of first law- Entropy of an Ideal gas- Entropy of mixing - Unavailable energy: Thermal death of universe - Physical concept of entropy- Maxwell relations- Thermodynamic relations involving heat capacities- TdS equations.

Books for Study:

1. Thermal Physics, S.C.Garg, RM Bansal & CK Ghosh ,Tata McGraw Hill Publications, 2nd edition. (2018).

Books for Reference:

1. Heat and Thermodynamics, Zemansky, McGraw – Hill Book Co. Inc., New York.

2. Heat and Thermodynamics , Brijlal and N. Subramanyam, S.Chand& Co, New Delhi (2000)

3. Heat, Narayana Moorthy and KrishnaRao, Triveni Publishers, Madras (1969).

4. Fundamentals of Physics, Resnick Halliday and Walker, 6th edition, , John Willey

and Sons, Asia Pvt.Ltd., Singapore.

5. Fundamentals of Thermodynamics, Carroll M.Leonard, Prentice-Hall of India (P)

Ltd., New Delhi (1965).

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