

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER
PH 3402(3)

**PHYSICS
HEAT AND THERMODYNAMICS
SYLLABUS**

Time: 4 Hrs./Week
Max. Marks: 100

COURSE OBJECTIVES:

- ❖ *Understand various physical processes involved in nature.*
- ❖ *Analyze a physical phenomenon based on physical laws.*
- ❖ *Apply the concepts and principles to face competitive examinations leading to higher studies and others.*

COURSE OUTCOMES:

- ❖ *To develop a working knowledge of the laws and methods of thermodynamics.*
- ❖ *To develop a working knowledge on the laws and methods of elementary statistical mechanics.*
- ❖ *To define and understand the meaning of specific heat capacity of solids and liquids.*
- ❖ *To know the concepts of heat exchange, heat capacity, phases of matters, ideal gas law, kinetic theory of gases etc.*

UNIT-I: Thermodynamics:

(12hrs.)

Introduction- Isothermal and Adiabatic processes, Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature and its identity with perfect gas scale, Second law of thermodynamics: Kelvin's and Clausius statements, Principle of refrigeration, Entropy, Physical significance, Change in entropy in reversible and irreversible processes; Entropy and disorder-Entropy of Universe; Temperature-Entropy (T-S) diagram and its uses ; change of entropy when ice changes into steam.

UNIT-II: Thermodynamic Potentials and Maxwell's equations:

(12hrs.)

Thermodynamic potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials, Applications to (i) Clausius-Clayperon's equation (ii) Value of CPCV (iii) Value of CP/CV (iv) Joule-Kelvin coefficient for ideal and Van der Waals' gases

UNIT-III: Low temperature Physics:

(12hrs.)

Methods for producing very low temperatures, Joule Kelvin effect, Porous plug experiment, Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule

Thomson cooling, Liquefaction of air by Linde's method, Production of low temperatures by adiabatic demagnetization (qualitative), Practical applications of substances at low temperatures.

UNIT- IV: Quantum theory of radiation:

(12 hrs.)

Blackbody and its spectral energy distribution of black body radiation, Kirchoff's law, Wein's displacement law, Stefan-Boltzmann's law and Rayleigh-Jean's law (No derivations), Planck's law of black body radiation-Derivation, Deduction of Wein's law and Rayleigh Jean's law from Planck's law, Solar constant and its determination using Angstrom pyroheliometer, Estimation of surface temperature of Sun.

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UNIT – V: Kinetic Theory of gases:

(12 hrs.)

Kinetic Theory of gases-Introduction, Maxwell's law of distribution of molecular velocities (qualitative treatment only) and its experimental verification, Mean free path, Degrees of freedom, Principle of equipartition of energy (Qualitative ideas only), Transport phenomenon in ideal gases: viscosity, Thermal conductivity and diffusion of gases.

REFERENCE BOOKS:

- BSc. Physics, Vol.2, Telugu Akademy, Hyderabad
- Thermodynamics, R.C. Srivastava, S.K. Saha & Abhay K. Jain, Eastern Economy Edition.
- Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath & Co. Ltd., Meerut
- Fundamentals of Physics. Halliday/Resnick/Walker. C. Wiley India Edition 2007
- Heat and Thermodynamics -N BrijLal, P Subrahmanyam, S. Chand& Co.,2012
- Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
- University Physics, HD Young, MW Zemansky, FW Sears, Narosa Publishers, New Delhi

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