



## BHAVAN'S VIVEKANANDA COLLEGE

of Science, Humanities and Commerce, Sainikpuri  
Autonomous College | Affiliated to Osmania University

Reaccredited with 'A' Grade by NAAC

**Syllabus - B Sc I Year Physics**

**W.e.f the academic year: 2025-26**

### Semester I

Course Name: **Mechanics** Course Code: **PH123** (60 Hours)

**HPW: 4**

**CREDITS: 4**

*Course Objectives: This course is designed to*

*COB1: illustrate applications of vector differentiation, integration*

*COB2: describe motion associated with variable mass systems and rigid bodies.*

*COB3: interpret the laws of planetary motion*

*COB4: infer the concept of relativity*

### Unit – I

**(15 hrs)**

#### **Vector Analysis (8)**

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and Curl of a vector field and related problems.

#### **Vector Integration (7)**

Vector integration- line, surface and volume integrals. Stoke's, Gauss, and Green's theorems – simple applications.

### Unit – II

**(15 hrs)**

#### **Motion of variable mass system (7)**

Laws of Motion-Motion of variable mass system, motion of a rocket, multi-stage rocket, conservation of energy and momentum.

#### **Mechanics of rigid bodies (8)**

Definition of Rigid body. Rotational kinematic relations, equation of motion for a rotating body, angular momentum and Inertia tensor. Euler's equations, torque free motion of a symmetric top. Symmetric top and precessional motion, Gyroscope.

### Unit – III

**(15 hrs)**

#### **Central forces (7)**

Central forces – definition and examples, conservative nature of central forces, force as a negative gradient of potential energy, center of mass of many body systems, two body problem, equation of motion under a central force.

#### **Gravitational forces (8)**

Gravitation potential and gravitational field, Kepler's Laws-Derivation, Colliding gravitational waves and Chandrasekhar's limit.

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## Unit – IV

(15 hrs)

### Frames of reference and transformation (8)

Frames of reference- inertial and non-inertial, Galilean transformation equations, Galilean Invariance, absolute frame of reference, Michelson – Morley experiment- significance of negative result.

### Consequences of relativistic transformations (7)

Postulates of special theory of relativity, Lorentz transformation, time dilation, length contraction, addition of velocities, mass – energy relation. Concept of four vector formalism and their transformations.

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

**Course Outcomes:** By the end of this course, the student will be able to

**CO1:** apply the concepts of vector differentiation, integration in solving numericals

**CO2:** analyze the motion of a rocket as a variable mass system and distinguish the various types of rigid body motion.

**CO3:** outlines the concepts of central forces and explains its conservative nature.

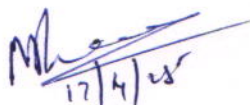
**CO4:** formulate a four vector in space and time by the modification of classical transformations.

### Text books:

1. First year Physics, *Telugu Akademi*.
2. Mechanics, D S Mathur, *S Chand and company Limited*.
3. Mechanics of Particles, Waves and Oscillations. Anwar Kamal, *New Age International*.
4. Mechanics of Particles, Waves and Oscillations. Dr S L Gupta and Sanjeev Gupta, *Jai Prakash Nath Publications*.
5. Mechanics, H S HANS and S P PURI, *Tata-McGraw Hill Company Edition, 2008*.
6. College Physics, I. T. Bhimasankaram and G. Prasad, *Himalaya Publishing House*.

### Reference Books:

1. Fundamentals of Physics, Halliday, Resnick and Walker, *Wiley India Edition 2007*.
2. Berkeley Physics Course Vol.1, Mechanics C. Kittel, M.A. Ruderman, *Tata McGraw Hill Company Edition 2008*.
3. University Physics, Young and Freeman, *Pearson Education 2005*.
4. Sears and Zemansky's University Physics, Hugh D. Young, Roger A., *Freedman Pearson Education Eleventh Edition*.
5. An Introduction to Mechanics, Daniel Kleppner & Robert Kolenkow, *The McGraw Hill Companies*.
6. Engineering Physics, R.K. Gaur & S.L. Gupta, *Dhanpat Rai Publications*.



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**Course Objectives:** *This course is designed to*

**COB1:** *determine moment of inertia and elastic constants.*

**COB2:** *study flow of liquids through capillaries and understand capillary rise*

**Experiments:**

1. Determination of Moment of Inertia of rectangular lamina and verification of perpendicular axes theorem using Bifilar suspension.
2. Calculate Young's modulus and rigidity modulus using oscillations of a mass under different combinations of springs.
3. Determination of Young's modulus by uniform Bending (or) Non- uniform Bending.
4. Moment of inertia of a flywheel.
5. Measurement of rigidity modulus using Torsional Pendulum.
6. Determination of Surface Tension of a liquid using capillary rise method.
7. Study of flow of liquids through capillaries-measurement of coefficient of viscosity.
8. Determination of  $g$  and  $k$  from the study of oscillations of compound pendulum.

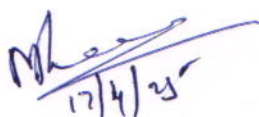
**Course Outcomes:** *by the end of this course, the student will be able to*

**CO1:** *acquire skill to determine moment of inertia and elastic constants.*

**CO2:** *adapt the methods of measurement of surface tension and coefficient of viscosity.*

**Recommended Books:**

1. B. Sc Practical Physics, C L Arora, S. CHAND & Company Ltd.
2. B. Sc Practical Physics, Harnam Singh Dr P S Hemne S. CHAND & Company Ltd.  
Advanced Practical Physics for Students, B L Flint and H T Worsnop, Methuen & co. Ltd.  
-London, S6 Essex Street, Strand, W G. 2
3. Theory Machines, R S KHURMI and J K GUPTA, S. CHAND & Company Ltd.
4. Introduction to Physics for Scientists and Engineers, F.J Ruche, McGraw Hill.
5. A Text Book of Practical Physics, Indu Prakash & Ramakrishna, Kitab Mahal, New Delhi.
6. Measurement, Instrumentation and Experiment Design in Physics and Engineering, Michael Sayer, Abhai Mansingh, PHI publishers.

  
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## Syllabus - B Sc I Year Physics

Wef the academic year: 2025-26

### Semester II

Course Name: Thermal Physics

Course Code: PH 223 (60 Hours)

HPW: 4

CREDITS: 4

**Course Objectives:** *This course is designed to*

**COB1:** *define the Laws of Thermodynamics*

**COB2:** *relate Laws of Thermodynamics in various applications*

**COB3:** *discuss various laws of Black body radiations and its applications*

**COB4:** *explain the concept of kinetic theory of gases to classical and Quantum Statistics*

### Unit-I

(15 hrs)

#### Thermodynamics (7)

Basics of thermodynamics- Isothermal and Adiabatic processes – Work done and relation between the specific heats. Reversible and Irreversible processes. Carnot's Engine and its efficiency.

#### Second Law of Thermodynamics(8)

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 and change of entropy when ice changes into steam.

### Unit-II

(15 hrs)

#### Thermodynamic potentials and Maxwell's equations (8)

Thermodynamic Potentials: Definitions, properties and applications. First and Second order Phase Transitions. Derivation of Maxwell's thermodynamic Relations and applications (1) Clausius-Clapeyron's equation, (2) Value of  $C_p - C_v$ , (3) TdS Equations. Joule Kelvin effect: Expression for Joule Kelvin coefficient for perfect and Vander wall's gas.

#### Low temperature Physics (7)

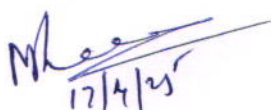
Methods of Production of low temperatures-Joule Thomson's porous plug Experiment. Distinction between Joule's, Adiabatic and Joule Thomson's Expansion processes. Liquefaction of gases: liquefaction of hydrogen and Helium-Adiabatic Demagnetization. Principle of Refrigeration, Vapor Compression Machine.

### Unit-III

(15 hrs)

#### Radiation Laws (9)

Black body: Ferry's black body, distribution of energy in the spectrum of Black body. Stefan's law, Wien's displacement law (qualitative), Wien's law and Rayleigh-Jeans law. Quantum theory of Radiation: Planck's law, deduction of Wien's law, Rayleigh-Jeans law and Stefan's law from Planck's law.

  
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### Measurement of Radiation: (6)

Pyrometers: Types of pyrometers. Disappearing filament optical pyrometer. Angstrom Pyroheliometer and determination of solar constant. Estimation of temperature of the Sun.

### Unit-IV

(15 hrs)

#### Kinetic theory of gases (7)

Elements of Kinetic theory of gases: Mean free path and degrees of freedom. Law of Equipartition of energy and its application to specific heat of mono and diatomic gases. Equation of State: Ideal and Vander wall's gases. Distribution of velocities: Derivation of Maxwell's law of distribution of speeds in ideal gas and its experimental verification. Thermal Ionization Equation of Meghnad Saha- Basic statement. Speed distribution curves. Transport phenomena: Viscosity, Thermal conduction and diffusion.

#### Statistical Mechanics (8)

Introduction to Statistical Mechanics: Concept of ensembles and phase space. Distribution and Statistical equilibrium. Concept of probability: Distribution function and probability theorems. Maxwell Boltzmann's distribution law: Molecular energies in ideal gas. Quantum statistics: Bose Einstein's Distribution law and Fermi Dirac distribution law. Bose condensate Theory-Statement only. Comparison of three statistics.

**Course Outcomes: By the end of this course, the student will be able to**

**CO1:** recognize the importance of the Laws of Thermodynamics

**CO2:** demonstrate the use of Maxwell's relations in various applications

**CO3:** interpret the various laws of radiation and estimate the Temperature of Sun and Solar Constant

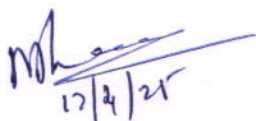
**CO4:** formulate Quantum statistics by using kinetic theory of gases and obtain molecular energies

#### Textbooks:

1. Second Year Physics, Telugu Akademi.
2. Heat and thermodynamics, Brijlal and Subrahmanyam S. Chand & Company Ltd.
3. Heat and thermodynamics, D.S. Mathur, S. Chand & Company Ltd.
4. Heat and thermodynamics, Mark W Zemansky, The McGraw-Hill companies.
5. Thermodynamics, R.C. Srivastava, Subit K. Saha & Abhay K. Jain Eastern Economy Edition.
6. Fundamentals of Physics, Halliday/Resnick/Walker.C. Wiley India Edition 2007.

#### Reference Books:

1. Statistical Physics, F. Reif. The McGraw- Hill Companies.
2. University Physics, Young and Freeman, Pearson Edition, Edition 2005.
3. Engineering Physics, Uma Mukherji, Narosa Publishing house.
4. Feynman's Lectures on Physics Vol. 1,2,3 & 4. Narosa Publications.
5. Modern Engineering Physics, A.S. Vasudeva. S.Chand & Co. Publications.

  
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**Semester II**

Course name: **Thermal Physics Practicals**  
HPW: 3

Course Code: **PH 323P**  
**CREDITS: 1**

**Course Objectives:** *This course is designed to*

**COB1:** *enhance ability to determine thermal conductivity, specific heat heating efficiency.*

**COB2:** *analyze discrepancy in practical and experimental observations and results in comparison to theory*

1. Measurement of Stefan's constant.
2. Specific heat of a liquid by applying Newton's law of cooling correction.
3. Coefficient of thermal conductivity of a bad conductor by Lee's method.
4. Heating efficiency of electrical kettle with varying voltages.
5. Thermistor characteristics-Resistance thermometry.
6. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
7. Measurement of Curie temperature by study of variation in resistance/capacitance/magnetic phase change with temperature.
8. Specific heat capacity of solids.
9. Cooling curve of a metallic body.

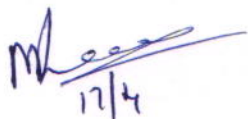
**Course Outcomes:** *By the end of this course, the student will be able to*

**CO1:** *acquire skill to determine thermal conductivity, specific heat heating efficiency.*

**CO2:** *adapt the comparative studies and understand discrepancy in practical and experimental observations*

**Recommended Books:**

1. A laboratory manual for undergraduate classes, D.P. Khandelwal, *Vani Publishing House, New Delhi.*
2. B.Sc Practical Physics, C L Arora, *S.Chand & Company Ltd.*
3. B.Sc Practical Physics, Harnam Singh Dr P S Hemne, *S.Chand & Company Ltd.*



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