Bharatiya Vidya Bhavan

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 processional 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.

17/4

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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.*

17/4/18

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Sainikpuri

Semester I Course Name: **Mechanics Practicals** **Course Code: PH123P**
HPW: 2 **CREDITS: 1**

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.*

17/4/25

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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 Claussius 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 Cp-Cv, (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.

17/4/25

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BOS in Physics

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 PhysicsVol. 1,2,3 & 4. *Narosa Publications.*
5. Modern Engineering Physics, A.S. Vasudeva. *S.Chand & Co. Publications.*

17/4/25

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Semester II

Course name: **Thermal Physics Practicals** Course Code: **PH 323P**

HPW: 3 **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.*

17/4

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