



Bharatiya Vidya
Bhavan

Bhavan's Vivekananda College
of Science, Humanities and Commerce

Sainikpuri, Secunderabad

Autonomous College | Affiliated to Osmania University

Reaccredited with 'A' Grade by NAAC

Syllabus - B Sc I Year Physics

w.e.f the academic year: 2026-27

Semester I

Course Name: **Mechanics and Oscillations**

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

HPW: 4

CREDITS: 4

Course Objectives: This course is designed to -

1. develop a strong foundation in vector analysis and illustrate its applications in physics.
2. describe motion associated with a variable mass system.
3. understand the dynamics of rigid bodies, rotational and precessional motion and interpret the laws of planetary motion.
4. introduce the concept of relativity and its physical implications.
5. study different types of oscillatory motion and understand the fundamentals of wave motion and wave equation in various systems.
6. develop logical and problem-solving skills in classical mechanics.

Unit – I

(15 hrs)

Vector Analysis (8)

Scalar and Vector fields, Gradient of a Scalar field, Divergence and Curl of a Vector field and their physical significance and related problems. Vector integration: line, surface and volume integrals. Stoke's, Gauss and Green's theorems- simple applications.

Motion of Particles (7)

Laws of Motion, Conservation of energy and momentum, Motion of variable mass system, motion of a rocket, multi-stage rocket, parts of a rocket and their functions. Concept of *Gati* (Motion) and *Karma* (Action) in Vaisheshika Philosophy.

Unit – II

(15 hrs)

Mechanics of Rigid bodies (7)

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.

Central forces (8)

Central forces – definition and examples, conservative nature of central forces, force as a negative gradient of potential energy, equation of motion under a central force, motion under inverse square law, derivation of Kepler's laws, Colliding gravitational waves and Chandrasekhar's limit.

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Unit – III**(12 hrs)****Frames of reference and transformation (6)**

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 (6)

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

Unit – IV**(18 hrs)****Oscillations (8)**

Simple harmonic oscillator and its solution, physical characteristics of SHM, Damped harmonic oscillator and its solution. Energy considerations, logarithmic decrement, relaxation time, quality factor, forced harmonic oscillator and its solution, amplitude resonance,

Waves (10)

Fundamentals of Waves – velocity of transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones, energy transport, and transverse impedance. Longitudinal vibrations in bars- wave equation and its general solution. Special cases (i) bar fixed at both ends ii) bar fixed at the mid-point iii) bar free at both ends iv) bar fixed at one end.

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 -

- PH123.CO1:** apply the concepts of vector differentiation, integration and theorems in physical systems.
- PH123.CO2:** analyze the motion of a rocket as a variable mass system
- PH123.CO3:** distinguish the various types such as rotational motion and precessional motion of rigid body and apply these concepts of central forces in various physical systems
- PH123.CO4:** formulate a four vector in space and time by the modification of classical transformations.
- PH123.CO5:** differentiate the types of oscillations and infer the concepts of wave motion in various physical systems.
- PH123.CO6:** understand physics laws in societal, environmental and ethical contexts with teamwork and proper communication.

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*.
7. Waves and Oscillations, Brij Lal and N. Subrahmanyam, *S Chand and company Limited*.
8. Physics in Ancient India Narayan Gopal Dongre and Shankar Gopal Nene, *National Book Trust, India*.

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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*.

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	-	2	-	-	-	-	-	-
CO2	3	3	2	1	-	1	-	-	-	-
CO3	3	3	1	2	-	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-
CO5	3	2	-	2	-	-	-	-	-	-
CO6	2	2	-	2	2	2	2	2	2	2


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Semester I

Course Name: **Mechanics and Oscillations Practical**

Course Code: **PH123P**

HPW: 2

CREDITS: 1

Course Objectives: *This course is designed to -*

1. *understand error estimation and determine various mechanical and wave related parameters.*
2. *provide hands-on experience with equipment and presentation skills.*

Experiments:

1. Measurement of errors – Simple Pendulum.
2. Determination of Moment of Inertia of rectangular lamina and verification of perpendicular axes theorem using Bifilar suspension.
3. Calculate Young's modulus and rigidity modulus using oscillations of a mass under different combinations of springs.
4. Determination of Young's modulus by uniform Bending (or) Non- uniform Bending.
5. Moment of inertia of a flywheel.
6. Measurement of rigidity modulus using Torsional Pendulum.
7. Determination of g and k from the study of oscillations of compound pendulum.
8. Study of oscillations of mass under Series and Parallel combination of springs.
9. Verification of Laws of a stretched string (Three Laws).
10. Velocity of Transverse wave along a stretched string.
11. Determination of Surface Tension of a liquid using capillary rise method.
12. Study of flow of liquids through capillaries-measurement of coefficient of viscosity.

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

PH123.CO1: *perform and analyze experiments using suitable equipment and methodology.*

PH123.CO2: *follow safe laboratory practices, teamwork, and proper handling of instruments.*


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

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	3	2	-	-	-	-	-
CO2	2	2	-	-	-	3	2	2	3	3


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w.e.f the academic year: 2026-27

Semester II

Course Name: **Thermal Physics**
HPW: 4

Course Code: **PH 223 (60 Hours)**
CREDITS: 4

Course Objectives: *This course is designed to -*

1. *define the Laws of Thermodynamics and relate the Laws of Thermodynamics in various applications*
2. *introduce the different methods of production of low temperatures*
3. *discuss various laws of Black body radiation and its applications*
4. *explain the concept of kinetic theory of gases to classical and Quantum Statistics*
5. *develop logical, analytical and problem-solving skills*
6. *motivate and inculcate a sense of conservation and production of renewable energy*

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. Application of entropy in waste management.

Unit-II

(15 hrs)

Thermodynamic potentials and Maxwell's equations (8)

Thermodynamic Potentials: Definitions, properties and applications. 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.


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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.

Measurement of Radiation: (6)

Pyrometers: Types of pyrometers. Disappearing filament optical pyrometer. Angstrom Pyrheliometer 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.. 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)

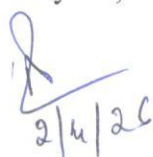
Introduction to Statistical Mechanics: Concept of ensembles and phase space. Distribution and Statistical equilibrium. Concept of probability: Distribution function and probability theorems. Maxwell Boltzmann's distribution law: Molecular energies in ideal gas. Quantum statistics: Bose Einstein's Distribution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

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

- PH223.CO1:** *apply the laws of thermodynamics to solve physical problems and analyze the dynamics of various process in the Universe by studying entropy variations*
- PH223.CO2:** *analyze and apply the concepts of thermodynamic potentials, Maxwell's relations and Joule-Thomson effect to various household and industrial applications*
- PH223.CO3:** *interpret the various laws of radiation and estimate the Temperature of Sun and Solar Constant*
- PH223.CO4:** *formulate classical and Quantum statistics by using kinetic theory of gases and obtain molecular energies*
- PH223.CO5:** *understand the relevance of the laws of Thermal Physics to promote sustainable growth, and address energy security challenges*
- PH223.CO6:** *build responsible teams to spread awareness on energy conservation with ethical and environmental responsibility and gain hands-on experience in sustainability practices.*

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.*


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1. Statistical Physics. 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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CO3	3	3	1	2	-	-	1	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-
CO5	3	3	2	2	2	3	2	1	2	1
CO6	1	2	2	2	1	3	3	2	3	2


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Semester II

Course name: **Thermal Physics Practicals**

Course Code: **PH 223P**

HPW: 3

CREDITS: 1

Course Objectives: *This course is designed to -*

1. *enhance ability to determine thermal conductivity, specific heat heating efficiency.*
2. *analyze discrepancy in practical and experimental observations and results in comparison to theory*

Experiments:

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. Stefan's Constant using spot deflection Galvanometer
9. Specific heat capacity of solids
10. Cooling curve of a metallic body
11. Simulations for T-S diagram
12. Thermal expansion of solids

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

PH223P.CO1: *acquire skill to determine thermal conductivity, specific heat heating efficiency.*

PH223P.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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