

**COURSE OUTCOME**  
**Department of Physics**  
**B.Sc. I year(Minor/open elective)**  
**Paper II: Mechanics and General Properties of Matter**

**Unit-1 : Historical Background and Mathematical Physics**

- To understand a brief historical background of mathematics and mechanics in the context of India and Indian culture.
- A brief biography of Varahamihira and Vikram Sarabhai with their major contribution to science and society
- To understand Scalar and vector fields
- To understand Gradient of a scalar field and its physical significance.
- To learn Vector integral line integral, surface integral and volume integral,
- To discuss Divergence of a vector field and its physical significance and Gauss divergence theorem.
- To understand Curl of a vector field and its physical significance,
- To learn Stokes and Green's theorem.

**Unit-2 Mechanics of rigid and Deformable bodies**

**Rigid body Mechanics**

- To understand System of particles and concept of Rigid body, Torque, Centre of mass : position of the centre of mass, Motion of the centre of mass, Conservation of linear and angular momentum with examples, Single stage and multistage rocket.
- To study Rotatory motion and concept of moment of inertia, Theorems on moment of inertia : theorem of addition, theorem of perpendicular axis, theorem of parallel axis, Calculation of moment of inertia of rectangular lamina, disc, solid cylinder, solid sphere

**Mechanics of Deformable Bodies**

- To study Hook's law, Young's modulus, Bulk modulus, Modulus of rigidity and Poisson's ratio, Relationship between various elastic moduli.
- To understand possible values of Poisson's ratio
- Finding Poisson's ratio of rubber in the laboratory, Torsion of a cylinder, Strain energy of twisted cylinder.
- Finding the modulus of rigidity of the material of a wire by Barton's method Torsional pendulum and Maxwell's needle, Searle's method to find  $Y$ ,  $\eta$  and  $\sigma$  of the material of a wire, Bending of beam, Cantilever, Beam supported at its ends and loaded in the middle.

**Unit-3 : Fluid Mechanics**

**Surface Tension**

- To study intermolecular forces and potential energy curve, force of cohesion and adhesion.
- Understanding of explanation of surface tension on the basis of intermolecular forces, surface energy.
- To learn effect of temperature and impurities on surface tension.
- To study daily life applications of surface tension.

- To study angle of contact and the pressure difference between the 2 sides of a curved liquid surface.
- To study excess pressure inside a soap bubble.
- To determine surface tension of a liquid capillary rise method Jaegers method.

### **Viscosity**

- To study ideal and viscous fluid streamline and turbulent flow, equation of continuity.
- To study rotational and is rotational flow, Energy of flowing fluid, Euler's equation of motion of a non viscous fluid and its physical significance.
- To understand bernoulli's theorem and its applications
- How to study viscous flow of a fluid, flow of liquid through a capillary tube poiseuille's formula, Stokes formula.

## **Unit-4 : Gravitational Potential and Central Forces**

### **Gravitational potential**

- To study conservative and non conservative force field, Conservation of energy in motion under the conservative and non conservative forces and potential energy of energy in motion.
- To understand gravitational potential and gravitational potential energy.
- To determine gravitational potential and intensity of gravitational field due to uniform spherical shell and a uniform solid sphere.
- To determine Gravitational self energy.

### **Central forces**

- To study motion under central forces.
- To study conservative characteristics of central forces the motion of a two particle system in central force.
- To understand concept of reduced mass, motion of particles in an inverse square central force motion of celestial bodies.
- To study kepler's laws, elastic and inelastic scattering.

## **Unit-5 : Relativistic Mechanics and Astrophysics**

### **Relativistic Mechanics**

- To understand frame of reference, Galilean transformation Michelson-Morley experiment.
- To study postulates of special theory of relativity. Lorentz transformation, simultaneity and order of events.
- Understanding of length contraction, time dilation, relativistic transformation of velocities variation of mass with velocities.
- Finding Mass-energy equivalence and its experimental verification.

### **Astrophysics**

- To introduce universe, properties of Sun and concept of Astronomical distance.
- To study life cycle of star, Chandrasekhar limit, H-R diagram, Red giant star, White dwarf star, Neutron star and black hole.
- To study Big Bang theory.

**COURSE OUTCOME**  
**Department of Physics**  
**B.Sc. I year (Major)**  
**Paper I: Thermodynamics and Statistical Physics**

**Unit-1 : Historical background and Laws of Thermodynamics**

**Historical background**

- To introduce a brief historical background of thermodynamics and statistical Physics in the context of India and Indian culture, Contribution of S. N. Bose in statistical Physics.

**Laws of thermodynamics**

- To study thermodynamical system and thermodynamical coordinates.
- To understand thermal equilibrium, Zeroth law of thermodynamics, The concept of path function and point function.
- To study work **done** by and **on the** system.
- Understanding of first law of thermodynamics, Internal energy as a state function, Reversible and irreversible change, Heat engine and its efficiency, Carnot's cycle, Carnot's engine and its efficiency, Carnot's theorem, Otto engine, Otto cycle, diesel engine.
- To understand second law of thermodynamics.
- Study of Kelvin-Planck and Clapeyron, Absolute scale of temperature: Zero of absolute scale, Size of degree, Identity of a perfect gas scale and absolute scale.

**UNIT- 2: Entropy**

- To understand the concept of entropy, Clausius theorem, Entropy as a point function,
- To study change in entropy in reversible and irreversible processes.
- To study change in entropy of an ideal gas, change in entropy when two liquids at different temperatures are mixed (or two bodies at different temperatures are kept in contact).
- To understand the principle of increase of Entropy, Change in entropy of the universe in an irreversible process and disorder and heat death of universe.
- Understanding of physical significance of Entropy, Temperature-entropy (T-S) diagram and third law of thermodynamics.

**UNIT 3: Thermodynamic Potentials and Kinetic theory of Gases**

**Thermodynamic potential and its applications**

- To study thermodynamic potentials, Thermal equilibrium, Internal energy, Helmholtz free energy, Enthalpy and Gibbs free energy.
- To derive Maxwell's relations from thermodynamic potentials.
- To study Gibbs- Helmholtz equation and thermodynamic energy equation for ideal and Vander Waal gas.
- To understand TdS equation and to derive expressions for Cp-Cv and their special cases for ideal and Vander Waal gases.
- To derive of the expression  $E_s/E_t = C_p/C_v$ .
- To understand Clausius-Clapeyron latent heat equation.

- Study of temperature change in adiabatic process.
- To study principle of refrigeration, Joule-Thomson effect,
- To understand cooling by adiabatic demagnetization, Production and measurement of very low temperatures.

### **Kinetic Theory of Gases**

- To study behaviour of a real gas and its deviation from an ideal gas,
- To understand Virial equation, Andrews experiment on CO<sub>2</sub> gas.
- To find critical constant, continuity of the liquid and gaseous state, vapour and gas state.
- To study Boyle temperature, Vander Waals equation for real gas, Values of critical constants, laws of the corresponding state.

### **UNIT 4: Classical Statistics**

- To study probability distribution of N particles in two identical boxes, Probability of occurrence of either event, probability of composite events, Weightage probability.
- To understand probability distribution and its narrowing with the increase in number of particles.
- To find expression for average properties, constraints, Accessible and non-accessible microstates.
- To understand ensemble theory (Micro-canonical, Canonical and Grand-canonical), Macro and micro states with examples.
- Study of the principle of equal a priori probability, concept of phase space.
- To find Boltzmann Canonical distribution law: Application: average energy of one-dimensional harmonic oscillator.
- To Derive law of equipartition of energy from statistics, Equilibrium between two systems in thermal contact and  $\beta$  parameter.
- To find statistical interpretation of entropy and relation  $S = k \log W$ .
- To understand Boltzmann partition function and derivation of expression for internal energy, Helmholtz free energy, Enthalpy and Gibbs free energy.

### **UNIT 5: Quantum Statistics**

- To study indistinguishability of particles and its consequences, Maxwell-Boltzmann statistics (Classical statistics) : Maxwell-Boltzmann distribution law of velocity and speed, Maxwell-Boltzmann statistics and its distribution law.
- To understand Quantum statistics: Bose-Einstein statistics and distribution law.
- To Derive Planck's radiation law from B-E statistics, Rayleigh-Jeans law, Wein's displacement law and Stefan's law.
- To study Fermi-Dirac statistics and its distribution law.
- To Explain free electron theory, Fermi level and Fermi energy.
- To compare between the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics.



**Session 2021-2022**

**B.Sc. First Year**

**Paper- I (Major-I)**

**Subject Name- Algebra, Vector Analysis and Geometry**

**Subject Nature - Compulsory**

**course objective -**

To enforce the students with the Matrix and solving linear equations upto three unknowns. To provide Historical background of Indian Mathematics and Great Indian Mathematicians.

**Learning Outcome -**

At the end of the course students should be able to

- known about our Great Indian Mathematicians.
- Find the Rank of matrix, some system of equations.
- Get knowledge about scalar and vector product and capable to solve real life problems related to it

**Session 2021-2022**

**B.Sc. First Year**

**Session 2021-2022**

**B.Sc. First Year**

**Paper – II (Major II/ Minor/Open Elective)**

**Subject Name – Calculus and Differential Equations**

**Course Objective –**

To enforce the students with the successive differentiation and curvatures. To provides the foundation of Linear differential equations. So that it would to helpful to students to solve the higher degree equations. The course is also providing the basic of geometrical meaning of differential equations.

**Learning Outcome –**

At the end of the course students should be able to

- To find successive differentiation and get knowledge about curvature.
- Enhance the knowledge of integration and reduction formula.
- Learn about geometrical meaning of a differential equation.

BSc I Year  
Subject : Chemistry  
Session 2021-22  
Paper – I Fundamentals of Chemistry ( Major I)

Course learning outcomes: After the successful completion of the paper the students will learn about-

- Contribution of ancient Indian scientists in chemistry
- General idea of different properties of s and p block elements.
- Different kinds of bonding and related concepts.
- Acid base concepts
- Fundamentals of organic chemistry with reference to reactivity and stereochemistry of organic molecules.
- Basics of chemical kinetics.

BSc I Year  
Subject : Chemistry  
Session 2021-22  
Paper – II Analytical Chemistry ( Major II/Minor/Open Elective)

Course learning outcomes: After the successful completion of the paper the students will learn about-

- Basic concepts and application of mathematics in chemistry.
- Introduction and importance of analytical chemistry.
- Application of computer for a chemist.
- Basic concepts of chemical equilibrium
- Principal and application of chromatographic techniques.
- Various spectral techniques for structural elucidations.