B. Sc.
(Subsidiary/Other Disciplines)

Sl. No.	Name of the Paper	Paper Code	Credits	Periods/week
Semester I				
1	Mechanics	PHB-11S	3	3
2	Lab 1	PHB-13L	1	2
Semester II				
3	Thermal Physics	PHB-21S	3	3
4	Lab II	PHB-23L	1	2
Semester III				
5	Electricity & Magnetism	PHB-31S	3	3
6	Lab III	PHB-33L	1	2
Semester IV				
7	Quantum Mechanics	PHB-41S	3	3
8	Lab IV	PHB-43L	1	2
Semester V				
9	Optics & Spectroscopy	PHB-51S	4	4
Semester VI				
10	Solid State Physics	PHB-61S	4	4

Semester I

Subsidiary Course **Mechanics** **PHB-11S**

Unit I: Fundamentals of Dynamics

Newton's Laws of motion, dynamics of a system of particles, centre of mass, conservation of momentum, impulse, variable mass system. Work-energy theorem, potential energy, conservative and non-conservative forces, force as gradient of potential energy. Particle collisions, centre of mass and laboratory frame. Inertial frames and non-inertial frames, uniformly accelerated system,

Unit II: Rotational Dynamics

Angular momentum of a system of particles, torque and conservation of angular momentum, rotation about a fixed axis, moment of inertia tensor: its calculation for regular bodies, kinetic energy of rotation; physics in rotating coordinate system, centrifugal and Coriolis forces.

Unit III: Gravitation

Newton's law of gravitation, inertial and gravitational mass, potential energy due to spherical shell and solid sphere, angular momentum conservation Kepler's laws.

Unit IV: Special Theory of Relativity I

Michelson Morley experiment, Lorentz transformations, simultaneity and order of events, Lorentz contraction and time dilation, velocity addition theorem.

Reference Books:

1. An introduction to mechanics : Kleppner & Kolenkow.
2. Feynman Lectures-Volume I,
3. Problems in Physics : Irodov
4. Special Theory of Relativity : Resnick
5. Newtonian Mechanics : A.P.French,
6. Mechanics : Berkeley Physics Course.

Semester I

Physics Practical **Lab I** **PHB-13L**

Mechanics & Oscillation

List of Experiments :

1. To study the Motion of Spring and calculate Spring constant by static and dynamic method. (4)
2. To determine the value of g using Bar Pendulum. (4)
3. To determine the value of g using Kater's Pendulum. (4)
4. To determine the coefficient of viscosity of a liquid by Stoke's law. (3)
5. To determine the Moment of Inertia of a Flywheel. (4)

Semester II

Subsidiary Course **Thermal Physics** **PHB-21S**

Unit I: Kinetic theory of gases

Derivation of Maxwell's law of distribution of velocities and its experimental verification. Mean free path. Transport phenomena, viscosity.

Unit II: Ideal and Real gases

Equation of state for ideal gas, internal energy, specific heat, entropy, deviation from ideal gas, Andrew's experiment, Van der Waal's equation, critical constants and law of corresponding states, Joule-Thompson effect.

Unit III: Thermodynamics

Zeroth, First and Second laws. Reversible and irreversible processes. Carnot's theorem. Clausius inequality. Absolute scale of temperature. Entropy. Thermodynamic Relations and their applications.

Unit IV: Thermodynamic Functions

Maxwell's relations and their applications. Change of phase. Equilibrium between a liquid and its vapour. Clausius–Clapeyron equation. Triple point with examples from physics. Second order phase transitions.

Reference Books:

1. Treatise of heat: M. N Saha and B.N Srivastava
2. Heat and Thermodynamics: Zemansky, Richard Dittman .
3. Thermal Physics : Garg, Bansal and Ghosh .
4. Thermodynamics, Kinetic Theory and Statistical Thermodynamics: Sears &Salinger.

Semester II

Physics Practical **Lab II** **PHB-23L**

Electronics (Analog) & Thermal Physics

List of Experiments :

1. To study V-I characteristics of PN junction diode. (4)
2. To study the V-I characteristics of a Zener diode and its use as voltage regulator. (4)
3. To study growth and decay of charge on a condenser in RC circuit. (4)
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee's disc method. (2)
5. To determine the frequency of the mains with Melde's experiment.(3)

Semester III

Subsidiary Course **Electricity & Magnetism** **PHB-31S**

Unit I: Vector Calculus

Scalars and vectors, dot and cross products. Gradient of a scalar field, divergence and curl of vector field. Line, surface and volume integrals involving vector fields. Gauss' , Green's and Stokes' theorems.

Unit II: Electrostatics

Coulomb's law, Calculation of electric field for simple distributions of charges. Electrostatic potential, Gauss' law and its applications. Capacitors, electrostatic field energy. Method of images. Poisson and Laplace's equations.

Unit III: Magnetostatics

Magnetic induction B. Lorentz force, Biot-Savart law. Ampere's law. Fields due to a straight wire and a circular current loop. Magnetic dipole. Circular current and solenoid.

Unit IV: Faraday's law

Electromagnetic induction: Integral and differential forms. Induced electric field and emf. Mutual and self-inductance. Transformers. Magnetic field energy.

Reference Books:

1. Introduction to Electrodynamics : D.J. Griffiths
2. Electricity and Magnetism : A.S. Mahajan and A.A. Rangwala
3. Electricity and Magnetism : Berkeley Physics Course ed. E.M. Purcell
4. Physics (Vol. 2) : Halliday and Resnick
5. Feynman Lectures in Physics (Vol II)

Semester III

Physics Practical **Lab III** **PHB-33L**

Optics

List of Experiments :

1. Determination of wavelength of sodium light by Newton's Rings method. (4)
2. Determination of specific rotation of sugar solution by Laurent's Half-Shade Polarimeter.(4)
3. Determination of refractive Index and dispersive power of a prism using spectrometer. (2)
4. Determination of wavelength of LASER using plane transmission diffraction grating. (2)
5. To determine wavelength of Na source using plane diffraction grating. (3)

Semester IV

Subsidiary Course **Quantum Mechanics** **PHB-41S**

Unit 1: Review of the old quantum theory

De Broglie hypothesis and the wave-particle duality. Davisson Germer experiment. Wave function and Born's interpretation. Fourier Transform. Particles and Wave packets. Phase and Group velocity. Uncertainty Principle. Application of uncertainty Principle

Unit II: The Schrodinger equation

Schrodinger Equation. Conservation of Probability. Probability current density. Expectation values. Ehrenfest theorem. Time independent Schrodinger equation. Stationary States. Eigen function and eigenvalues.

Unit III: One dimensional problems

Particle in potential well - infinite square well and finite square wells. Potential barrier problems - step potential and rectangular potential. The harmonic oscillator problem.

Unit IV: The three-dimensional problem

Spherically symmetric potential. Angular momentum operator and its eigenvalues. Commutation Relations. Spin of the electron. Hydrogen atom and the degeneracy of energy levels.

Reference

1. Concepts in Modern Physics: Beiser
2. Quantum Mechanics: Zettili
3. Quantum Mechanics: Griffiths
4. A text book on Quantum Mechanics : M.C.Jain

Semester IV

Physics Practical **Lab IV** **PHB-43L**

Electricity & Magnetism

List of Experiments:

1. Determination of E.C.E. of copper using a Copper Voltameter and checking the accuracy of ammeter. (2)
2. Determination of Self Inductance of a coil using Anderson's Bridge. (3)
3. Conversion of a moving coil galvanometer into an ammeter and voltmeter. (3)
4. Study of LCR circuit and determination of impedence. (3)
5. Study of the Wien bridge oscillator and determine the frequency of the oscillator. (2)

Semester V

Subsidiary Course **Optics & Atomic Physics** **PHB-51S**

Unit I: Interference :

Coherent sources, Young's Double slit experiment, Division of wave front. Fresnel's bi-prism. Division of amplitude. Interference in thin films. Newton's rings. Michelson's interferometer.

Unit II: Diffraction :

Fraunhofer diffraction at single, double and N slits. Fresnel diffraction at a straight edge and circular aperture. Cornu-spiral. Half-period zones. Zone plate. Diffraction grating.

Unit III: Polarization :

Plane, circular and elliptical polarization of light. Double refraction. Nicol prisms. Wave plates. Optical activity.

Unit IV: Atomic Physics:

Pauli's Exclusion Principle; Symmetric & Antisymmetric Wave Functions; Fine structure; Spin-orbit coupling; Vector model; L-S and J-J couplings. Hund's Rule. Term symbols. Spectra of Hydrogen and Alkali Atoms. Spin angular momentum; Larmors Theorem; Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman effect; Normal and Anomalous Zeeman Effect; Paschen Beck effect; Stark effect (Qualitative Discussion only).

Reference Books:

1. Optics : A. K.Ghatak
2. Fundamentals of Optics : Jenkins and White
3. Molecular Spectroscopy : C.N. Banwell.
4. Physics of Atoms and Molecules :Bransden and Joachein

Semester VI

Subsidiary Course **Solid State Physics** **PHB-61S**

Unit I: Crystal Structure Defects

Crystalline state of solids, Lattice Translation Vector, Unit cell, Wigner- Seitz cell, Number of lattice point per unit cell, packing fraction, Bravais lattice, Miller indices, Interplaner spacing, Symmetry elements, types of lattices Brillouin zone, reciprocal lattice. Point defects-Frenkel and Schottky vacancies, Line defects-Edge and screw dislocations, Planer defects, Stacking faults

Unit II: X-rays and Atomic Bonding

X-Rays: Continuous and characteristic X-rays spectra, Absorption of X-rays, Diffraction of X-rays, Bragg's law, Laue's equations, Powder method. Atomic Bonding: Interatomic forces and classification of solids, Bond dissociation Energy, Cohesive Energy of ionic crystal, Types of Bonds; Ionic bond, Covalent bond, Metallic Bonding, Van der Waals Bonding

Unit III: Elementary Lattice Dynamics

Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic molecules chains, Acoustical and Optical Phonons, Qualitative Description of the Phonon spectrum in solids, Dulong and Petit law, Einstein and Debye theories of specific heat of solids, Debye T3 law.

Unit IV: Electrical Conductivity

Free electron theory, Sommerfeld model, Fermi level, Density of states, Electrical conductivity of metals and its temperature dependence, Weidemann-Franz law, Hall Effect.

Reference Books:

1. Introduction to Solid State Physics : Charles Kittle
2. Solid state physics : Rita John
3. Introduction to Solids : Azaroff L. V
4. Solid State Physics : N.W. Ashcroft and N.D. Mermin
5. Solid-state Physics : H. Ibach and H. Luth
6. Elements of Solid State Physics : J.P. Srivastava.