PHYSICS

Course Structure

Unit	Topics	Marks
I	**Physical World and Measurement**	**23**
1	Physical World	
2	Units and Measurements	
II	**Kinematics**	
3	Motion in a Straight Line	
4	Motion in a Plane	
III	**Laws of Motion**	
5	Laws of Motion	
IV	**Work, Energy and Power**	17
6	Work, Energy and Power	
V	**Motion of System of Particles**	
7	System of Particles and Rotational Motion	
VI	**Gravitation**	
8	Gravitation	
VII	**Properties of Bulk Matter**	20
9	Mechanical Properties of Solids	
10	Mechanical Properties of Fluids	
11	Thermal Properties of Matter	
VIII	**Thermodynamics**	
12	Thermodynamics	
IX	**Kinetic Theory Gases**	
13	Kinetic Theory	
X	**Oscillation and Waves**	10

14	Oscillations	
15	Waves	
	Practical	30
Total		**100**

Course Syllabus

Unit I: Physical World and Measurement

Chapter 1: Physical World

- Physics - scope and excitement
- Nature of physical laws
- Physics, technology and society

Chapter 2: Units and Measurements

- Need for measurement
- Units of measurement
- Systems of units:
    - SI units
    - Fundamental and derived units
- Length, mass and time measurements
- Accuracy and precision of measuring instruments
- Errors in measurement
- Significant figures
- Dimensions of physical quantities
- Dimensional analysis and its applications

Unit II: Kinematics

Chapter 3: Motion in a Straight Line

- Frame of reference
- Motion in a straight line
- Position-time graph
- Speed and velocity
- Elementary concepts of differentiation and integration for describing motion
- Uniform and non-uniform motion
- Average speed and instantaneous velocity
- Uniformly accelerated motion
- Velocity time
- Position-time graphs
- Relations for uniformly accelerated motion (graphical treatment)

Chapter 4: Motion in a Plane

- Scalar and vector quantities
- Position and displacement vectors
- general vectors and their notations
- equality of vectors, multiplication of vectors by a real number
- addition and subtraction of vectors
- Relative velocity
- Unit vector
- Resolution of a vector in a plane - rectangular components
- Scalar and Vector product of vectors
- Motion in a plane
- Cases of uniform velocity and uniform acceleration-projectile motion
- Uniform circular motion

Unit III: Laws of Motion

Chapter 5: Laws of Motion

- Intuitive concept of force
- Inertia
- Newton's first law of motion
- momentum and Newton's second law of motion
- impulse; Newton's third law of motion
- Law of conservation of linear momentum and its applications
- Equilibrium of concurrent forces
- Static and kinetic friction
- laws of friction
- rolling friction
- lubrication
- Dynamics of uniform circular motion:
    - Centripetal force, examples of circular motion (vehicle on a level circular road, vehicle on banked road)

Unit IV: Work, Energy and Power

Chapter–6: Work, Energy and Power

- Work done by a constant force and a variable force
- Kinetic energy
- Work-energy theorem
- Power
- Notion of potential energy
- Potential energy of a spring
- Conservative forces
- Conservation of mechanical energy (kinetic and potential energies)
- Non-conservative forces
- Motion in a vertical circle

- Elastic and inelastic collisions in one and two dimensions

Unit V: Motion of System of Particles and Rigid Body

Chapter 7: System of Particles and Rotational Motion

- Centre of mass of a two-particle system
- momentum conservation and centre of mass motion
- Centre of mass of a rigid body
- Centre of mass of a uniform rod
- Moment of a force
- Torque
- angular momentum
- laws of conservation of angular momentum and its applications
- Equilibrium of rigid bodies
- rigid body rotation and equations of rotational motion
- comparison of linear and rotational motions
- Moment of inertia
- radius of gyration
- Values of moments of inertia, for simple geometrical objects (no derivation)
- Statement of parallel and perpendicular axes theorems and their applications

Unit VI: Gravitation

Chapter 8: Gravitation

- Keplar's laws of planetary motion
- The universal law of gravitation
- Acceleration due to gravity and its variation with altitude and depth
- Gravitational potential energy and gravitational potential
- Escape velocity
- Orbital velocity of a satellite

- Geo-stationary satellites

Unit VII: Properties of Bulk Matter

Chapter–9: Mechanical Properties of Solids

- Elastic behavior
- Stress-strain relationship
- Hooke's law
- Young's modulus
- Bulk modulus
- Shear modulus of rigidity
- Poisson's ratio
- Elastic energy

Chapter–10: Mechanical Properties of Fluids

Pressure due to a fluid column

- Pascal's law and its applications (hydraulic lift and hydraulic brakes)
- Effect of gravity on fluid pressure
- Viscosity
- Stokes' law
- terminal velocity
- streamline and turbulent flow
- critical velocity
- Bernoulli's theorem and its applications
- Surface energy and surface tension
- angle of contact
- excess of pressure across a curved surface
- application of surface tension ideas to drops
- bubbles and capillary rise

Chapter–11: Thermal Properties of Matter

- Heat, temperature, thermal expansion
- Thermal expansion of:
  - Solids
  - Liquids
  - Gases
- Anomalous expansion of water
- Specific heat capacity
- Cp, Cv – calorimetry
- Change of state
- Latent heat capacity
- Heat transfer:
  - Conduction
  - Convection
  - radiation
- Thermal conductivity
- Qualitative ideas of Blackbody radiation
- Wein's displacement Law
- Stefan's law
- Greenhouse effect

Unit VIII: Thermodynamics

Chapter 12: Thermodynamics

- Thermal equilibrium and definition of temperature
  - Zeroth law of thermodynamics
- Heat, work and internal energy
- First law of thermodynamics
- Isothermal and adiabatic processes
- Second law of thermodynamics:

- Reversible and irreversible processes

- Heat engine and refrigerator

Unit IX: Behaviour of Perfect Gases and Kinetic Theory of Gases

Chapter–13: Kinetic Theory

- Equation of state of a perfect gas
- Work done in compressing a gas
- Kinetic theory of gases:
  - Assumptions
  - Concept of pressure
- Kinetic interpretation of temperature:
  - rms speed of gas molecules
  - Degrees of freedom
  - Law of equi-partition of energy (statement only) and application to specific heat capacities of gases
  - Concept of mean free path
  - Avogadro's number

Unit X: Oscillations and Waves

Chapter 14: Oscillations

- Periodic motion - time period, frequency, displacement as a function of time
- Periodic functions
- Simple harmonic motion (S.H.M) and its equation
- Phase
- Oscillations of a spring-restoring force and force constant
- Energy in S.H.M. Kinetic and potential energies
- Simple pendulum derivation of expression for its time period
- Free, forced and damped oscillations (qualitative ideas only), resonance

Chapter–15: Waves

- Wave motion
- Transverse and longitudinal waves
- speed of wave motion
- Displacement relation for a progressive wave
- Principle of superposition of waves
- reflection of waves
- standing waves in strings and organ pipes
- fundamental mode and harmonics
- Beats
- Doppler effect

PRACTICALS

The record that submitted by the students, at the time of their annual examination, has to include:

- Record of at least 15 Experiments (with a minimum of 8 from section A and 7 from section B), to be performed by the students
- Record of at least 5 Activities (with a minimum of 2 each from section A and section B), to be performed by the students
- Report of the project to be carried out by the students