

## COURSE STRUCTURE

### Class XI (Theory)

**One Paper**

**Three Hours**

**Max Marks: 70**

| Class XI     |  | Weightage |
|--------------|--|-----------|
| Unit I       | Physical World & Measurement                       | 03        |
| Unit II      | Kinematics   | 10        |
| Unit III     | Laws of Motion                                     | 10        |
| Unit IV      | Work, Energy & Power                               | 06        |
| Unit V       | Motion of System of particles & Rigid Body         | 06        |
| Unit VI      | Gravitation  | 05        |
| Unit VII     | Properties of Bulk Matter                          | 10        |
| Unit VIII    | Thermodynamics                                     | 05        |
| Unit XI      | Behaviour of Perfect Gas & Kinetic Theory of gases | 05        |
| Unit X       | Oscillations & Waves                               | 10        |
| <b>Total</b> |  | <b>70</b> |

### **Unit I: Physical World and Measurement**

**(periods 10)**

Physics - scope and excitement; nature of physical laws; Physics, technology and society.

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; significant figures.

Dimensions of physical quantities, dimensional analysis and its applications.

### **Unit II: Kinematics**

**(Periods 30)**

Frame of reference. Motion in a straight line: Position-time graph, speed and velocity.

Uniform and non-uniform motion, speed and velocity - average and instantaneous

Uniformly accelerated motion, velocity-time graph and position-time graph, equations for uniformly accelerated motion (graphical treatment only).

Simple introduction to elementary concepts of differentiation and integration for describing motion.

Scalar and vector quantities: vectors, notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Position and displacement vectors, relative velocity.

Unit vector; Resolution of a vector in a plane - rectangular components. Motion in a plane. Projectile motion, circular motion.

### **Unit III: Laws of Motion**

**(Periods 16)**

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.

Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on level circular road, vehicle on banked road).

### **Unit IV: Work, Energy and Power**

**(Periods 16)**

Scalar product of vectors. Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power.

Potential energy, potential energy of a spring, conservative forces: conservation of mechanical energy (kinetic and potential energies); non-conservative forces: elastic collisions and elementary idea of inelastic collisions.

### **Unit V: Motion of System of Particles and Rigid Body**

**(Periods 18)**

Centre of mass of a two-particle system, Centre of mass of rigid bodies. Momentum conservation and motion centre of mass.

Vector product of vectors; moment of a force, torque, angular momentum, conservation of angular momentum with some examples.

Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions;

Moment of inertia, radius of gyration. Moments of inertia for simple geometrical objects (no derivation). Only statement of parallel and perpendicular axes theorems and their applications.

### **Unit VI: Gravitation**

**(Periods 14)**

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; gravitational potential. Escape velocity. Orbital velocity of a satellite. Geo-stationary satellites.

### **Unit VII: Properties of Bulk Matter**

**(Periods 28)**

Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity.

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, Reynold's number, streamline and turbulent flow. Bernoulli's theorem and its applications.

Surface energy and surface tension, angle of contact, application of surface tension to drops, bubbles and capillary action.

Heat, temperature, thermal expansion; specific heat capacity - calorimetry; change of state - latent heat.

Heat transfer-conduction, convection and radiation, thermal conductivity, Newton's law of cooling.

### **Unit VIII: Thermodynamics (Periods 12)**

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics). Heat, work and internal energy. First law of thermodynamics.

Second law of thermodynamics: reversible and irreversible processes. Heat engines and refrigerators.

### **Unit IX: Kinetic Theory of Gases (Periods 8)**

Equation of state of a perfect gas, work done on compressing a gas.

Kinetic theory of gases - assumptions, concept of pressure. Kinetic energy and temperature; rms speed of gas molecules; degrees of freedom, law of equipartition 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 (Periods 28)**

Periodic motion - 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 and forced (damped) oscillations (qualitative ideas only), resonance.

Wave motion. Transversal and longitudinal waves. Displacement relation for a progressive wave. Reflection of waves, principle of superposition of waves, standing waves in strings and organ pipes, fundamental mode and harmonics, Beats. Doppler effect.

### **Practicals**

**Note:** Every student will perform 10 experiments (5 from each section) and 8 activities (4 from each section) during the academic year.

Two demonstration experiments must be performed by the teacher with participation of students. The students will maintain a record of these demonstration experiments. Schools are advised to follow the guidelines for evaluation in practicals for Class XII.

### **Evaluation Scheme for Practical Examinations**

|  |          |
|--|----------|
| ● One experiment from any one section                                  | 8 marks  |
| ● Two activities (one from each section) (4+4)                         | 8 marks  |
| ● Practical record (experiments & activities)                          | 6 marks  |
| ● Record of demonstration experiment & Viva based on these experiments | 3 marks  |
| ● Viva on experiments & activities                                     | 5 marks  |
| Total  | 30 marks |

## SECTION A

### *Experiments*

1. Use of Vernier Callipers
  - (i) to measure diameter of a small spherical/cylindrical body.
  - (ii) to measure dimensions of a given regular body of known mass and hence find its density.
  - (iii) to measure internal diameter and depth of a given beaker/calorimeter and hence find its volume.
2. Use of screw gauge
  - (i) to measure diameter of a given wire and (ii) to measure thickness of a given sheet.
3. To determine radius of curvature of a given spherical surface by a spherometer.
4. To find the weight of a given body using parallelogram law of vectors.
5. Using a simple pendulum, plot L-T and L-T<sup>2</sup> graphs. To find the (a) effective length of second's pendulum using appropriate graph (b) acceleration due to gravity.
6. To study the relationship between force of limiting friction and normal reaction and to find co-efficient of friction between a block and a horizontal surface.

### *Activities*

1. To make a paper scale of given least count, e.g. 0.2cm, 0.5cm.
2. To determine mass of a given body using a metre scale by principle of moments.
3. To plot a graph for a given set of data, with proper choice of scales and error bars.
4. To measure the force of limiting friction for rolling of a roller on a horizontal plane.
5. To study the variation in range of a jet of water with angle of projection.
6. To study the conservation of energy of a ball rolling down on inclined plane (using a double inclined plane).

## SECTION B

### *Experiments*

1. To determine Young's modulus of elasticity of the material of a given wire.
2. To find the force constant of a helical spring by plotting graph between load and extension.
3. To study the variation in volume with pressure for a sample of air at constant temperature by plotting graphs between P and V, and between P and I/V.
4. To determine the surface tension of water by capillary rise method.
5. To determine the coefficient of viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body.

6. To study the relationship between the temperature of a hot body and time by plotting a cooling curve.
7. (i) To study the relation between frequency and length of a given wire under constant tension using sonometer.  
(ii) To study the relation between the length of a given wire and tension for constant frequency using sonometer.
8. To find the speed of sound in air at room temperature using a resonance tube by two-resonance positions.
9. To determine specific heat capacity of a given solid, liquid, by method of mixtures.

### Activities

1. To observe change of state and plot a cooling curve for molten wax.
2. To observe and explain the effect of heating on a bi-metallic strip.
3. To note the change in level of liquid in a container on heating and interpret the observations.
4. To study the effect of detergent on surface tension by observing capillary rise.
5. To study the factors affecting the rate of loss of heat of a liquid.
6. To study the effect of load on depression of a suitably clamped metre scale loaded (i) at its end (ii) in the middle.  
gested manstration experiments.

## SUGGESTED LIST OF DEMONSTRATION EXPERIMENTS

### CLASS XI

1. To demonstrate that a centripetal force is necessary for moving a body with a uniform speed along a circle, and that the magnitude of this force increases with increase in angular speed.
2. To demonstrate inter-conversion of potential and kinetic energy
3. To demonstrate conservation of linear momentum.
4. To demonstrate conservation of angular momentum.
5. To demonstrate the effect of angle of launch on range of a projectile.
6. To demonstrate that the moment of inertia of a rod changes with the change of position of a pair of equal weights attached to the rod.
7. To study variation of volume of a gas with its pressure at constant temperature using a doctors' syringe.
8. To demonstrate Bernoulli's theorem with simple illustrations
9. To demonstrate that heat capacities of equal masses of different materials are different.
10. To demonstrate free oscillations of different vibrating systems.
11. To demonstrate resonance with a set of coupled pendulums.
12. To demonstrate longitudinal and transverse waves.
13. To demonstrate the phenomenon of beats, due to superposition, of waves produced by two sources of sound of slightly different frequencies

14. To demonstrate resonance using an open pipe.
15. To demonstrate the direction of torque.
16. To demonstrate the law of moments.

***Recommended Textbooks.***

1. Physics Part-I, Textbook for Class XI, Published by NCERT
2. Physics Part-II, Textbook for Class XI, Published by NCERT