PHYSICS (Code No. 042)

Senior Secondary stage of school education is a stage of transition from general education to discipline-based focus on curriculum. The present updated syllabus keeps in view the rigour and depth of disciplinary approach as well as the comprehension level of learners. Due care has also been taken that the syllabus is comparable to the international standards. Salient features of the syllabus include:

- Emphasis on basic conceptual understanding of the content.
- Emphasis on use of SI units, symbols, nomenclature of physical quantities and formulations as per international standards.
- Providing logical sequencing of units of the subject matter and proper placement of concepts with their linkage for better learning.
- Reducing the curriculum load by eliminating overlapping of concepts/content within the discipline and other disciplines.
- Promotion of process-skills, problem-solving abilities and applications of Physics concepts.

Besides, the syllabus also attempts to

- strengthen the concepts developed at the secondary stage to provide firm foundation for further learning in the subject.
- expose the learners to different processes used in Physics-related industrial and technological applications.
- develop process-skills and experimental, observational, manipulative, decision making and investigatory skills in the learners.
- promote problem solving abilities and creative thinking in learners.
- develop conceptual competence in the learners and make them realize and appreciate the interface of Physics with other disciplines.

PHYSICS (Code No. 042)
COURSE STRUCTURE
Class XI (Theory) (2018-19)

Time: 3 hrs.   Max Marks: 70

		No. of Periods	Marks
Unit-I	**Physical World and Measurement**		
	Chapter–1: Physical World	10	
	Chapter–2: Units and Measurements		
Unit-II	**Kinematics**		20
	Chapter–3: Motion in a Straight Line	20	
	Chapter–4: Motion in a Plane		
Unit-III	**Laws of Motion**	14	
	Chapter–5: Laws of Motion		

Unit-IV	Work, Energy and Power	12	17
	Chapter–6: Work, Energy and Power		
Unit-V	Motion of System of Particles and Rigid Body	18	
	Chapter–7: System of Particles and Rotational Motion		
Unit-VI	Gravitation	12	
	Chapter–8: Gravitation		
Unit-VII	Properties of Bulk Matter	20	16
	Chapter–9: Mechanical Properties of Solids		
	Chapter–10: Mechanical Properties of Fluids		
	Chapter–11: Thermal Properties of Matter		
Unit-VIII	Thermodynamics	12	
	Chapter–12: Thermodynamics		
Unit-IX	Behaviour of Perfect Gases and Kinetic Theory of Gases	08	
	Chapter–13: Kinetic Theory		
Unit-X	Mechanical waves and Ray Optics	34	17
	Chapter–14: Oscillations and waves		
	Chapter–15: Ray optics		
Total		160	70

Unit I: Physical World and Measurement   10 Periods

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   20 Periods

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 and 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   14 Periods

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 a banked road).

Unit IV: Work, Energy and Power   12 Periods

Chapter-6: Work, Engery 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   18 Periods

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, law 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   12 Periods

Chapter-8: Gravitation

Kepler's laws of planetary motion, 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   20 Periods

Chapter-9: Mechanical Properties of Solids

Elastic behaviour, 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 and gases, anomalous expansion of water; specific heat capacity; Cp, Cv - calorimetry; change of state - latent heat capacity.

Heat transfer-conduction, convection and radiation, thermal conductivity, qualitative ideas of Blackbody radiation, Wein's displacement Law, Stefan's law, Green house effect.

Unit VIII: Thermodynamics   12 Periods

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   08 Periods

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: Mechanical Waves and Ray Optics   16 Periods

Chapter-14: Oscillations and Waves

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 loaded 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.

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.

Chapter-15: RAY OPTICS   **18 Periods**

Ray Optics: Reflection of light, spherical mirrors, mirror formula, refraction of light, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lensmaker's formula, magnification, power of a lens, combination of thin lenses in contact, refraction and dispersion of light through a prism.

Scattering of light - blue colour of sky and reddish apprearance of the sun at sunrise and sunset.

Optical instruments: Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

PRACTICALS   **Total Periods: 60**

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

- Record of at least 15 Experiments [with a minimum of 6 from each section], 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 demonstrated by the teachers.
- Report of the project to be carried out by the students.

EVALUATION SCHEME

Time Allowed: Three hours   **Max. Marks: 30**

Two experiments one from each section	8+8 Marks
Practical record (experiment and activities)	6 Marks
Investigatory Project	3 Marks
Viva on experiments, activities and project	5 Marks
Total	**30 Marks**

SECTION-A

Experiments

1. To measure diameter of a small spherical/cylindrical body and to measure internal diameter and depth of a given beaker/calorimeter using Vernier Callipers and hence find its volume.

2. To measure diameter of a given wire and thickness of a given sheet using screw gauge.

3. To determine volume of an irregular lamina using screw gauge.

4. To determine radius of curvature of a given spherical surface by a spherometer.

5. To determine the mass of two different objects using a beam balance.

6. To find the weight of a given body using parallelogram law of vectors.

7. Using a simple pendulum, plot its L-T^2 graph and use it to find the effective length of second's pendulum.

8. To study variation of time period of a simple pendulum of a given length by taking bobs of same size but different masses and interpret the result.

9. To study the relationship between force of limiting friction and normal reaction and to find the co-efficient of friction between a block and a horizontal surface.

10. To find the downward force, along an inclined plane, acting on a roller due to gravitational pull of the earth and study its relationship with the angle of inclination θ by plotting graph between force and sinθ.

Activities (for the purpose of demonstration only)

1. To make a paper scale of given least count, e.g., 0.2cm, 0.5 cm
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 projectile with angle of projection
6. To study the conservation of energy of a ball rolling down on an inclined plane (using a double inclined plane)
7. To study dissipation of energy of a simple pendulum by plotting a graph between square of amplitude & time

SECTION-B

Experiments

1. To determine Young's modulus of elasticity of the material of a given wire.
2. To determine the surface tension of water by capillary rise method
3. To determine the coefficient of viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body
4. To determine specific heat capacity of a given solid by method of mixtures
5. a) To study the relation between frequency and length of a given wire under constant tension using sonometer

   b) To study the relation between the length of a given wire and tension for constant frequency using sonometer.
6. To find the speed of sound in air at room temperature using a resonance tube by two resonance positions.
7. To find the value of v for different values of u in case of a concave mirror and to find the focal length.
8. To find the focal length of a convex lens by plotting graphs between u and v or between 1/u and 1/v.
9. To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation.
10. To determine refractive index of a glass slab using a travelling microscope.

Activities (for the purpose of demonstration only)

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 of water 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 at (i) its end (ii) in the middle.
7. To observe the decrease in presure with increase in velocity of a fluid.
8. To observe refraction and lateral deviation of a beam of light incident obliquely on a glass slab.
9. To study the nature and size of the image formed by a (i) convex lens, (ii) concave mirror, on a screen by using a candle and a screen (for different distances of the candle from the lens/mirror).
10. To obtain a lens combination with the specified focal length by using two lenses from the given set of lenses.

Practical Examination for Visually Impaired Students
Class XI

Note: Same Evaluation scheme and general guidelines for visually impaired students as given for Class XII may be followed.

A. Items for Identification/Familiarity of the apparatus for assessment in practicals (All experiments)

Spherical ball, Cylindrical objects, vernier calipers, beaker, calorimeter, Screw gauge, wire, Beam balance, spring balance, weight box, gram and milligram weights, forceps, Parallelogram law of vectors apparatus, pulleys and pans used in the same 'weights' used, Bob and string used in a simple pendulum, meter scale, split cork, suspension arrangement, stop clock/stop watch, Helical spring, suspension arrangement used, weights, arrangement used for measuring extension, Sonometer,

Wedges, pan and pulley used in it, 'weights' Tuning Fork, Meter scale, Beam balance, Weight box, gram and milligram weights, forceps, Resonance Tube, Tuning Fork, Meter scale, Flask/Beaker used for adding water.

B. List of Practicals

1. To measure diameter of a small spherical/cylindrical body using vernier calipers.

2. To measure the internal diameter and depth of a given beaker/calorimeter using vernier calipers and hence find its volume.

3. To measure diameter of given wire using screw gauge.

4. To measure thickness of a given sheet using screw gauge.

5. To determine the mass of a given object using a beam balance.

6. To find the weight of given body using the parallelogram law of vectors.

7. Using a simple pendulum plot L-T and L-T^2 graphs. Hence find the effective length of second's pendulum using appropriate length values.

8. To find the force constant of given helical spring by plotting a graph between load and extension.

9. (i) To study the relation between frequency and length of a given wire under constant tension using a sonometer.

    (ii) To study the relation between the length of a given wire and tension, for constant frequency, using a sonometer.

10. To find the speed of sound in air, at room temperature, using a resonance tube, by observing the two resonance positions.

Note: The above practicals may be carried out in an experiential manner rather than recording observations.

Prescribed Books:

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

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

3. Laboratory Manual of Physics, Class XI Published by NCERT

4. The list of other related books and manuals brought out by NCERT (consider multimedia also).

PHYSICS (Code No. 042)
QUESTION PAPER DESIGN
CLASS - XI (2018-19)

Time 3 Hours   **Max. Marks: 70**

S.	Typology of Questions	Very Short Answer (VSA) (1 mark)	Short Answer-I (SA-I) (2 marks)	Short Answer -II (SA-II) (3 marks)	Long Answer (LA) (5 marks)	Total Marks	% Weightage
1.	**Remembering- (Knowledge based** Simple recall questions, to know specific facts, terms, concepts, principles, or theories, identify, define, or recite information)	2	1	1	-	7	10%
2	**Understanding- (Comprehension -**to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase information)	-	2	4	1	21	30%
3	**Application -** (Use abstract - information in concrete situation, to apply knowledge to new situations, Use given content to interpret a situation, provide an example, or solve a problem)	-	2	4	1	21	30%
4	**Higher Order Thinking Skills - (Analysis & Synthesis-** Classify, compare, contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources)	2	-	1	1	10	14%
5	**Evaluation -** (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	1	2	2	-	11	16%
	TOTAL	**5x1=5**	**7x2=14**	**12x3=36**	**3x5=15**	**70(27)**	**100%**

Question Wise Break Up

Type of Question	Mark per Question	Total No. of Questions	Total Marks
VSA	1	5	05
SA-I	2	7	14
SA-II	3	12	36
LA	5	3	15
Total		**27**	**70**

1. **Internal Choice:** *There is no overall choice in the paper. However, there is an internal choice in one question of 2 marks weightage, one question of 3 marks weightage and all the three questions of 5 marks weightage.*

2. *The above template is only a sample. Suitable internal variations may be made for generating similar templates keeping the overall weightage to different form of questions and typology of questions same.*