PHYSICS (Code No. 042)
CLASS XII

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 iscomparable 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.

CLASS XII (2017-18)
(THEORY)

Time: 3 hrs. (Max Marks: 70)

	Topic	No. of Periods	Marks
Unit-I	**Electrostatics**	22	**15**
	Chapter–1: Electric Charges and Fields		
	Chapter–2: Electrostatic Potential and Capacitance		
Unit II	**Current Electricity**	20	
	Chapter–3: Current Electricity		
Unit III	**Magnetic Effects of Current and Magnetism**	22	**16**
	Chapter–4: Moving Charges and Magnetism		
	Chapter–5: Magnetism and Matter		
Unit IV	**Electromagnetic Induction and Alternating Currents**	20	
	Chapter–6: Electromagnetic Induction		
	Chapter–7: Alternating Current		
Unit V	**Electromagnetic Waves**	04	**17**
	Chapter–8: Electromagnetic Waves		
Unit VI	**Optics**	25	
	Chapter–9: Ray Optics and Optical Instruments		
	Chapter–10: Wave Optics		
Unit VII	**Dual Nature of Radiation and Matter**	08	**10**
	Chapter–11: Dual Nature of Radiation and Matter		
Unit–VIII	**Atoms and Nuclei**	14	
	Chapter–12: Atoms		
	Chapter–13: Nuclei		
Unit–IX	**Electronic Devices**	15	

	Chapter–14: Semiconductor Electronics: Materials, Devices and Simple Circuits		**12**
Unit–X	**Communication Systems**	10	
	Chapter–15: Communication Systems		
	TOTAL	**160**	**70**

Unit I: Electrostatics (22 Periods)

Chapter–1: Electric Charges and Fields

Electric Charges; Conservation of charge, Coulomb's law-force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.
Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, torque on a dipole in uniform electric fleld.
Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside).

Chapter–2: Electrostatic Potential and Capacitance

Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field.
Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor.

Unit II: Current Electricity (20 Periods)

Chapter–3: Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity, Carbon

resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance.
Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel, Kirchhoff's laws and simple applications, Wheatstone bridge, metre bridge.
Potentiometer - principle and its applications to measure potential difference and for comparing EMF of two cells; measurement of internal resistance of a cell.

Unit III: Magnetic Effects of Current and Magnetism (22 Periods)

Chapter–4: Moving Charges and Magetism

Concept of magnetic field, Oersted's experiment.
Biot - Savart law and its application to current carrying circular loop.
Ampere's law and its applications to infinitely long straight wire. Straight and toroidal solenoids (only qualitative treatment), force on a moving charge in uniform magnetic and electric fields, Cyclotron.
Force on a current-carrying conductor in a uniform magnetic field, force between two parallel current-carrying conductors-definition of ampere, torque experienced by a current loop in uniform magnetic field; moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter.

Chapter–5: Magnetism and Matter

Current loop as a magnetic dipole and its magnetic dipole moment, magnetic dipole moment of a revolving electron, magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis, torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; earth's magnetic field and magnetic elements.
Para-, dia- and ferro - magnetic substances, with examples. Electromagnets and factors affecting their strengths, permanent magnets.

Unit IV: Electromagnetic Induction and Alternating Currents (20 Periods)

Chapter–6: Electromagnetic Induction

Electromagnetic induction; Faraday's laws, induced EMF and current; Lenz's Law, Eddy

currents.
Self and mutual induction.

Chapter–7: Alternating Current

Alternating currents, peak and RMS value of alternating current/voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, power factor; wattless current.
AC generator and transformer.

Unit V: Electromagnetic waves (04 Periods)

Chapter–8: Electromagnetic Waves

Basic idea of displacement current, Electromagnetic waves, their characteristics, their Transverse nature (qualitative ideas only).
Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

Unit VI: Optics (25 Periods)

Chapter–9: Ray Optics and Optical Instruments

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, combination of a lens and a mirror, 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.

Chapter–10: Wave Optics

Wave optics: Wave front and Huygen's principle, reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygen's principle. Interference, Young's double slit experiment and expression for fringe width,

coherent sources and sustained interference of light, diffraction due to a single slit, width of central maximum, resolving power of microscope and astronomical telescope, polarisation, plane polarised light, Brewster's law, uses of plane polarised light and Polaroids.

Unit VII: Dual Nature of Radiation and Matter (08 Periods)

Chapter–11: Dual Nature of Radiation and Matter

Dual nature of radiation, Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation-particle nature of light.
Matter waves-wave nature of particles, de-Broglie relation, Davisson-Germer experiment (experimental details should be omitted; only conclusion should be explained).

Unit VIII: Atoms and Nuclei (14 Periods)

Chapter–12: Atoms

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum.

Chapter–13: Nuclei

Composition and size of nucleus, Radioactivity, alpha, beta and gamma particles/rays and their properties; radioactive decay law.
Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission, nuclear fusion.

Unit IX: Electronic Devices (15 Periods)

Chapter–14: Semiconductor Electronics: Materials, Devices and Simple Circuits

Energy bands in conductors, semiconductors and insulators (qualitative ideas only)
Semiconductor diode - I-V characteristics in forward and reverse bias, diode as a rectifier; Special purpose p-n junction diodes: LED, photodiode, solar cell and Zener diode and their characteristics, zener diode as a voltage regulator.
Junction transistor, transistor action, characteristics of a transistor and transistor as an amplifier (common emitter configuration), basic idea of analog and digital signals, Logic gates (OR, AND, NOT, NAND and NOR).

Unit X: Communication Systems (10 Periods)

Chapter–15: Communication Systems

Elements of a communication system (block diagram only); bandwidth of signals (speech, TV and digital data); bandwidth of transmission medium. Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation, satellite communication. Need for modulation, amplitude modulation.

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.
- The 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 [experiments and activities]	6 marks
Investigatory Project	3 marks
Viva on experiments, activities and project	5 marks
TOTAL	30 marks

SECTION–A

Experiments

1. To determine resistance per cm of a given wire by plotting a graph for potential difference versus current.
2. To find resistance of a given wire using metre bridge and hence determine the resistivity (specific resistance) of its material.

3. To verify the laws of combination (series) of resistances using a metre bridge.
4. To verify the laws of combination (parallel) of resistances using a metre bridge.
5. To compare the EMF of two given primary cells using potentiometer.
6. To determine the internal resistance of given primary cell using potentiometer.
7. To determine resistance of a galvanometer by half-deflection method and to find its figure of merit.
8. To convert the given galvanometer (of known resistance and figure of merit) into a voltmeter of desired range and to verify the same.
9. To convert the given galvanometer (of known resistance and figure of merit) into an ammeter of desired range and to verify the same.
10. To find the frequency of AC mains with a sonometer.

Activities

(For the purpose of demonstration only)
1. To measure the resistance and impedance of an inductor with or without iron core.
2. To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multimeter.
3. To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source.
4. To assemble the components of a given electrical circuit.
5. To study the variation in potential drop with length of a wire for a steady current.
6. To draw the diagram of a given open circuit comprising at least a battery, resistor/rheostat, key, ammeter and voltmeter. Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram.

SECTION–B

Experiments

1. To find the value of v for different values of u in case of a concave mirror and to find the focal length.
2. To find the focal length of a convex mirror, using a convex lens.
3. To find the focal length of a convex lens by plotting graphs between u and v or between $1/u$ and $1/v$.

4. To find the focal length of a concave lens, using a convex lens.
5. To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation.
6. To determine refractive index of a glass slab using a travelling microscope.
7. To find refractive index of a liquid by using convex lens and plane mirror.
8. To draw the I-V characteristic curve for a p-n junction in forward bias and reverse bias.
9. To draw the characteristic curve of a zener diode and to determine its reverse break down voltage.
10. To study the characteristic of a common - emitter *npn* or *pnp* transistor and to find out the values of current and voltage gains.

Activities

(For the purpose of demonstration only)
1. To identify a diode, an LED, a transistor, an IC, a resistor and a capacitor from a mixed collection of such items.
2. Use of multimeter to
(i) identify base of transistor,
(ii) distinguish between npn and pnp type transistors,
(iii) see the unidirectional flow of current in case of a diode and an LED, (iv) check whether a given electronic component (e.g., diode, transistor or IC) is in working order.
3. To study effect of intensity of light (by varying distance of the source) on an LDR.
4. To observe refraction and lateral deviation of a beam of light incident obliquely on a glass slab.
5. To observe polarization of light using two Polaroids.
6. To observe diffraction of light due to a thin slit.
7. 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).
8. To obtain a lens combination with the specified focal length by using two lenses from the given set of lenses.

Suggested Investigatory Projects

1. To study various factors on which the internal resistance/EMF of a cell depends.

2. To study the variations in current flowing in a circuit containing an LDR because of a variation in
(a) the power of the incandescent lamp, used to 'illuminate' the LDR (keeping all the lamps at a fixed distance).
(b) the distance of a incandescent lamp (of fixed power) used to 'illuminate' the LDR.
3. To find the refractive indices of (a) water (b) oil (transparent) using a plane mirror, an equi convex lens (made from a glass of known refractive index) and an adjustable object needle.
4. To design an appropriate logic gate combination for a given truth table.
5. To investigate the relation between the ratio of (i) output and input voltage and (ii) number of turns in the secondary coil and primary coil of a self designed transformer.
6. To investigate the dependence of the angle of deviation on the angle of incidence using a hollow prism filled one by one, with different transparent fluids.
7. To estimate the charge induced on each one of the two identical styrofoam (or pith) balls suspended in a vertical plane by making use of Coulomb's law.
8. To set up a common base transistor circuit and to study its input and output characteristic and to calculate its current gain.
9. To study the factor on which the self inductance of a coil depends by observing the effect of this coil, when put in series with a resistor/(bulb) in a circuit fed up by an A.C. source of adjustable frequency.
10. To construct a switch using a transistor and to draw the graph between the input and output voltage and mark the cut-off, saturation and active regions.
11. To study the earth's magnetic field using a tangent galvanometer.

Practical Examination for Visually Impaired Students of Classes XI and XII

Evaluation Scheme

Time Allowed: Two hours (Max. Marks: 30)

Identification/Familiarity with the apparatus	5 marks
Written test (based on given/prescribed practicals)	10 marks
Practical Record	5 marks
Viva	10 marks
TOTAL	**30 Marks**

General Guidelines

- The practical examination will be of two hour duration.
- A separate list of ten experiments is included here.
- The written examination in practicals for these students will be conducted at the time of practical examination of all other students.
- The written test will be of 30 minutes duration.
- The question paper given to the students should be legibly typed. It should contain a total of 15practical skill based very short answer type questions. A student would be required to answer any 10 questions.
- A writer may be allowed to such students as per CBSE examination rules.
- All questions included in the question papers should be related to the listed practicals. Every question should require about two minutes to be answered.
- These students are also required to maintain a practical file. A student is expected to record at least five of the listed experiments as per the specific instructions for each subject. These practicals should be duly checked and signed by the internal examiner.
- The format of writing any experiment in the practical file should include aim, apparatus required,simple theory, procedure, related practical skills, precautions etc.
- Questions may be generated jointly by the external/internal examiners and used for assessment.
- The viva questions may include questions based on basic theory/principle/concept, apparatus/materials/chemicals required, procedure, precautions, sources of error etc.

Class XII

A. Items for Identification/ familiarity with the apparatus for assessment in practicals (All experiments)

Meter scale, general shape of the voltmeter/ammeter, battery/power supply, connecting wires, standard resistances, connecting wires, voltmeter/ammeter, meter bridge, screw gauge, jockey Galvanometer, Resistance Box, standard Resistance, connecting wires, Potentiometer, jockey, Galvanometer, Lechlanche cell, Daniell cell (simple distinction between the two vis-à-vis their outer (glass and copper) containers, rheostat connecting

wires, Galvanometer, resistance box, Plug-in and tapping keys, connecting wires battery/power supply, Diode, Transistor, IC, Resistor (Wire-wound or carbon ones with two wires connected to two ends), capacitors (one or two types), Inductors, Simple electric/electronic bell, battery/power supply, Plug-in and tapping keys, Convex lens, concave lens, convex mirror, concave mirror, Core/hollow wooden cylinder, insulated wire, ferromagnetic rod, Transformer core, insulated wire.

B. List of Practicals

1. To determine the resistance per cm of a given wire by plotting a graph between voltage and current.
2. To verify the laws of combination (series/parallel combination) of resistances by ohm's law.
3. To find the resistance of a given wire using a meter bridge and hence determine the specific resistance (resistivity) of its material.
4. To compare the e.m.f of two given primary cells using a potentiometer.
5. To determine the resistance of a galvanometer by half deflection method.
6. To identify a
(i) diode, transistor and IC
(ii) resistor, capacitor and inductor, from a mixed collection of such items.
7. To understand the principle of (i) a NOT gate (ii) an OR gate (iii)an AND gate and to make their equivalent circuits using a bell and cells/battery and keys /switches.
8. To observe the difference between
(i) a convex lens and a concave lens
(ii) a convex mirror and a concave mirror and to estimate the likely difference between the power of two given convex /concave lenses.
9. To design an inductor coil and to know the effect of
(i) change in the number of turns
(ii) introduction of ferromagnetic material as its core material on the inductance of the coil.
10. To design a (i) step up (ii) step down transformer on a given core and know the relation between its input and output voltages.

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

Prescribed Books:

1. Physics, Class XI, Part -I and II, Published by NCERT.
2. Physics, Class XII, Part -I and II, Published by NCERT.
3. The list of other related books and manuals brought out by NCERT (consider multimedia also).

PHYSICS (Code No. 042)
QUESTION PAPER DESIGN
CLASS - XII (2017-18)

Time 3 Hours (Max. Marks: 70)

Typology of Questions:

1. Remembering- (Knowledge based Simple recall questions, to know specific facts, terms, concepts, principles, or theories, identify, define, or recite information)

Very Short Answer (VSA) (1 mark): 2
Short Answer-I (SA-I) (2 marks): 1
Short Answer –II (SA-II) (3 marks): 1
Value based question (4 marks): 0
Long Answer (LA) (5 marks): 0
Total Marks: 7
% Weightage: 10%

2. Understanding- (Comprehension -to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase information)

Very Short Answer (VSA) (1 mark): 0
Short Answer-I (SA-I) (2 marks): 2
Short Answer –II (SA-II) (3 marks): 4
Value based question (4 marks): 0
Long Answer (LA) (5 marks): 1
Total Marks: 21

% Weightage: 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)

Very Short Answer (VSA) (1 mark): 0
Short Answer-I (SA-I) (2 marks): 2
Short Answer –II (SA-II) (3 marks): 4
Value based question (4 marks): 0
Long Answer (LA) (5 marks): 1
Total Marks: 21
% Weightage: 30%

4. High 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)

Very Short Answer (VSA) (1 mark): 2
Short Answer-I (SA-I) (2 marks): 0
Short Answer –II (SA-II) (3 marks): 1
Value based question (4 marks): 0
Long Answer (LA) (5 marks): 1
Total Marks: 10
% Weightage: 14%

5. Evaluation - (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)

Very Short Answer (VSA) (1 mark): 1
Short Answer-I (SA-I) (2 marks): 0
Short Answer –II (SA-II) (3 marks): 2
Value based question (4 marks): 1
Long Answer (LA) (5 marks): 0
Total Marks: 11

% Weightage: 16%

Total

Very Short Answer (VSA) (1 mark): 5x1=5

Short Answer-I (SA-I) (2 marks): 5x2=10

Short Answer –II (SA-II) (3 marks): 12x3=36

Value based question (4 marks): 1x4=4

Long Answer (LA) (5 marks): 3x5=15

Total Marks: 70(26)

% Weightage: 100%

Question Wise Break Up

Type of Questions	Mark Per Questions	Total no. of Questions	Total Marks
VSA	1	5	05
SA-I	2	5	10
SA-II	3	12	36
VBQ	4	1	04
LA	5	3	15
TOTAL		**26**	**70**

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