

# PHYSICS

## SYLLABUS FOR HIGHER SECONDARY FINAL YEAR COURSE

One Paper

Time : Three Hours

Marks 70

### Unitwise Distribution of Marks and Periods :

Unit No.	Title	Marks	Periods
Unit-I	Electrostatics	08	25
Unit-II	Current Electricity	07	22
Unit-III	Magnetic Effects of Current and Magnetism	08	25
Unit-IV	Electromagnetic Induction and Alternating Currents	08	20
Unit-V	Electromagnetic Waves	03	04
Unit-VI	Optics	14	30
Unit-VII	Dual Nature of Matter and Radiation	04	08
Unit-VIII	Atoms and Nuclei	06	18
Unit-IX	Electronic Devices	07	18
Unit-X	Communication System	05	10
<b>Total</b>		<b>70</b>	<b>180</b>

### Unitwise Distribution of Course contents :

#### Unit-I : ELECTROSTATIC

Electric charges and their conservation. 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 dipole, electric field due to dipole; torque on a dipole in a uniform electric field.

Electric field lines; 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).

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 charges and of electric dipoles 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

Electric current, flow of electric charges in a metallic conductor, drift velocity and 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 applications to measure potential difference, and for comparing emf of emfs cell's; measurement of internal resistance of a cell.

### **Unit-III : MAGNETIC EFFECTS OF CURRENT AND MAGNETISM**

Concept of Magnetic field, Oersted's experiment.

Biot-Savart law and its applications to current carrying circular loop (both at centre and at axial point), finite straight conductor.

Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids.

Force on a moving charge in uniform magnetic and electric fields. Lorentz force Cyclotron.

Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors—definition of one ampere current. Torque experienced by a current loop in a Uniform magnetic field; moving coil galvanometer— its current sensitivity and voltage sensitivity and conversion to ammeter and voltmeter.

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. Magnetic Hysteresis Electromagnets and factors affecting their strengths. Permanent magnets.

### **Unit-IV : ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENTS**

Faraday's Expt, Magnetic flux, Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, Eddy currents. Self and mutual inductance.

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

AC generator and transformer.

### **Unit-V : ELECTROMAGNETIC WAVES**

Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves. Need for displacement current.

Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses.

### **Unit-VI : OPTICS (Follow NC Convention wherever necessary)**

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 the sky and reddish appearance of the sun at sunrise and sunset.

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

Wave optics : Wavefront and Huygens' principle, reflection and refraction of plane wave at a

plane surface using wavefronts. Proof of laws of reflection and refraction using Huygens' 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 microscopes and astronomical telescopes. Polarisation, plane polarised light; Brewster's law, uses of plane polarised light and Polaroids.

**Unit-VII : DUAL NATURE OF MATTER AND 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.

**Unit-VIII : ATOMS AND NUCLEI**

Alpha– particle scattering experiment; Rutherford's atomic model; Bohr model, energy levels, hydrogen spectrum.

Composition and size of a nucleus, atomic masses, isotopes, isobars; isotones. 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 and fusion.

**Unit-IX : ELECTRONIC DEVICES**

Semiconductors; semiconductor diode– I-V characteristics in forward and reverse bias, diode as a rectifier; I-V characteristics of LED, photodiode, solar cell, and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor, Logic gates (OR, AND, NOT, NAND and NOR).

**Unit-X : COMMUNICATION SYSTEM**

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. Need for modulation.

**SYLLABUS FOR PHYSICS PRACTICAL****Total Marks- 30****Section-A**

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

**Experiments :**

1. To observe the variation of potential difference (V) across a given resistor by changing the current (I) through it. Draw I-V graph and find the value of the given resistance from the graph.
2. To find the value of a given resistance by using a metre bridge.
3. Construct a potential divider with the help of a rheostat and a battery (or cell) and use it to verify, Ohm's Law.
4. To determine the internal resistance of given primary cell using potentiometer.
5. Place a bar magnet in the magnetic meridian and draw the field lines with its
  - (i) North-pole pointing towards the geographical north pointing.
  - (ii) South pole pointing towards the geographical north on one side of the magnet and to locate the position of the neutral point.

**Activities :**

1. To observe deflection of a magnetic needle placed near a conductor carrying current.
2. To measure resistance, dC voltage, dC current and check continuity of a given electric circuit using multimeter.
3. To assemble a household circuit comprising three bulbs, three on/off switches a fuse and a power source.  
or, Assemble an extension board with an indicator, a fuse, three plug points and three on/off switches.
4. To study the variation in potential drop with length of a wire for a steady current.
5. Assemble an electric circuit comprising of atleast a battery, rheostat, key, ammeter and voltmeter. Mark the components that are not connected in proper order and correct the circuit and also draw the correct circuit diagram.

**Section-B****Experiments :**

1. To find the focal length of a convex lens by plotting graphs between  $u$  and  $v$  [Taken three readings making  $u > v$  and three readings making  $u < v$ .]
2. To find the focal length of a concave lens using a convex lens.
3. To find the angle of minimum deviation for a given equilateral prism by plotting a graph between the angles of incidence ( $i$ ) and corresponding angles of deviation ( $\delta$ ). Determine the refractive index of the material of the prism. [Take angles of incidence as  $35^\circ$ ,  $40^\circ$ ,  $45^\circ$ ,  $50^\circ$ ,  $55^\circ$ ,  $60^\circ$ ]
4. Measure the angles of incidence ( $i$ ) and corresponding angles of refraction ( $r$ ) for a glass slab by pin method. Draw  $\sin i - \sin r$  graph and find the refractive index of the material of the glass slab from the graph.
5. Draw the I-V characteristics graph of a p – n junction in forward bias. Find the dc forward resistance of the diode from the graph.
6. Draw the output characteristic graphs of an n – p – n transistor in common emitter configuration. Find the value of  $\beta$  from the graphs.

**Activities :**

1. To identify resistance from resistance colour codes and to verify the values using a multimeter.
2. To identify a diode, an LED, a transistor, a resistor, a capacitor and an IC from a mixed collection of such items using a multimeter.
3. To observe refraction and lateral deviation of a beam of light incident obliquely on a glass slab.
4. To observe polarization of light using two polaroids.
5. Identify a concave and a convex mirror by observing the images formed by the mirrors.
6. To study the nature and size of the image formed by (i) convex lens (ii) concave mirror, using an optical bench.
7. Identify a concave and a convex mirror by the image formed by the mirrors.

**Suggested Investigatory Projects : (Students and teachers are free to design other project.)**

1. To investigate whether the energy of a simple pendulum is conserved.
2. To investigate changes in the velocity of a body under the action of a constant force and determine

its acceleration.

3. To compare effectiveness of different materials as insulators of heat.
4. To study various factors on which the internal resistance/emf of a cell depends.
5. To study infrared radiations emitted by different sources using photo-transistors.
6. To compare effectiveness of different materials as absorbers of sound.
7. To design an automatic traffic signal system using suitable combination of logic gates.
8. To compare the Young's modulus of elasticity of different specimens of rubber and also draw their elastic hysteresis curve.
9. To study collision of two balls in two dimensions.

**Evaluation Scheme for Practical Examination :**

* One experiment from any one section	<b>12 marks</b>
* One activity (from any one section) and one investigatory project	
Or	<b>4+4=8 marks</b>
Two activities (maximum one from each section)	
* Practical record (experiments, activities and projects)	<b>6 marks</b>
* Viva voce on activities, experiments and projects	<b><u>4 marks</u></b>
<b>Total</b>	<b>30 marks</b>

**Recommended Textbooks.**

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

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