NATIONAL

CORE

CURRICULUM

PHYSICS

In Unit I (Physical World and Measurement), the topics relating to the measurement and error analysis using Verniercallipers, screw gauge, determination of g using simple pendulum, Y by searls' method specific heat using calorimeter, focal length of mirrors and lenses, speed of sound using resonance column, verification of ohm's law using voltmeter and ammeter and specific resistance of wire using meter bridge, etc. are not explicitly included in the structure of theory course, since the students are already familiar and use them in the analysis of the practical work in the laboratories.

PHYSICS

COURSE STRUCTURE

CLASS - First year PUC -Theory

One Paper **Time: 3 Hours** **Max Marks: 80**

Unit	Titles	Weightage
I	Physical World & Measurement	03
II	Kinematics	10
III	Laws of Motion	10
IV	Work, Energy & Power	06
V	Motion of System of particles & Rigid Body	06
VI	Gravitation	05
VII	Properties of Bulk Matter	10
VIII	Thermodynamics	05
IX	Behavior of Perfect Gas & Kinetic Theory of gases	05
X	Oscillations & Waves	10
XI	Practical Oriented questions	
	Total	**80**

PHYSICS

CLASS - First year PUC – Theory

Unit I: Physical World and Measurement

Physics-scope and excitement: nature of physical laws; physics, technology and society.
Need for measurement: Units of measurement; system 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

Frame of reference (inertial and non-inertial frames). 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). Scalar and vector quantities: Position and displacement vectors, general vectors and notation, 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

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.

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

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

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 uniform rod.
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.
Values of moments of inertia for simple geometrical objects (no derivation).Statement of parallel and perpendicular axes theorems and their applications.

Unit VI: Gravitation

Keplar's laws of planetary motion.The universal law of gravitation.Acceleration due to gravity and its variation with altitude, depth and rotation of earth.
Gravitational potential energy; gravitational potential.Escape velocity.
Orbital velocity of a satellite.Geo-stationary satellites.

Unit VII: Properties of Bulk Matter

Elastic behavior, stress-strain relationship, Hooke's law, Young modulus, bulk modulus, shear, modulus of rigidity, poison's ratio; elastic energy 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.Critical velocity.Bernoulli's theorem and its applications.Surface energy and surface tension, angle of contact, excess of pressure, application of surface tension ideas to drops, bubbles and capillary rise.

Heat temperature, thermal expansion; thermal expansion of solids, liquids and gases, ideal gas laws, isothermal and adiabatic processes; anomalous expansion and its effect, specific heat capacity: Cp, Cv-calorimetry; change of state-specific latent heat capacity. Heat transfer-conduction, convection and radiation, Blackbody radiation kirchoff's Law, absorptive and emissive powers and greenhouse effect thermal conductivity, Newton's law of cooling, wein's displacement Law, stefan's law.

Unit VIII: Thermodynamics

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: Behaviour of Perfect Gas and Kinetic Theory

Equation of state of a perfect gas, work done in compressing a gas.Kinetic theory of gases-assumptions, concept of pressure. Kinetic energy and temperature: rms speed of gas molecules; degress of freedom, law of equipartition of energy (statement only) and application to specific heats of gases; concept of mean free path, Avogadro's number.

Unit X: Oscillations and Waves

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 forced, and damped oscillations (qualitative ideas only) resonance. Wave motion. Longitudinal and transverse 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.

PHYSICS – First Year
Practicals

Note: Every student will perform 15 experiments (8 from Section A& 7 from Section B). The activities mentioned are for the purpose of demonstration by the teachers only. These are not to be evaluated during the academic year. For evaluation in examination, students would be required to perform two experiments-One from each section.

SECTION A

Experiments
(Any 8 experiments out of the following to be performed by the students)

1. To measure diameter of a small spherical/cylindrical body using Vernier Callipers.
2. To measure internal diameter and depth of a given beaker/calorimeter using Vernier Callipers and hence find its volume.
3. To measure diameter of a given wire using screw gauge
4. To measure thickness of a given sheet using screw gauge
5. To measure volume of an irregular lamina using screw gauge
6. To determine radius of curvature of a given spherical surface by a spherometer.
7. To find the weight of a given body using parallelogram law of vectors.
8. Using a simple pendulum, plot L-T and L-T2 graphs. Hence find the effective length of second's pendulum using appropriate graph.
9. 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.
10. To find the downward force, along inclined plane, acting on a roller due to gravitational pull of the earth and study its relationship with the angle of inclination by plotting graph between force and sin□.

Activities (For the purpose of demonstration only)

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 angle of projection.
6. To study the conservation of energy of a ball rolling down on 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 and time.

SECTION B

Experiments

(Any 7 experiments out of the following to be performed by the students)

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 loadand extension.
3. To study the variation in volume with pressure for a sample of air at constant temperature by plotting 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 hot body and time by plotting a cooling curve.
7. To determine specific heat of a given (i) Solid (ii) liquid by method of mixtures.
8. (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.
9. To find the speed of sound in air at room temperature using a resonance tube by two-resonance positions.

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 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.

PHYSICS

Class - Second Year PUC - Theory

One Paper **Time: 3 Hours** **Max. Marks: 80 Marks**

Unit	**Titles**	**Marks**
I	Electrostatics	08
II	Current Electricity	07
III	Magnetic effect of current & Magnetism	08
IV	Electromagnetic induction and Alternating current	08
V	Electromagnetic Waves	03
VI	Optics	14
VII	Dual Nature of Matter	04
VIII	Atoms and Nuclei	06
IX	Electronic Devices	07
X	Communication Systems	05
XI	Practical Oriented Questions	10
	Total	**80**

ClASS - SECOND YEAR PUC – THEORY

Unit I: Electrostatics

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 field. Electric flux, statement of Gauss, 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 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. Van de Graaff generator.

Unit II: 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.Elementary idea of secondary cells.Kirchoffs' laws and simple applications. Wheatstone bridge, meter 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

Concept of magnetic field, Oersted's experiment.Biot-Savart law and its application to current carrying circular loop. Ampere's law its applications to infinitely long straight wire, straight and toroidal solenoids. Force on a moving charge in uniform magnetic and electric fields. Cyclotron. Force on a current-carrying in uniform magnetic 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. 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

Electromagnetic induction; Faraday's laws, induced emf and current; Lenz's Law, Eddy currents.Self and mutual induction.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, wattless current.AC generator and transformer.

Unit V: Electromagnetic waves

Need for displacement current. Electromagnetic waves and their characteristics (qualitative ideas only).Transverse nature of electromagnetic waves. Electromagnetic spectrum (radio waves, microwaves, infrared, visible ultraviolet, xrays, gamma rays) including elementary facts about their uses.

Unit VI: Optics

Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibers, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Newton's relation: Displacement method to find position of images (conjugate points) 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 the sky and reddish appearance of the sun at sunrise and sunset. Elementary idea of Raman effect. Optical instruments: Human eye, image formation and accommodation, correction of eye defects (myopia, hypermetropia, presbyopia and astigmatism) using lenses. Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

Wave optics: Wave front and Huygens principle, reflection and refraction of plane wave at a plane surface using wave fronts. 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. Polarization, plane polarized light; Brewster's law, uses of plane polarized light and polaroids.

Unit VII: Dual Nature of Matter and Radiation

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

Unit VIII: Atoms & Nuclei

Alpha-particles scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Continuous and characteristic X-rays.Composition and size of

nucleus, atomic masses, isotopes, isobars; isotones.Radio activity 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

Energy bands in solids, conductors, insulators and 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; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

Unit X: 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. Need for modulation. Production and detection of an amplitude-modulated wave.

Practicals

SECTION A

Experiments
(Any 7 experiments out of the following to be performed by the students)

1. To find resistance of a given wire using metre bridge and hence determine the specific resistance of its material.
2. To determine resistance per cm of a given wire by plotting a graph of potential difference versus current.
3. To verify the laws of combination (series/parallel) of resistances using a metre bridge.
4. To compare the emf of two given primary cells using potentiometer.
5. To determine the internal resistance of given primary cell using potentiometer.
6. To determine resistance of a galvanometer by half-deflection method and to find its figure of merit.
7. To convert the given galvanometer (of known resistance and figure of merit) into an ammeter and voltmeter of desired range and to verify the same.
8. To find the frequency of the a.c. 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 and correct the circuit and also the circuit diagram.

SECTION B

Experiments

(Any 8 experiments out of the following to be performed by the students)

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 I/u and I/v.
4. To find the focal length of a concave lens, using convex lens.
5. To determine angle of minimum deviation for a given prism by plotting 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 (i) concave mirror (ii) convex lens and plane mirror.
8. To draw the I-V characteristic curve of 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 characteristics 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 and IC, a resistor and a capacitor from 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 L.D.R.
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 (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.