B. Sc. Honours(CBCS) in Physics

Programme Specific Outcome (PSO)

By the end of the program UG in Physics, the student will be able to:

- Demonstrate in-depth knowledge in one of the foundational areas of the physical science.
- Communicate physical concepts using numerical, graphical, and symbolic representations.
- Analyse, test, and interpret technical arguments, and form independent judgments.
- Solve complex problems by identifying different concepts.
- Gather and organize relevant qualitative and quantitative information such as related problems, examples, and daily life problems.
- To improve their performance in physics competitions (like IIT-JAM, TIFR, JEST, CSIR- NET), as well as their general physical concepts if competitions are not their main goal their higher studies

Course Outcome (CO)

PHSHCC01: Mathematical Physics

Outcomes:

Calculus :-

- Students will be able to productively discuss mathematics in a group setting
- Students will be able to write detailed solutions using appropriate mathematical language
- Students will be able to identify areas in mathematics and other fields where Calculus is useful
- Students will be able to generate solutions to unfamiliar problems

Vector Calculus:

- Knowledge. The student has knowledge of central concepts in multivariable analysis, including space curves; directional derivative; gradient; multiple integrals; line and surface integrals; vector fields; divergence, curl and flux; the theorems of Green and Stokes, and the divergence theorem.
- Skills. The student is able to apply techniques from multivariable analysis to set up and solve mathematical models, to deduce simple mathematical results, and to calculate integrals. The student is able to set up and solve simple optimization problems, including problems with constraints.

Orthogonal Curvilinear Coordinates:

- Student will be able to write detailed solution using Orthogonal Curvilinear Coordinates.
- Student will be able to identify Divargence of gradient .
- Student will be able other identify Curl and laplaciancartesian.

Probability:

- Student will be able to identify of random variables
- Student will be able to write details probability of distribution

function .

- Student will be able learning to recognize binomial, Gaussian and poisson function

DiracDelta Function:

- Student will be able to definition of indentify DiracDelta function.
- Student will be able to DiracDelta function as action as a localization operator but are not able to employ theDelta function in mathematically formal way .
- Student view 2 dimensional and 3 dimensional problems as independent concept rather then one being a special case of other to able to student.

PHSHCC-02:
Mechanics
Outcomes:
Fundamentals of Dynamics

- Students will know about Reference frames. Inertial frames; Newton's Laws of Motion.
- Students will learn about Galilean transformations; Galilean invariance.
- Students will learn about Momentum of variable- mass system: motion of rocket.
- Students will able to calculate Motion of a projectile in Uniform gravitational field .
- Students will learn about Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum and able to solve problem related to this.

Work and Energy

- Students will learn about Work and Kinetic Energy Theorem.
- Students will learn about Conservative and non- conservative forces. Potential Energy.
- Students will be able to find Stable and unstable equilibrium condition.
- Students will able to calculate Elastic potential energy, Force as gradient of potential energy.
- Students will learn about Work & Potential energy. Work done by non conservative forces. Law of conservation of Energy.

Collisions

- Students will learn about Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames

Rotational Dynamics

- Students will learn about Angular momentum of a particle and system of particles.
- Students will able to calculate Torque.
- Students will learn about Principle of conservation of angular momentum.
- Students will learn about Rotation about a fixed axis. Moment of Inertia.
- Students will able to Calculate the moment of inertia for rectangular, cylindrical and spherical bodies.
- Students will learn about Kinetic energy of rotation. Motion involving both translation and rotation

Elasticity

- Students will learn about Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

Fluid Motion

- Students will learn about Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary

Gravitation and Central Force Motion

- Students will learn aboutLaw of gravitation. Gravitational potential energy.
- Students will be able to solve problems related to gravitation

Oscillations

- Students will learn about Simple Harmonic Oscillations. Differential equation of SHM and its solution.
- Students will be able to calculate Kinetic energy, potential energy, total energy and their time-average values.
- Students will learn about Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality FactorLaw of gravitation.

Non-Inertial Systems

- Students will learn aboutNon-inertial frames and fictitious forces.
- Students will learn about Uniformly rotating frame. Laws of Physics in rotating coordinate systems.
- Students will able to solve problems related to relativity .

PHSHCC03:Electricity AndMagnetism

Outcomes:

- Students will know aboutElectric Field and Electric Potential and able to solve problems related to this
- Students will know aboutDielectric Properties of Matter.
- Students will learn aboutMagnetic Properties of Matter
- Students will learn aboutThevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem
- Student will able to solve problems related to magnetism.

PHSHCC04 - Waves and Optics

Outcomes:

- Students will learn about concept What is the superposition of Collinear Harmonic oscillations and also the Superposition Principle. What will be its outcomes in two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats).
- They will learn about Graphical and Analytical Methods in Lissajous Figures with equal and unequal frequency and their uses and by these Lissajous Figures they can solve various numerical problems.
- Students can learn about the Plane and Spherical Waves and also learn what will be Longitudinal, Transverse Waves and Plane Progressive (Travelling) Waves.
- Students can find out the differential Equation of plane Progressive (Travelling) Waves.
- They can find out the Particle and Wave Velocities by this Differential Equation.
- Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves.

PHSHCC05:Mathematical physics

Outcomes:

Fourier Series:-

- Student will be able to understand and concept Periodic Function.
- Student can calculate the sine and cosine function.
- Student can related about dirichelet condition.

- Student caneastiamte even and odd function and their fourier expansion.
- Student will able to tern by tern differentiation and integration of fourierseries .

Special Function:-

- Student will be able to singular point of scendoder linear differential
- equation.
- Student can understand legndre, besscl, hermite and lagregian differential equation.
- Student can able to orthogoanlity, generating function and rodrigues formula.
- Student can explain Bessel function (J0(x) and (J1(x) and orthogonality.

Special Integrals :-

- Student can able to beta and Gamma function and relation between them.
- Student can estimate expressions of integral in terms of Gamma function.
- Student can calculate of error function of probability integral.

VariationalClaculus :-

- Student can understand basic idea of functional.
- Student will obtain basic principle of mechanics.
- Student will be able to canonical equation of motion and legendre transformation.

Partial Differential Equation :-

- Student can calculate partial differential equation using separation of variables.
- Student will be able to understand laplace'sequation in problems of rectangular, cylindrical and spherical symmetry.
- Student will be able to understand diffusion equation.

PHSHCC06: Thermal physics

Outcomes:

- Students will know aboutFirst Law of Thermodynamics and 2nd law of thermodynamics and able to solve problems based on this.
- Students will know about the Concept of Entropy.
- Students will learn about Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy.
- Students will learn aboutMaxwell-Boltzmann Law of Distribution and able to calculate problems based on this.

- Student will learn about Behaviour of Real Gases and Deviations from the Ideal Gas Equation.

PHSHCC07: Digital Systems and Applications

Outcomes:

- Students will know about Integrated Circuits and different type of gates.
- Students will know about De Morgan's Theorems. Boolean Laws and Simplification of Logic Circuit using Boolean Algebra.
- Students will learn about Half and Full Adders. Half & Full Substractors, 4-bit binary Adder/Substractor. Sequential Circuits.
- Students will learn aboutComputer memory. Memory organization & addressing. Memory Interfacing.
- Students will learn aboutSerial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers.

PHSHCC08: Mathematical Physics III

Outcomes:

Complex Analysis:

- Student will able to derive Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions.
- Student will learn about analytic functions, Singular functions then they can calculatepoles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable.
- Student will able to derive Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.

Integrals Transforms:

- Student will learn the basic concept of Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral.
- Student can derive Inverse Fourier transform, Convolution theorem.

- Student can apply Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations.

Matrices:

- Student can add and multiply of Matrices.
- Student will learn about Null Matrices. Diagonal. Transpose of a Matrix. Symmetric and Skew-Symmetric Matrices. Hermitian and Skew-Hermitian Matrices. Singular and Non-Singular matrices. Orthogonal and Unitary Matrices. Trace of a Matrix. Inner Product
- Student can calculate Eigenvalue and Eigen function of matrices.

Mathematical Physics III Lab:

- Student can solve differential equations.
- Student can solve Dirac Delta Function.
- Student can calculate error for each data point of observations recorded in experiments done in previous semesters.
- Student can calculate least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program.

PHSHCC09: Elements of Modern Physics

Outcomes:

Planck's quantum:

- Student will be able to understand the concept of photon.
- Student will be able to explain photoelectric effect, Compton scattering.
- Student will know the concept of De Broglie wavelength and matter waves.
- Student will be able to explain Davisson-Germer experiment.

Problems with Rutherford model:

- Student will be able to understand Bohr's quantization rule and atomic stability;
- Student can calculate the energy levels for hydrogen like atoms and their spectra.
- Student can observe Instability of atoms and observation of discrete atomic spectra.

Position measurement:

- Student can understand about Gamma ray microscope thought experiment.
- Student can relate about Wave-particle duality and Heisenberg uncertainty principle.
- Student can estimate minimum energy of a confined particle using uncertainty principle and Energy-time uncertainty principle.

Two slit interference experiment:

- Student will obtain a basic concept about linear superposition principle as a consequence; Matter waves and wave amplitude.
- Student can solve Schrodinger equation for non-relativistic particle.
- Student will know the relation about Momentum and Energy operator.
- Student will obtain the basic concept stationary states; physical interpretation of wave function.
- Student can normalize any wave function.
- Student can calculate probabilities and probability current densities in one dimension of any given wave function.

One Dimensional infinitely Rigid Box:

- Student can calculate energy eigenvalues and Eigen functions, normalization constant.
- Student can understand Quantum mechanical scattering and tunneling in one dimension - across a step potential and across a rectangular potential barrier.

Size and structure of atomic nucleus and its relation with atomic weigh:

- Student can under the nature of nuclear force, NZ graph,
- Student will be able to calculate semi-empirical mass formula and binding energy.

Radioactivity:

- Student will be able to calculate Law of radioactive decay.
- Student can calculate Mean life and half-life; decay.
- Student will be able to explain decay - energy released, spectrum and Pauli's prediction of neutrino; -ray emission.

Fission and fusion:

- Student can calculate Mass deficit, relativity and generation of energy;
- Student will understand Fission - nature of fragments and emission of neutrons.

- Student will know about nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions.

Elements of Modern Physics Lab:

- Student can measure of Planck's constant using black body radiation and photo-detector.
- Student can determine work function of material of filament of directly heated vacuum diode.
- Student can determine the Planck's constant using LEDs of at least 4 different colors.
- Student can determine the wavelength of H-alpha emission line of Hydrogen atom. 6. To determine the ionization potential of mercury.
- Student can determine the absorption lines in the rotational spectrum of Iodine vapour.

PHSHCC10: Analog Systems and Applications

Outcomes:

- Students will know about Conductivity and Mobility, Concept of Drift velocity, PN Junction Fabrication etc.
- Students will know about the Principle and structures of (1) LEDs, (2) Photodiode and (3) Solar Cell.
- Students will learn about n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations.
- Students will learn aboutTransistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers.
- Student will learn about Op-Amps applications as (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Substractor(4)Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator.

PHSHCC11: Quantum Mechanics and Applications

Outcomes:

Schrodinger equation:

- Students will learn about concepts about Time dependent Schrodinger equation and dynamical evolution of a quantum state and also Properties Of Wave Function.

- Students will taking idea about Interpretation of Wave Function Probability and probability current densities in three dimensions.
- Students will know theConditions for Physical Acceptability of Wave Functions.
- Students will take ideas about Normalization.
- Students will know theLinearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy Operators; commutator of position and momentum operators
- Students will know about Expectation values of position and momentum.
- Students can learn about the Wave Function of a Free Particle and Time independent Schrodinger equation-Hamiltonian in stationary states and also energy eigenvalues.
- Students will know about Application to spread of Gaussian wave-packet for a free particle in one dimension; wave and Fourier transforms and also momentum space wave function;
- Students can learn about Position-momentum uncertainty principle.

General discussion of bound states in an arbitrary potential:

- Students will know about Continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential.
- Students can learn about Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius methodHermite Polynomials ground state and zero point energy and also uncertainty principle.
- Students will know Quantum theory of hydrogen-like atoms and it's Radial wave functions from Frobenius method; shapes of the probability densities for ground & first excited states
- Students can learn about Orbital angular momentum quantum numbers l and m;s,p,d,..shells.
- Students will know Atomic Electric & Magnetic Fields.
- Students can learn about Space quantization.
- Students will know Electron Spin And Spin Angular Momentum and it's Spin Magnetic Moment.
- Students can learn about the Stern-Gerlach Experiment.
- Students will know the Zeeman Effect Electron and Gyromagnetic Ratio and Bohr Magneton and also Normal and Anomalous ZeemanEffect.
- Students can learn about Paschen Back and Stark Effect

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Many electron atoms:

- Students will know Pauli's Exclusion Principle and Symmetric & Antisymmetric Wave Functions.
- Students can learn aboutFine structure and Spin Orbit coupling. Spectral Notations for Atomic Statesand also Total angular momentum.
- Students will know about Vector Model. Spin-orbit coupling in atoms - L- S and J-J couplings and Hund'sRule.

Term symbols.

- Students will know about Spectra of Hydrogen and Alkali Atoms

PHSHCC12: Solid State Physics

Outcomes:

- Students will know about Amorphous and Crystalline Materials.
- Students will know about Lattice Vibrations and Phonons.
- Students will learn about Dia-, Para-, Ferri- and Ferromagnetic Materials.
- Students will learn about Dielectric Properties of Materials.
- Students will learn about superconducting behaviour of materials.
- Students will learn about Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator.

PHSHCC13: Electromagnetic Theory

Outcomes:

- Students will learn about Maxwell's equations and Displacement Current and also Vector and Scalar Potentials.
- Students will know the Gauge Transformations and their classes (Lorentz and Coulomb Gauge.)
- Students will learn about Boundary Conditions at Interface between Different Media and Wave Equations and also Plane Waves in Dielectric Media.
- Students will know Poynting Theorem and Poynting Vectors and Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density.

EM Wave Propagation in Unbounded Media

- Students will learn about Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index

and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth.

- Students will know Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere.

EM Wave in Bounded Media

- Students will learn Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction.
- Students will know Fresnel's Formulae for perpendicular & parallel polarization cases,
- Students will learn Brewster's law. Reflection & Transmission coefficients and Total internal reflection, evanescent waves. Metallic reflection (normal Incidence).

Polarization of Electromagnetic Waves

- Students will know Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media.
- Students will learn about Symmetric Nature of Dielectric Tensor. Fresnel’s Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction.
- Students will know Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light.
- Students will learn about Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Analysis of Polarized Light
- Students will know about Rotatory Polarization: Optical Rotation. Biot’s Laws for Rotatory Polarization. Fresnel’s Theory of
- Students will learn optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel’s theory.
- Students will know about Specific rotation. Laurent’s half-shade polarimeter.

Wave guides

- Students will learn Planar optical waveguides. Planar dielectric waveguide. Condition of continuity at interface. Phase
- Students will know about shifts in total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field
- Students will learn about energy and Power transmission.

Optical Fibres

- Students will know about the Numerical Aperture. Step and Graded Indices

PHSHCC14: Statistical Mechanics

Outcomes:

Classical Statistical Mechanics :-

- Student will be able to macrostate and microstate elementary particle
- Student can understand phase space, entropy and thermodynamic probability.
- Student can obtain law of equi partition of energy.

Classical Theory Of Radiation :-

- Student can understand backbody radiation, kirchhoff's law , Stefan Boltzmann law .
- Student will be able to wien'sdisplaecement law , wien's distribution law
- Student can understand sasha's ionization formula.

Quantum Theory of radiation :-

- Student will be able backbody radiation planck's quantum postulates, planck'slaw .
- Student can estimate wien's distribution law , Rayleigh jeans law .

Bose Einstein Statistics :-

- Student will able to B.E distribution law .
- Student can explain radiation as a photon gas and thermodynamics function of photo gas.
- Student can understand bose derivation of planck's law.

Fermi Dirac Statistics :-

- student will be able to F.D distribution law .

- Student can explain thermodynamic function of a completely and strongly degenerate Fermi gas, fermi energy .
- Student can understand specific hit of metals.

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PHSHSE01: -Electrical Circuits and Network Skills
Outcomes:

- Students will know aboutBasic Electricity Principles
- Students will learn aboutSingle-phase and three-phase alternating current sources.
- Students will learn aboutLadder diagrams, Electrical Schematics, Power circuits, Control circuits.
- Students will learn aboutDC Power sources. AC/DC generators. Inductance, capacitance, and impedance.
- Student will learn about Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors.

PHSHSE02: Applied Optics
Outcomes:

Sources and Detectors:

- Students will learn fundamental idea on Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, light amplification, Characterization of laser beam, He-Ne laser, and Semiconductor lasers.

Fourier Optics:

- Students will able to understand concept of spatial frequency filtering, Fourier transforming property of a thin lens Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry.

Holography:

- Students will get a brief idea on basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram,

application of holography in microscopy, interferometry, and character recognition.

Photonics: Fibre Optics:

- Students will learn about optical fibers and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating

PHSHDS01: -CLASSICAL DYNAMICS

Outcomes:

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- Students will know aboutLagrangian and Hamiltonian mechanics.
- Students will learn aboutmotion of particle in uniform electric field, magnetic field- gyro radius and gyro frequency, motion in crossed electric and magnetic fields.
- Students will able to solve problems on Small Amplitude Oscillations.
- Students will learn aboutrelativity and know about Time – dilation, length contraction and twin paradox. Four-vectors: space-like, time-like and light-like. Four-velocity and acceleration.
- Student will learn about viscosity, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe.

PHSHDS02: Nuclear&Particle Physics

Outcomes:

General Properties of Nuclei :-

- Student will able to mss , radii, charge, density, binding energy, average energy.
- Student will obtain of binding energy versus mass number curve.
- Student can understand angular momentum parity .magnetic moment , electric moment , nuclear excites states.

Nuclear Models :-

- Student will be able to liquid drop model approach .
- Student can calculated two nucleon separation energies.
- Student can understand concept of mean field , residual intersection , concept to nuclear force .

Radioactivity Decay:-

- Student will be able to explain type of Alpha decay, Beta decay and Gamma decay.
- Student will be able to understand basics of Alpha decay process.
- Student will be able to understand energy kinematics for Beta decay .
- Student will be able to understand Gamma ray emission and kinematics , internal conversion.

Nuclear Reaction :-

- Student will know the concept of conservation law .
- Student can calculate Q value , reaction rate, reaction cross section .
- Student will be able to resonance reaction , coulomb scattering.

Intersection Of Nuclear Radiation With Matter :-

- Student will obtain a energy lose of electron.
- Student will be able to Gamma ray interaction through matter .
- Student can understand photoelectric effect, Compton scattering , pair production, neutron interaction with matter.

Detector for nuclear radiations :-

- Student will be able to mobility of particle for ionization chamber.
- Student can understand GM counter .
- Student will be able to semiconductor detectors for charge particle and photon detection , neutron detection .

Particle accelerators :-

- Student will be able to cyclotron .
- Student can understand van –de graaff generator.

Particle Physics :-

- Student can basic concept of basic features .

- Student can explain of types of particle.
- Student can obtain of conservations of laws.

PHSHDS03:
CommunicationElectronics

Outcomes:

- Students will know about Amplitude Modulation, Frequency Modulation (FM) and Phase Modulation (PM).
- Students will know about the Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Binary Phase Shift Keying (BPSK).
- Students will learn about geosynchronous satellite orbits geostationary satellite advantages of geostationary satellites.
- Students will learn aboutBasic concept of mobile communication.
- Student will learn about communication network, idea of GSM, CDMA, TDMA and FDMA technologies, simplified block diagram of mobile phone handset, 2G, 3G and 4G concepts.

PHSHDS04: Experimental Techniques

Outcomes:

- Students will know aboutTypes of errors: Gross error, systematic error, random error.
- Students will know aboutcurve fitting.
- Students will learn aboutS/N ratio and Noise figure.
- Students will learn aboutMethods of safety grounding. Energy coupling. Grounding, Electrostatic shielding.
- Students will know aboutdigital multimeter, vacuum system,Q meter.
- Students will learn about Static and dynamic characteristics of measurement Systems.
- Students will learn aboutRTD, Thermistor, Thermocouples, Semiconductor type temperature sensors, LVDT.

PHSHGE01: Elements of Modern Physics

Outcomes:

Planck's quantum:

- Student will be able to understand the concept of photon.

- Student will be able to explain photoelectric effect, Compton scattering.
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Problems with Rutherford model:

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Position measurement:

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One Dimensional infinitely Rigid Box:

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Size and structure of atomic nucleus and its relation with atomic weigh:

- Student can under the nature of nuclear force, NZ graph,
- Student will be able to calculate semi-empirical mass formula and binding energy.

Radioactivity:

- Student will be able to calculate Law of radioactive decay.
- Student can calculate Mean life and half-life; decay.
- Student will be able to explain decay - energy released, spectrum and Pauli's prediction of neutrino; -ray emission.

Fission and fusion:

- Student can calculate Mass deficit, relativity and generation of energy;
- Student will understand Fission - nature of fragments and emission of neutrons.
- Student will know about nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions.

Practical:

- Student will able to determine value of Boltzmann constant using V-I characteristic of PN diode.
- Student can determine work function of material of filament of directly heated vacuum diode.
- Student can determine value of Planck's constant using LEDs of at least 4 different colours.
- Student can determine the ionization potential of mercury.
- Student can study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo-sensor and compare with incoherent source – Na light.

PHSHGE02: Thermal Physics and Statistical Mechanics

Outcomes:

- Students will know aboutFirst Law of Thermodynamics and 2nd law of thermodynamics and able to solve problems based on this.
- Students will know aboutthe Concept of Entropy.
- Students will learn aboutThermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy.
- Students will learn aboutMaxwell-Boltzmann Law of Distribution and able to calculate problems based on this.
- Students will know aboutMaxwell-Boltzmann law , distribution of velocity , Quantum statistics - Fermi- dirac distribution law, Bose-Einstein distribution law, comparison of three statistics.
- Student will learn about Behaviour of Real Gases and Deviations from the Ideal Gas Equation.

PHSHGE03: Solid State Physics

Outcomes:

- Students will know aboutAmorphous and Crystalline Materials.
- Students will know aboutLattice Vibrations and Phonons.
- Students will learn aboutDia-, Para-, Ferri- and Ferromagnetic Materials.
- Students will learn aboutDielectric Properties of Materials.
- Students will learn about superconducting behaviour of materials.
- Students will learn aboutKronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator.

PHSHGE04: Digital and analog circuits and instrumentation

Outcomes:

- Students will know aboutIntegrated Circuits and different type of gates.
- Students will know aboutDe Morgan's Theorems. Boolean Laws and Simplification of Logic Circuit using Boolean Algebra.
- Students will learn aboutHalf and Full Adders. Half & Full Substractors, 4-bit binary Adder/Substractor. Sequential Circuits.
- Students will learn aboutComputer memory. Memory organization & addressing. Memory Interfacing.
- Students will learn aboutSerial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers.