Course Outcome & Programme Outcome for B.Sc. Physics General (CBCS)

Semester - I

Paper : CC 1A

Mechanics

CO1: Students are able to learn vector algebra, scaler and vector products, derivative of a vector and vector problem.

CO2: Students learn to solve first order and second order homogeneous differential equations with constant coefficients.

CO3:Students learn Frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass.

CO3: Students learn Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets and related problems.

CO4: Students learn Angular velocity and angular momentum. Torque. Conservation of angular momentum.

CO5: Students learn Newton's Law of Gravitation. Motion of a particle in a central force field. Kepler's Laws . Satellite in circular orbit and its applications.

CO6: Students learn Simple harmonic motion. Differential equation of SHM and its solutions.

CO7: Students learn Hooke's law, Poisson's Ratio, Rigidity modulus and moment of inertia.

CO8: Students learn Special Theory of Relativity, Length contraction, Time dilation, Relativistic addition of velocities.

PO 1: Students learn basic vector algebra and its applications in physical problems.

PO 2 : The differential equations and its applications in physical problems.

PO 3 : Students learn work energy theorem and different conservation laws and rocket motion.

PO 4 : Students learn Angular momentum and its related problems.

PO 5 : Students learn Gravitational law and its application of Kepler laws to planetary system.

PO 6 : The application of simple harmonic motion and its related problems are learnt by students.

PO 7 : Students learn elastic properties of solid and its applications.

PO 8 : The theory of relativity and its application to physics are learnt by students.

Semester II

Paper : CC IB

Electricity and Magnetism

CO 1 : Students learn Vector algebra, line, surface and volume vector integration and their applications. They learn divergence and Stokes theorem and their application.

CO 2 : Students learn electric field, potential and Gauss;s law for different conducting surface. They learn properties of conductors and its applications. They learn dielectrics and their behaviour and applications.

CO 3: Students learn Biot Savart law and its application for different problems to find magnetic fields. They learn different properties of magnetic materials like dia para and ferro magnetic materials.

CO 4 : Students learn Faraday;s laws of electromagnetic induction and their applications.

CO 5 : Students Maxwell's equations and electromagnetic wave and its propagation through space.

PO 1 : The basic knowledge in vector algebra helps to solve different problems in line surface and volume integration.

PO 2 : The knowledge of electric field and potential helps students to solve the problems in electrostatics.

PO3 : The knowledge in electricity and magnetism helps students to solve various problems in physics.

PO 4 : The knowledge of electromagnetic induction helps students to understand the working of different electrical instruments including generators.

PO 5 : The knowledge of Maxwell 's equation gives an idea to students how electromagnetic wave propagates in space and development for future communication systems.

Semester III

Paper : CC 1C

Thermal Physics and Statistical Mechanics

CO1 : Students study the Zeroth, First law of thermodynamics , concept of work and heat developed and able to solve the problems following first law.

CO2 :Students study second law of thermodynamics, reversible and irreversible process with examples, Carnot cycle, Carnot engine and its efficiency, refrigerator and its performance.

CO3: Students study entropy and entropy principle and its applications in various physical problems.

CO4 : Students study thermodynamic potentials, enthalpy, Helmholtz free energy, Gibb's free energy and phase transitions relating to physical systems.: Students study Maxwell relations and its applications, adiabatic demagnetisation and low temperature physics.

CO 5: Students study Maxwell's law of distribution of velocities, mean free path, transport phenomena and learn to solve the problems.

CO6 : Students study real gasses and behaviour of real gases, Vander Waal's equation of state, Low temperature physics and its related applications.

CO 7 : Students learn Blackbody radiation, Spectral distribution and Planck law, Wien displacement law and their applications.

CO 8 : Students learn phase space, micro canonical ensemble, Maxwell Boltzmann distribution and quatum satitistics and their applications.

Programme Outcome

PO1: Zeroth law of thermodynamics and first law of thermodynamics and applications.

PO2: Second law of thermodynamics and different processes and its applications.

PO3: Study and entropy and its principle and its applications.

PO4: Study on thermodynamic potentials, enthalpy and free energy and its applications.

PO5: Adiabatic demagnetization and third law of thermodynamics.

PO 6 : The knowledge of real gases and their behavior helps students to understand different thermo dynamical properties of real gases.

PO 7 : The knowledge of blackbody radiation and different laws helps students to solve the problems of radiation.

PO 8 : The knowledge of classical and quantum statistics helps students to understand the microscopic behavior of particles.

Semester IV

Paper : CC – 1D

Waves and Optics

CO 1 : Students learn linear superposition two simple harmonic oscillations and their behavior and acquire knowledge of Lissajous figures.

CO 2 : Students learn transverse vibration of strings, propagation of travelling wave and behavior of standing wave in strings. They learn normal modes and of a string vibration, group and phase velocity.

CO 3 : Students learn surface tension and properties of liquid surface. They learn fluid dynamics, viscosity and production of low pressure. They acquire knowledge of reverberation and building acoustics.

CO 4 : Students learn electromagnetic nature of light. They learn interference of light and its properties in optical devices like biprism and LLyod mirrors, Newton's rings.

CO 5 : Students Michelson and Fabry Perrot interferometers and their applications.

CO 6 : Students Fraunhofer and Fresnel's diffraction , zone plate and diffraction gratings and its applications to study diffraction.

CO 7 : Students learn polarization and study different kind of polarization and their applications in polaroids.

PO 1 : Study of superposition of two simple harmonic motion helps to study and determination of unknown frequency of simple harmonic motion.

PO 2 : The study of string vibrations help to acquire knowledge of different musical string instruments.

PO 3 : The knowledge of fluid dynamics helps to find the flow of fluid through a narrow tube.

PO 4 : The knowledge of sound wave propagation and study of building acoustic aware students about the criterion of a good auditorium.

PO 5 : The knowledge of propagation of electromagnetic wave in medium helps to study the properties of electromagnetic wave and optical phenomena.

PO 6 : The knowledge of interferometers helps to study the phenomena of interference in laboratory.

PO 7 : The knowledge of diffraction gratings and its accessories help students to study diffraction phenomena.

Semester – V

Paper : DSE 1 A

Elements of modern physics

CO-1 :- students learn about Planck's Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson – Germer experiment.

CO-2:- students learn about Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra.

CO-3:- students learn about gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.

CO-4:- students learn about Two slit interference experiment with photons, atoms and particles;linear super position principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non- relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension.

CO-5:- Students learn about One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

CO-6:- Students learn about Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.

CO-7:- Students learn about Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & half-life; α decay; β decay - energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission.

CO-8:- Students learn about Fission and fusion-mass deficit, relativity and generation of energy; Fission-nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium-235; Fusion and thermonuclear reactions.

PROGRAM OUTCOME

PO-1 origin of quantum theory, photoelectric and Compton effect

PO-2 Rutherford and Bohr atomic model, hydrogen spectra,

PO-3 DeBroglie hypothesis ,wave particle duality, Heisenberg uncertainty principle

PO-4 Schroedinger wave equation ,physical interpretation of wave function

PO-5 Oned dimensional infinitely rigid box, quantization of energy, tunnelling effect

PO-6 Structure of atomic nuclei, nuclear force

PO-7 Radioactivity, alpha and beta decay

PO-8 Fission, fusion and nuclear reactor.

Semester VI

Paper : DSE 1B

Quantum mechanics

CO-1:- Students learn about Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretationof Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigen functions. Position, momentum & Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle.

CO-2:- Students learn about Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to the spread of Gaussian wavepacket for a free particle in one dimension; wave packets, Fourier transforms and momentum space wave function; Position-momentum uncertainty principle.

CO-3:- Students learn about General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem- square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method.

CO-4:- Students learn about Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wavefunctions from Frobenius method; Orbital angular momentum quantum numbersl and m; s, p, d,.. shells (idea only)

CO-5:- Students learn about Atoms in Electric and Magnetic Fields:- Electron Angular Momentum. Space Quantization.Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton. Atoms in External Magnetic Fields:- Normal and Anomalous Zeeman Effect.

CO-6:- Students learn about Many electron atoms:- Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular Momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings.

Program outcome

PO-1 Time dependent Schroedinger equation, probability and probability current density, energy and momentum operators, commutation relation

PO-2 Time independent Schroedinger equation, stationary states, momentum space wave function

PO-3 Bound state problem, square well potential, linear harmonic oscillator, origin of discrete energy states

PO-4 Schroedinger equation in spherical polar coordinate, Hydrogen atom problem, angular momentum, s-p-d-f shells

PO-5 Stern -Garlach experiment, normal and anamo;ous Zeeman effect

PO-6 Many electron atom, Pauli's exclusion principle, vector atom model

PO7: Computational problem to solve the s-wave schrodinger equation and plote the corresponding wave function

PO8: Computational problem to solve thes-wave radial Schrodinger equation for an atom and find the energy of the ground state and plotting the corresponding wave functions.

PO 9Computational problem to solve thes-wave radial Schrodinger equation fora particle of mass mFor the anharmonic oscillator potential.

PO 10Computational problem to solve thes-wave radial Schrodinger equationfor the vibrations of hydrogen molecule and Find the lowest vibrational energy and corresponding wave function plotting.

SEM V

PHYSICS HONS

CC-XI

PO

PO1: Computational problem to solve the s-wave schrodinger equation and plote the corresponding wave function

PO2: Computational problem to solve thes-wave radial Schrodinger equation for an atom and find the energy of the ground state and plotting the corresponding wave functions.

PO3: Computational problem to solve thes-wave radial Schrodinger equation fora particle of mass mFor the anharmonic oscillator potential.

PO4:Computational problem to solve thes-wave radial Schrodinger equationfor the vibrations of hydrogen molecule and Find the lowest vibrational energy and corresponding wave function plotting.

SEM VI

PHYSICS HONS

CC-XIV

PO

PO1: Computational analysis of the behavior of a collection of particles in a box that satisfy Newtonian mechanics.

PO2:Computation of the partition function and study of how partition function , average energy, energy fluctuation, specific heat at constant volume depend upon the temperature.

PO3:Planck’s law for Black Body radiation and compare it with Raleigh-Jeans Law

PO4:Dulong-Petit law, Einstein distribution function, Debye distribution function plotting for high and low temp and compare.
PO5:Maxwell-Boltzmann distribution, Fermi-Dirac distribution, Bose-Einstein distribution plotting with energy at different temperatures.

SEM III

PHYSICS GEN

CO

CO1: Students learn Zeroth Law, first law, second law and third law of thermodynamics,

Various Thermodynamical Processes, Entropy, Carnot’s cycle & theorem.

CO2:Student learn Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell’s relations & its applications.

CO3:Students learn Maxwell’s law of distribution of velocities and its experimental verification, Mean free path, Transport Phenomena: , Law of equipartition of energy and its applications to specific heat of gases.

CO4: Students learnBlackbody radiation,Planck's law, Wien’s distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and its derivation
CO5:Students learn Phase space, Macro state and Micro state, Entropy and comparison of three statistics- Maxwell-Boltzmann law , Fermi-Dirac distribution law ,Bose-Einstein Distribution law