SUBJECT: PHYSICS	PO, PSO and COs
Program Outcomes	**The Program outcome for the 3-year B. Sc. Physics is the following, in which the students will:** **PO1**: Inculcate a solid understanding of core physical principle and fundamental aspects of physical phenomena in various fields such as Mechanics, Electromagnetism, Thermodynamics, Quantum Physics and Statistical methods etc. **PO2**: Develop analytical and problem-solving skills to formulate and solve complicated core subject problems using mathematical and computational physics. **PO3**: Learn Hands-on experiments and Lab set-up skills to independently run experiments and analyze the data. **PO4**: Learn data interpretation and evaluation of experimental results within the specific allowed error bars. **PO5**: Learn and develop presentation skills and debate about the learned phenomena from laboratory experiments and classroom understanding of theory. **PO6**: Develop research ability through research projects.
Program specific outcomes (PSOs)	Through this 3-year Bachelors degree in Physics program the students should be able to: **PSO1: Apply** fundamental principles of physics to solve complex problems in various domains such as mechanics, electromagnetism, and thermodynamics. **PSO2: Utilize** mathematical tools and computational techniques to model physical systems and analyze experimental data. **PSO3: Demonstrate** proficiency in conducting laboratory experiments, including the proper use of instruments and adherence to scientific methods. **PSO4: Integrate** theoretical knowledge with practical applications to develop innovative solutions and approaches in both academic and industrial contexts. **PSO5: Communicate** scientific findings effectively through written

	reports, oral presentations, and collaborative projects, adhering to academic and professional standards. **PSO6: Evaluate** emerging technologies and research trends in physics, contributing to advancements in science and engineering fields.
Course outcomes:	
DSC1: Mathematical Physics-I	**CO1: Plot** and analyse functions, understanding and identifying continuous and differentiable functions, and represent curves graphically. **CO2: Apply** approximation techniques using Taylor and binomial series for function expansion and approximation in practical problems. **CO3: Solve** first-order differential equations using integrating factors and second-order homogeneous differential equations with constant coefficients, including applications of the Wronskian and understanding the general solution. **CO4: Evaluate** initial value problems by understanding the statement and implications of the existence and uniqueness theorem. **CO5: Analyze** vector algebra concepts such as scalar and vector products, scalar triple products, and their interpretations in terms of area and volume. **CO6: Derive** and apply orthogonal curvilinear coordinates, and compute gradient, divergence, curl, and Laplacian in Cartesian, spherical, and cylindrical coordinate systems. **CO7: Understand** the Dirac delta function, including its definition, representation as limits of Gaussian and rectangular functions, and its properties. **CO8: Compute** directional and normal derivatives, and apply vector differentiation techniques to find gradients, divergences, and curls, understanding their geometric interpretations. **CO9: Evaluate** vector integrals, including line, surface, and volume integrals, and apply integral theorems such as Gauss' divergence theorem, Green's theorem, and Stokes' theorem to various problems
DSC-2 Mechanics	**CO1: Analyse** the centre of mass and its motion, and apply concepts of angular momentum and its conservation to particles and systems of

	particles, including the moment of inertia and rotational kinetic energy. **CO2: Calculate** the moment of inertia for various bodies using perpendicular and parallel axis theorems and Routh's rule, and apply Euler's equations of rigid body motion to problems involving both translation and rotation. **CO3: Understand** non-inertial reference frames and fictitious forces, including centrifugal and Coriolis forces, and apply these concepts to rotating coordinate systems. **CO4: Apply** principles of elasticity to relate elastic constants, analyze twisting torques on cylinders or wires, and determine bending moments and flexural rigidity in beams, including cantilever configurations. **CO5: Study** fluid motion and kinematics, including Poiseuille's equation for flow through capillary tubes, and analyze surface tension and viscosity effects. **CO6: Compute** gravitational potential energy, fields, and forces for spherical bodies, solve the two-body problem, and apply Kepler's laws to planetary motion, including the concepts of geosynchronous orbits and GPS systems. **CO7: Investigate** simple harmonic oscillations, including the calculation of kinetic, potential, and total energy, and analyze damped and forced oscillations, resonance, and quality factors in various oscillatory systems. **CO8: Explain** the principles of Special Theory of Relativity, including Lorentz transformations, time dilation, Lorentz contraction, and relativistic effects on velocity, energy, and momentum. **CO9: Apply** relativistic concepts to analyze phenomena such as mass-energy equivalence, relativistic Doppler effect, and transformations in energy and momentum.
DSC-3 **Electricity and Magnetism**	**CO1: Apply** Gauss's Law to calculate electric fields for various charge distributions, and understand the concepts of electric potential, potential of a dipole, and electrostatic energy of charged systems. **CO2: Analyze** magnetic fields and forces using Biot-Savart's Law and Ampere's Circuital Law, including the behavior of current loops as magnetic dipoles and the application of these concepts to devices such as

	solenoids and toroids. **CO3: Explain** the dielectric properties of materials, including polarization, susceptibility, and capacitance of capacitors with dielectric materials, as well as the magnetic properties of matter, including magnetization, susceptibility, and ferromagnetism. **CO4: Solve** AC circuit problems using Kirchhoff's laws, complex reactance, impedance, and network theorems, and analyze transient currents in RC and LR circuits, including resonance, power dissipation, and quality factors in series and parallel LCR circuits.
DSC-4 Wave and Optics	**CO1: Apply** Fermat's principle to analyze reflection and refraction at plane interfaces, use matrix formulation for geometrical optics, and understand cardinal points and planes in optical systems. **CO2: Understand** the electromagnetic nature of light and apply Huygens' principle to describe wave fronts, as well as analyze temporal and spatial coherence in wave optics. **CO3: Analyze** wave motion including plane and spherical waves, longitudinal and transverse waves, and apply superposition principles to study harmonic oscillations and Lissajous figures. **CO4: Explain** and apply principles of interference and diffraction, including the Young's double slit experiment, interference in thin films, and Fraunhofer and Fresnel diffraction patterns, as well as the resolving power of telescopes and gratings
DSC-5 Wave and Optics	**CO1: Derive** Fourier series expansions for periodic functions, apply orthogonality principles, and compute Fourier coefficients for both sine and cosine series, including complex representations and applications to non-periodic functions. **CO2: Apply** the Frobenius method to solve differential equations with singular points and analyze special functions such as Legendre and Hermite polynomials, including their generating functions, orthogonality, and applications. **CO3: Utilize** recurrence relations and series expansions for Legendre and

	Hermite polynomials, and solve problems involving associated Legendre polynomials and spherical harmonics, including applications to physical problems. **CO4: Solve** partial differential equations using separation of variables, applying techniques to Laplace's equation and the wave equation for problems with rectangular, cylindrical, and spherical symmetries, including the analysis of conducting and dielectric spheres in external electric fields.
DSC-6 Thermal Physics	**CO1: Explain** the fundamental laws of thermodynamics, including the Zeroth, First, and Second Laws, and apply these concepts to analyze reversible and irreversible processes, Carnot's theorem, and the concept of entropy in both reversible and irreversible contexts. **CO2: Apply** thermodynamic potentials such as internal energy, enthalpy, Helmholtz free energy, and Gibbs free energy to various thermodynamic problems, including phase transitions and the effect of surface films and temperature on surface tension. **CO3: Utilize** kinetic theory to analyze the distribution of velocities in gases, including Maxwell-Boltzmann distribution, mean free path, and the law of equipartition of energy, and apply this understanding to transport phenomena such as viscosity, thermal conductivity, and diffusion. **CO4: Analyze** the behavior of real gases using the Virial equation and Van der Waals equation, including deviations from ideal gas behavior, critical constants, and the Joule-Thomson effect, and apply these concepts to experimental results and real-world applications.
DSC-7 **Analog Systems and Applications**	**CO1: Analyze** the operation and characteristics of semiconductor diodes, including P-N junction formation, barrier potential, and the current flow mechanisms in forward and reverse bias conditions, as well as applications in rectifiers, Zener diodes, LEDs, photo diodes, and solar cells. **CO2: Understand** the structure and behavior of Bipolar Junction Transistors (BJTs), including n-p-n and p-n-p configurations, current

	gains, load line analysis, and biasing techniques, as well as analyze their operation in active, cut-off, and saturation regions. **CO3: Design** and evaluate transistor amplifiers, including single-stage common-emitter (CE) amplifiers using the hybrid model, and understand their classification (class A, B, C) and the concept of push-pull amplifiers. Analyze coupled amplifiers and their frequency responses. **CO4: Apply** operational amplifier (Op-Amp) concepts to design and analyze various analog circuits, including inverting and non-inverting amplifiers, adders, subtractors, differentiators, integrators, log amplifiers, and Wein bridge oscillators, while understanding characteristics such as CMRR, slew rate, and virtual ground.
DSC-8 Mathematical Physics 3	**CO1: Analyze** complex functions using Cauchy-Riemann conditions to determine analyticity, and apply concepts of singularities, residues, and the residue theorem to evaluate integrals and solve problems involving analytic functions. **CO2: Apply** Fourier transforms to various functions, including trigonometric, Gaussian, and finite wave trains, and use the Fourier transform to represent the Dirac delta function and solve differential equations related to wave and heat flow problems. **CO3: Utilize** properties of Fourier transforms, including the convolution theorem and its application to three-dimensional transforms, and analyze their role in solving differential equations and other mathematical problems. **CO4: Apply** Laplace transforms to solve ordinary differential equations, including those related to damped harmonic oscillators and electrical circuits, and use properties of Laplace transforms for analyzing and transforming functions, including unit step and Dirac delta functions.
DSC-9 Elements of Modern Physics	**CO1: Analyze** atomic spectra using classical and quantum models, including the limitations of the Rutherford model and the Bohr model, and explain the corrections for the finite mass of the nucleus and discrete energy exchanges by atoms.

	CO2: Understand and apply concepts of wave packets, including phase and group velocities, Gaussian wave packets, and the time development and spatial localization of wave packets, as well as wave-particle duality and complementarity. **CO3: Explain** and utilize the Heisenberg Uncertainty Principle in various contexts, including gamma-ray microscope thought experiments and electron diffraction, and estimate ground state energies for systems such as the harmonic oscillator and hydrogen atom. **CO4: Describe** nuclear physics concepts including the structure and size of atomic nuclei, nuclear forces, radioactivity, decay processes, and the principles of nuclear fission and fusion, and discuss applications such as nuclear reactors and stellar energy production.
DSC-10 **Digital systems and applications**	**CO1: Describe** the fundamental concepts of integrated circuits (ICs), including the differences between active and passive components, the advantages and drawbacks of ICs, and the various scales of integration (SSI, MSI, LSI, VLSI) along with examples of linear and digital ICs. **CO2: Understand** digital circuit design by explaining the difference between analog and digital circuits, binary number systems, and the use of basic logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR) in constructing and simplifying logic circuits, including applications such as parity checkers. **CO3: Analyze** and simplify logic circuits using Boolean algebra, including De Morgan’s Theorems, fundamental products, and methods for converting truth tables to logic circuits using Sum of Products and Karnaugh Maps. **CO4: Apply** knowledge of data processing circuits, including multiplexers, de-multiplexers, decoders, encoders, and arithmetic circuits for binary operations (addition, subtraction) and timing applications (IC 555), as well as understand basic computer organization concepts such as memory organization, interfacing, and shift registers and counters.
DSC-11	**CO1: Derive and solve** the time-dependent Schrödinger equation for

Quantum Mechanics and Application	different systems, analyze the properties of wave functions, and apply the principles of normalization, linearity, and superposition to describe wave packets and their evolution over time. **CO2: Understand and utilize** operators in quantum mechanics, including position, momentum, angular momentum, and energy operators. Apply commutator algebra, Hermitian operators, and expectation values to analyse physical observables and their uncertainties. **CO3: Solve** the time-independent Schrödinger equation in one, two, and three dimensions for various potential models, including the square well potential, harmonic oscillator, and infinitely rigid box. Apply these solutions to study quantum mechanical phenomena such as bound states, energy eigenfunctions, and tunnelling. **CO4: Explore** the interaction of atoms with electric and magnetic fields, including the effects of electron spin, the Stern-Gerlach experiment, and the Zeeman effect. Analyse the implications of L-S and J-J coupling, as well as the normal and anomalous Zeeman effects on atomic spectra.
DSC-12 Solid State Physics	**CO1: Analyze and describe** the crystal structures of solids, including the concepts of lattice translation vectors, unit cells, Miller indices, and reciprocal lattices. Apply Bragg's law to understand X-ray diffraction and the factors affecting atomic and geometrical contributions to diffraction patterns. **CO2: Understand and explain** the basic principles of lattice vibrations and phonons in solids, including acoustic and optical phonons, and their impact on thermal properties. Compare and apply Einstein and Debye theories to the specific heat of solids and discuss the implications of the T^3 law. **CO3: Explore and characterize** the magnetic and dielectric properties of materials. Analyze different types of magnetic materials (diamagnetic, paramagnetic, ferrimagnetic, and ferromagnetic) and their behaviors, including Langevin's and Weiss's theories. Understand dielectric polarization, susceptibility, and the Clausius-Mosotti equation. **CO4: Explain and apply** the fundamentals of laser operation, including

	Einstein's coefficients, optical pumping, and population inversion. Differentiate between three-level and four-level laser systems and describe specific examples such as Ruby and He-Ne lasers. Additionally, understand the basic concepts of band theory, including the Kronig-Penney model, and the properties of conductors, semiconductors, and insulators, as well as the phenomenon of superconductivity and its experimental results, critical temperatures, and types of superconductors.
DSC-13 Electromagnetic Theory	**CO1: Comprehend and apply** Maxwell's equations, including the displacement current, vector and scalar potentials, and gauge transformations (Lorentz and Coulomb). Analyze boundary conditions at interfaces between different media and solve wave equations to understand plane wave propagation in dielectric media. Utilize the Poynting theorem to determine electromagnetic energy density and its physical implications. **CO2: Analyze and describe** electromagnetic wave propagation in unbounded media, including vacuum and isotropic dielectric media. Evaluate the transverse nature of plane waves, refractive index, dielectric constant, and wave impedance. Understand and compute propagation characteristics in conducting media, including relaxation time, skin depth, and applications to ionized gases and the ionosphere. **CO3: Evaluate and explain** the behavior of electromagnetic waves in bounded media. Apply boundary conditions at plane interfaces between different media to understand reflection and refraction of plane waves. Utilize Fresnel's formulas for different polarization cases, apply Brewster's law, and analyze phenomena such as total internal reflection, evanescent waves, and metallic reflection. **CO4: Understand and interpret** the polarization of electromagnetic waves, including linear, circular, and elliptical polarization. Explore the behavior of light in uniaxial and biaxial crystals, including double refraction, and apply Nicol prisms and phase retardation plates (quarter-wave and half-wave plates). Investigate optical rotation, Biot's laws, Fresnel's theory of optical rotation, and use experimental tools like

	Laurentz's half-shade polarimeter to measure specific rotation.
DSC-14 Statistical Mechanics	**CO1: Understand and apply** the fundamental concepts of classical statistical mechanics, including the definitions of macrostates and microstates, and the concepts of ensembles (microcanonical, canonical, and grand canonical). Analyze the phase space, entropy, thermodynamic probability, and the Maxwell-Boltzmann distribution law, and compute the partition function for different systems. **CO2: Analyze and interpret** classical statistical properties of ideal gases, including classical entropy expressions, the Gibbs paradox, and the Sackur-Tetrode equation. Apply the law of equipartition of energy to calculate specific heat and understand its limitations. Investigate thermodynamic functions for systems with two energy levels and explore the concept of negative temperature. **CO3: Explore and differentiate** between quantum statistics for fermions and bosons, including Bose-Einstein and Fermi-Dirac distribution functions. Analyze Bose-Einstein condensation and deviations from Planck's law, and understand the effects of temperature on Fermi-Dirac distribution functions. Study the properties of degenerate Fermi gases and compute the density of states and Fermi energy. **CO4: Describe and apply** the principles of thermal radiation, including blackbody radiation and its temperature dependence. Derive and verify Kirchhoff's law, Stefan-Boltzmann law, Wien's displacement law, and Rayleigh-Jeans law from Planck's law of blackbody radiation. Analyze the implications of these laws for radiation pressure and the ultraviolet catastrophe, and understand the experimental verification of Planck's law.
DSE-1 Classical Dynamics	**CO1: Apply** the principles of generalized coordinates and velocities to derive and solve Lagrangian equations of motion using D'Alembert's principle. Analyze mechanical systems including simple, compound, and double pendulums, a single particle in space, Atwood's machine, dumb-bell systems, and linear harmonic oscillators through the Lagrangian framework.

	CO2: Utilize Hamilton's principle and the calculus of variations to derive Euler-Lagrange equations. Apply Hamiltonian mechanics to solve problems such as finding the shortest distance between two points in a plane, geodesic problems, minimum surfaces of revolution, and the Brachistochrone problem. Analyze the equations of motion and first integrals, canonical momenta, Hamilton's equations, and applications to central force motion and coupled oscillators, including the motion of charged particles in external electric and magnetic fields. **CO3: Understand and explain** the postulates of special relativity, including Lorentz transformations and Minkowski space. Analyze concepts such as the invariant interval, light cone, and world lines, and describe phenomena like time dilation, length contraction, and the twin paradox. Derive and apply the mass-energy relation to understand how mass varies with velocity. **CO4: Explore and apply** the concept of four-vectors, including space-like, time-like, and light-like vectors. Analyze four-velocity, four-momentum, and energy-momentum relations, and interpret Doppler effects from a four-vector perspective. Understand the concept of four-force and conservation of four-momentum, and apply these concepts to the two-body decay of an unstable particle.
DSE-2 Nuclear and Particle Physics	**CO1: Understand and describe** the general properties of atomic nuclei, including their constituents (protons and neutrons) and intrinsic properties such as mass, radius, charge density, and binding energy. Analyze the variation of binding energy with mass number and the main features of the binding energy versus mass number curve. Evaluate properties such as angular momentum, parity, magnetic moment, electric moments, and nuclear excited states. **CO2: Analyze and explain** the processes of radioactive decay, including alpha decay, beta decay, and gamma decay. Understand the theory behind alpha emission, including the Gamow factor and Geiger-Nuttall law. Apply energy kinematics to beta decay processes, including positron emission and electron capture, and understand the neutrino hypothesis.

	Develop an elementary understanding of gamma decay and its significance. **CO3: Apply and evaluate** nuclear models, including the liquid drop model and semi-empirical mass formula. Discuss the significance of various terms in the mass formula and conditions for nuclear stability. Analyze two-nucleon separation energies and evidence for nuclear shell structure, including nuclear magic numbers and basic assumptions of shell models. **CO4: Identify and describe** different types of detectors for nuclear radiation. Understand the principles of gas detectors, including ionization chambers and Geiger-Müller counters, as well as scintillation detectors and photomultiplier tubes (PMTs). Explore semiconductor detectors (Si and Ge) for charge particle and photon detection, and understand the concept of charge carriers and mobility. Develop knowledge of neutron detectors and their applications. **CO5: Explain and apply** the principles of particle accelerators, including the Van de Graaff generator (Tandem Accelerator), linear accelerators, cyclotrons, and synchrotrons. Understand their basic construction and operation principles, as well as their applications in particle physics research. **CO6: Understand and analyze** the basic features of particle interactions and types of particles and their families. Discuss symmetries and conservation laws, including energy and momentum, angular momentum, parity, baryon number, lepton number, isospin, strangeness, and charm. Develop elementary ideas of quarks and gluons and their role in particle physics.
DSE-3 Nanomaterials and Applications	**CO1: Understand and describe** the fundamental concepts of nanoscale systems, including length scales in physics, types of nanostructures (1D, 2D, 3D) such as nanodots, thin films, nanowires, and nanorods. Analyze the band structure and density of states of materials at the nanoscale, and discuss size effects and quantum confinement in nano systems. Apply the Schrödinger equation to model quantum confinement in 3D, 2D, and 1D

	nanostructures, and understand the consequences of these effects on their properties. **CO2: Explain and apply** various synthesis techniques for nanostructured materials. Differentiate between top-down and bottom-up approaches, and describe methods including photolithography, ball milling, gas-phase condensation, vacuum deposition (thermal and e-beam evaporation), pulsed laser deposition, chemical vapor deposition (CVD), sol-gel, electrodeposition, spray pyrolysis, hydrothermal synthesis, colloidal methods, and molecular beam epitaxy (MBE) growth of quantum dots. **CO3: Identify and utilize** different characterization techniques for nanostructures. Discuss the principles and applications of X-Ray Diffraction (XRD), Optical Microscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), and Scanning Tunneling Microscopy (STM). Understand how these techniques are used to analyze the structure and properties of nanomaterials. **CO4: Explore and evaluate** the applications of nanotechnology in various fields. Analyze the use of nanoparticles, quantum dots, nanowires, and thin films in photonic devices such as LEDs and solar cells. Discuss single-electron devices, carbon nanotube-based transistors, and nanomaterial devices including quantum dot heterostructure lasers, optical switching, optical data storage, magnetic quantum wells, magnetic dots for data storage, and the role of Micro Electromechanical Systems (MEMS) and Nano Electromechanical Systems (NEMS) in technology advancements.
DSE-4 Project	**CO1**:Learn Hands-on experiments and Lab set-up skills to independently run experiments and analyze the data. **CO2**: Learn data interpretation and evaluation of experimental results within the specific allowed error bars. **CO3**: Learn and develop presentation skills and debate about the learned phenomena from laboratory experiments and classroom understanding of theory.

	CO4: Develop research ability through research projects.
GE-1	**CO1: Mechanics and Properties of Matter** • Understand and apply the concepts of moment of inertia including parallel axis and perpendicular axis theorems, and compute the moments of inertia for common solid shapes such as spheres and cylinders. • Analyze gravitational potential and fields due to spherical bodies, and solve problems related to gravitational effects at both internal and external points. • Apply the concepts of elastic constants, surface tension, and viscous flow in various physical contexts, including the calculation of depression in cantilevers and the use of Poiseuille's formula for viscous flow. **CO2: Oscillations and Waves** • Describe and analyze simple harmonic motion (SHM), including different damping scenarios (under-damped, over-damped, and critically damped), and understand the principles of forced vibration and resonance. • Derive and solve the wave equation for longitudinal and transverse waves in elastic media, and analyze the composition of SHM through the study of Lissajous figures for various frequency ratios. **CO3: Thermal Physics** • Explain the concepts of entropy, the second law of thermodynamics, and Carnot's theorem, and calculate efficiencies and changes in entropy for reversible and irreversible processes. • Apply the differential equations for heat flow and understand thermal conductivity, Maxwell's thermodynamic relations, and the Clausius-Clapeyron equation. • Discuss black-body radiation and apply Planck's radiation formula to understand thermal radiation characteristics. **CO4: Electricity and Magnetism** • Apply Gauss's law to compute electrostatic fields and solve problems involving magnetic induction using Biot-Savart law and

	Ampère's circuital law. • Analyze electromagnetic equations, their differential and integral forms, and understand the significance of Maxwell's equations. • Understand AC circuit behavior, including growth and decay of currents, time constants, impedance, power factor, and resonance in RL, RC, and LCR circuits. • Describe the operation and characteristics of semiconductors, including PN-junctions, rectifiers, transistors (PNP and NPN), JFET, and their applications in electronic circuits.
GE-II	**CO1: Optics-I** • **Understand Monochromatic Aberrations:** Explain the types of monochromatic aberrations in optical systems and methods for their minimization. • **Analyze Chromatic Aberration:** Discuss chromatic aberration, its effects, and achromatic combinations used to correct it. • **Apply Interference and Diffraction Theory:** Describe the theory of interference and diffraction, including Young's double slit experiment, measurement of wavelength using a biprism, and the phenomena of Newton's rings and thin film colors. • **Explore Diffraction:**Analyze Fresnel and Fraunhofer diffraction, and solve problems involving diffraction by a single slit and plane transmission gratings. **CO2: Optics-II** • **Electromagnetic Nature of Light:** Explain the electromagnetic nature of light and its implications. • **Understand Polarization:** Differentiate between polarized and unpolarized light, and describe polarization by reflection, refraction, Brewster's Law, and Malus's Law. • **Double Refraction:** Explain the phenomenon of double refraction and the concepts of ordinary and extraordinary rays. **CO3: Atomic Physics** • **Classical Physics and Quantum Theory:** Discuss the inadequacy

	of classical physics in explaining atomic phenomena, including Rayleigh-Jeans theory and Planck's quantum theory of radiation. • **Quantum Nature of Light and Matter:** Analyze the photoelectric effect, Compton effect, and dual nature of radiation. Explain de Broglie's hypothesis, matter waves, and wave-particle duality, including experimental evidence from the Davisson-Germer experiment. • **Bohr's Theory:** Explain Bohr's theory of the hydrogen atom, including its ability to explain hydrogen spectra, corrections for the finite mass of the nucleus, and the correspondence principle. Discuss the limitations of Bohr's theory and discrete energy exchange in atoms. **CO4: Quantum Mechanics and Relativity** • **Quantum Mechanics:** Understand the Heisenberg Uncertainty Principle and solve problems involving the time-dependent Schrödinger wave equation in one and three dimensions. Discuss the physical interpretation of the wave function, including probability density, probability current density, and the equation of continuity. Calculate expectation values of observables and apply Ehrenfest's theorem. Solve the time-independent Schrödinger equation for a particle in a box, and determine energy eigenvalues and eigenfunctions. • **Nuclear Physics:** Discuss the properties of the nucleus, including charge, size, spin, magnetic moment, mass defect, binding energy, and nuclear forces. Explain radioactive decay laws, average life, half-life, and the concepts of nuclear fission and fusion. Describe linear accelerators and cyclotrons. • **Relativity:** Explain the limitations of Newtonian relativity, the Michelson-Morley experiment, and the postulates of special relativity. Understand Lorentz transformations, length contraction, time dilation, and the mass-energy relation.
