PREM CHAND MARKANDA S.D. COLLEGE FOR WOMEN, JALANDHAR CITY

Re-accredited 'A+' grade (2nd Cycle) by NAAC Bangalore

A unique prestigious Post Graduate Institution of Northern India

Department of Physics

ODD SEMESTER

B.Sc. Non - Medical

Session-2023-2024

Semester- Sem 1

Faculty Name-Miss. Mehak

Subject- – Mechanics

DURATION	TOPIC	TEACHING TOOLS
July-August	**Introduction** –Cartesian and spherical polar co–ordinate systems, area, volume, velocity and Acceleration in these systems. **Conceptual Frame Work** Solid angle, Relationship of conservation laws and symmetries of space and time.	**Lecture based teaching learning** (chalk and talk) **Demonstration**

September	**Introduction and Conceptual Frame Work:** Various forces in Nature (Brief introduction) centreof mass, equivalent one body problem, central forces, equation of motion under central force, equation of orbit and turning points. Kepler Laws. Concept of Ether and Michelson son–Morley experiment.	**Lecture based teaching** (chalk and talk) **Group discussion learning** **Any other (**quiz)
October	**Introduction and Conceptual Frame Work:** Inertial frame of reference. Galilean transformation and Invariance. Non Inertial frames, coriolis force and its applications. Variation of acceleration due to gravity with latitude. Focault pendulum.	**Lecture based teaching learning** (chalk and talk) **Practical based learning** (you tube videos on different topics) **Self study** (library visit)
November	Elastic collision in Lab and C.M. system, velocities, angles and energies, crosss section of elastic scattering, Rutherford scattering. Rigid Body motion; Rotational motion, principal moments and Axes. Euler's equations, precession and elementary gyroscope.	**Lecture based learning** (chalk and talk) **Practicle based learning** **Individual learning**

Course outcome

CO.1	Understand Newton's laws of motion and motion of variable mass system and its application to rocket motion and the concepts of impact parameter, scattering cross section.
CO.2	Apply the rotational kinematic relations, the principle and working of gyroscope and it applications and the precessional motion of a freely rotating symmetric top.
CO.3	Comprehend the general characteristics of central forces and the application of Kepler's laws to describe the motion of planets and satellite in circular orbit through

	the study of law of Gravitation.
CO.4	Understand postulates of Special theory of relativity and its consequences such as length contraction, time dilation, relativistic mass and mass-energy equivalence.
CO.5	Examine phenomena of simple harmonic motion and the distinction between undamped, damped and forced oscillations and the concepts of resonance and quality factor with reference to damped harmonic oscillator.

B.Sc. non-medical

Semester-Semester-I

Faculty Name- Dr. Jyoti Sharma

Subject- ELECTRICITY AND MAGNETISM

DURATION	**TOPIC**	**TEACHING TOOLS**
July-August	Basic ideas of Vector Calculus Gradient, Divergence, curl and their physical significance. Laplacian in rectangular, cylindrical and spherical coordinates. Coulomb's Law for point charges and countinuous distribution of charges. Electric field due to dipole, line charge and sheet of charge. Electric flux, Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's theorem.	**Lecture based teaching learning** (chalk and talk) **Any other (**assignments)
September	Work and potential difference. Potential difference as line integral of field. Electric potential due to a point charge, a group of point charges, dipole and quadrupole moments, long uniformly charged wire, charged disc. Stoke's theorem and its applications in Electrostatic field, curl E=0. Electric fields as gradient of scalar potential. Calculation of E due to a point charge and dipole from	**Lecture based teaching learning** (chalk and talk) Group discussion

	potential. Potential due to arbitrary charge distribution and multipole moments.	
October	Poisson and Laplace's equation and their solutions in Cartesian and spherical coordinates. Concept of electrical images. Calculation of electric potential and field due to a point charge placed near an infinitely conducting sheet.Current and current density, equation of continuity. Microscopic form of Ohm's Law (J=σE) and conductivity, Failure of Ohm's Law.	**Lecture based teaching learning** (chalk and talk) **Technology based learning** Self study(library visit)
November	Interaction between moving charges and force between parallel currents. Behaviour of various substances in magnetic field. Definition of M and H and their relation to free and bound currents. Permeability and susceptibility and their interrelationship. Orbital motion of electrons and diamagnetism, Para-magnetism and Ferromagnetism.	**Lecture based learning**(chalk and talk) **Learning through problem solving**(numericals) **Individual learning**

Course outcome

CO.1	Understand the Gauss law and its application to obtain electric field in different cases and formulate the relationship between electric displacement vector, electric polarization, Susceptibility, Permittivity and Dielectric constant.
CO.2	Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.
CO.3	Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.
CO.4	Develop an understanding on the unification of electric and magnetic fields and

	Maxwell's equations governing electromagnetic waves.
CO.5	Apply law such as Bio t - Savart's and Lenz's law for selected problems in electricity and magnetism.

Semester-Semester- 3rd

Faculty Name- Miss. Mehak

Subject- STATISTICAL PHYSICS & THERMODYNAMICS

DURATION	**TOPIC**	**TEACHING TOOLS**
July-August	Basic ideas of Statistical Physics, Scope of Statistical Physics, Basic ideas about probability, Distribution of four distinguishable particles into compartments of equal size. Concept of macrostates, microstates, Thermodynamic Priobability, Effects of constraints on the system. Distribution of particles in two compartments. Deviation from the state of maximum probability. Equilibrium state of dynamic system. Distribution of distinguishable n particles in k compartments of unequal sizes.	**Lecture based learning**(chalk and talk) **Group teaching and learning**
September	Phase space and division into elementary cells. Three kinds of statistics. The basic approach in three statistics. Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of law of distribution of molecular speeds. Need for Quantum Statistics – B.E. Statement	**Lecture based teaching learning** Chalk and talk **Any other (**seminars) **Self study**

	of planck's law of Radiation Wien's Displacement and Stefan's law. Fermi Dirac (FD) statistics. Comparison of M.B, B.E and F.D statistics.	
October	Statistical definition of entropy, Change of entropy of system, additive naturwe of entropy, Law of increase of entropy, Reversible and irreversible processes, and their examples, work done in reversible process, examples of increase in entropy in natural processes, entropy and disorder, Brief review of Terms, Laws of Thermodynamics, Carnot Cycle, Entropy changes in carnot cycle, Applications of thermodynamics to thermoelectric effect, change of entropy along reversible path in P-V diagram. Heat death of universe.	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**
November	Derivation of Maxwell Thermodynamics relations, Cooling produced by adiabatic stretching, Adiabatic Compression, change of internal energy with volume, Specific heat and constant pressure and constant volume. Expression for CP-Cv, Change of state and Claypron equation.	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**

Course outcome

CO.1	Understand the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions and the transport phenomenon in ideal gases.
CO.2	Gain knowledge on the basic concepts of thermodynamics, the first and the second law of thermodynamics, the basic principles of refrigeration, the concept of entropy,the thermodynamic potentials and their physical interpretations.
CO.3	Understand the working of Carnot's ideal heat engine, Carnot cycle and its efficiency.
CO.4	Develop critical understanding of concept of Thermodynamic potentials, the formulation of Maxwell's equations and its applications.
CO.5	Differentiate between principles and methods to produce low temperature and liquefy air and also understand the practical applications of substances at low temperatures.

Semester-Semester- 3rd

Faculty Name- Dr. Jyoti Sharma

Subject- OPTICS AND LASERS

DURATION	**TOPIC**	**TEACHING TOOLS**
July-August	**Interference of Light:** Superposition of light waves and interference, young's double slit experiment, Conditions for sustained interference pattern, Coherent sources of light, Interference pattern by division of wave front, Fresnel Biprism, Displacement of fringes, Change of phase on reflection, Interference in thin films due to reflected and transmitted light, non reflecting films, Newton's Rings. Michelson Interferometer.	**Lecture based learning**(chalk and talk) **Group teaching and learning**

September	**Diffraction:**Huygen'sfresnel theory, half-period zones, Zone plate, Distinction between fresnel and fraunhoffer diffraction. Fraunhoffer diffraction at rectangular and circular apertures, Effect of diffraction in optical imaging, Resolving power of telescope in diffraction grating, its use as a spectroscopic element and its resolving power, Resolving power of microscope.	**Lecture based teaching learning** Chalk and talk **Any other (**seminars) **Self study**
October	**Polarization:** Plane Polarized light, Elliptically polarized light, wire grid polarizer, Sheet polarizer, Mauls' Law, Brewester Law, Polarization by reflection, Scattering, Double reflection, Nicol prism, Retardation plates, Production Analysis of polarized light, Quarter and half wave plates.	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**
November	**Laser Fundamentals**: Derivation of Einstein relations, Concept of stimulated emission and population inversion, broadening of spectral lines, three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes.Components of laser devices, condition for laser action, types of lasers, Ruby and Nd:YAG lasers, He-Ne and CO2 lasers construction, mode of creating population inversion and output	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**

	characteristics, application of lasers –a general outline.	

Course outcome

CO.1	Understand the phenomenon of interference of light and its formation in (i) Lloyd's single mirror due to division of wave front and (ii) Thin films, Newton's rings and Michelson interferometer due to division of amplitude.
CO.2	Describe the construction and working of zone plate and make the comparison of zone plate with convex lens.
CO.3	Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.
CO.4	Distinguish between Fresnel's diffraction and Fraunhoffer's diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating.
CO.5	Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields.

Semester-Semester- 5th

Faculty Name- Miss. Mehak

Subject- ELECTRONICS

DURATION	**TOPIC**	**TEACHING TOOLS**
July-August	Concepts of current and voltage sources, p-n junction, Biasing of diode, V-I characteristics, Rectification: half wave, full wave rectifiers and bridge rectifiers, Efficiency, Ripple factor, Qualitative ideas of filter circuits (LC and π filters), Zener diode and voltage regulation, Introduction to Photonic devices (solar cell, photodiode and LED). Basic concepts of Boolean algebra, AND OR NOT and NAND Gates.	**Lecture based teaching learning** Chalk and talk **Group discussion**
September	Junction transistor :	**Lecture based teaching learning**

	Structure and working relation between different currents in transistors, Sign conventions, Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics, Structure and characteristics of JEFT, Transistor biasing and stabilization of operating point, Voltage divider biasing circuit.	Chalk and talk **Informational based videos (**you tube videos) **Self study** (library visit)
October	Working of CE amplifier, Amplifier analysis using h-parameters, Equivalent circuits, Determination of current gain, Power gain, Input impedance, FET amplifier and its voltage gain, Feed back in amplifiers, Different types, Voltage gain, Advantage of negative feed back, Emitter follower as negative feed back circuit.	**Lecture based teaching learning** Chalk and talk **Informational based videos (**you tube videos) **Any other (**class test)
November	Barkausen criterion of sustained oscillations, LC oscillator (tuned collector, tuned base Hartley), RC oscillators, phase shift and Wein bridge.	**Lecture based teaching learning** Chalk and talk **Any other (assignment)** **Self study**

Course outcome

CO.1	Various network which use to solve problems related to complicated circuits by converting them into simpler circuits. This has wide applications in electronic and transmission circuits.
CO.2	Knowledge about semiconductors since it is a basic materials used in many electronic components like diode, transistors FET, UJT etc.
CO.3	Characteristics and working of operational amplifiers which are useful in various medical and scientific investigations to amplify the signals.
CO.4	Generation of high frequency signals using oscillator circuits and their applications.

CO.5	Junction Field Effect Transistor and MOS Field Effect Transistor, Working and applications.

Semester-Semester-5th

Faculty Name- Dr. Jyoti Sharma

Subject- CONDENSED MATTER PHYSICS

DURATION	**TOPIC**	**TEACHING TOOLS**
July-August	Crystal structure, Symmetry operations for a two and three dimensional crystal, Two dimensional Bravais lattices, Three dimensional Bravais lattices, Basic primitive cells, Crystal planes and Miller indices, Diamond and NaCl structure.	**Lecture based teaching learning** Chalk and talk **Group discussion**
September	Crystal Diffraction: Bragg's law, Experimental methods for crystal structure studies, Laue equations, Reciprocal lattices of SC, BCC and FCC, Brag's law in reciprocal lattice, Brillouin zones and its construction in two and three dimensions, Structure factor and atomic form factor.	**Lecture based teaching learning** Chalk and talk **Informational based videos (**you tube videos) **Self study** (library visit)
October	Lattice vibrations, Concepts of phonons, Scattering of photons by phonons, Vibration and mono- atomic, linear chains, Density of modes, Einstein and Debye models of specific heat.	**Lecture based teaching learning** Chalk and talk **Informational based videos (**you tube videos) **Any other (**class test)

November	Free electron model of metals, Free electron, Fermi gas and Fermi energy, Band Theory: Kronig- Penney model, Metals and insulators, Qualitative discussion of the following: Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, band gap in semiconductors	**Lecture based teaching learning** Chalk and talk **Any other (assignment)** **Self study**

Course outcome

CO.1	Understand basic mechanics and properties of matter and structure.
CO.2	Understand crystal structures and X-ray diffraction methods to analyze crystal structures
CO.3	Analyze crystal structures using Bragg's law, Laue equations, and experimental methods, understand reciprocal lattices and Brillouin zones, and evaluate structure and atomic form factors.
CO.4	Understand lattice vibrations, phonons, their role in thermal properties, scattering phenomena, vibrational modes in mono-atomic chains, and apply the Einstein and Debye models to analyze specific heat.
CO.5	Understand and analyze the electronic properties of materials using the Free Electron Model, Fermi gas, Band Theory (Kronig-Penney model), and semiconductor concepts such as conductivity variation, Fermi levels, and band gaps, to differentiate between metals, semiconductors, and insulators and their applications.

EVEN SEMESTER

B.Sc. non - medical

Semester-Semester-2nd

Faculty Name- Miss. Mehak

Subject- RELATIVITY AND ELECTROMAGNETISM

DURATION	TOPIC	TEACHING TOOLS
July-August	Postulates of special theory of relatively. Lorentz transformations, observer and viewer in relativity. Relativity of simultaneity, Length, Time, velocities. Relativistic Dopper effect. Variation of mass with velocity, mass–energy equivalence, rest mass in an inelastic collision, relativistic momentum & energy, their transformation, concepts of Minkowski space, four vector formulation.	**Lecture based learning**(chalk and talk) **Group teaching and learning**
September	Invariance of charge, E in different frames of references. Fiels of a point charge moving with constant velocity, Lorentz's force, Definition of B. Biot Savart's Law and its application to long straight wire, circular current loop and solenoid. Ampere's Circuital law and its application. Divergence and curl of B. Hall effect, derivation of Hall co–efficient. Vector potential, current– density and its applications. Transformation equation of E and B from one frame to another.	**Lecture based teaching learning** Chalk and talk **Any other (**seminars) **Self study**
October	Faraday's Law of EM induction, Displacement current, Mutual inductance and reciprocity theorem.	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**

	Self inductance, L for solenoid, Coupling of Electrical circuits. Analysis of LCR series and parallel resonant circuits, Q–factor, Power consumed, power factor.	
November	Maxwell's equations their derivation and characterizations, E.M. waves and wave equation in a medium having finite permeability and permitivity but with conductivity σ). Poynting vector, Impedance of a dielectric to EM waves. EM waves in a conducting medium and Skin depth. EMwave velocity in a conductor and anomalous dispersion. Response of a conducting medium to EMwaves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence.	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**

Course outcome

CO.1	Understand and apply the principles of special relativity, including Lorentz transformations, relativistic effects on time, length, and velocities, relativistic Doppler effect, mass-energy equivalence, and momentum-energy transformations, with insights into Minkowski space and four-vector formulation.
CO.2	Understand electromagnetic phenomena across reference frames, including charge invariance, electric and magnetic field transformations, Lorentz force, Biot-Savart and Ampere's laws, Hall effect, vector potential, and current density applications.
CO.3	Understand Faraday's law, displacement current, inductance concepts (self and mutual), and their applications, including the reciprocity theorem and circuit coupling.
CO.4	Understand Faraday's law, displacement current, inductance concepts (self and

	mutual), and their applications, including the reciprocity theorem and circuit coupling.
CO.5	Examine the behavior of EM waves at boundaries, including reflection, transmission, and dispersion in conducting and dielectric media for normal and oblique incidences.

Semester-Semester-2nd

Faculty Name- Dr. Jyoti Sharma

Subject- VIBRATION AND WAVES

DURATION	**TOPIC**	**TEACHING TOOLS**
July-August	Simply harmonic motion, energy of a SHO. Compound pendulum. Torsional pendulum Electrical Oscillations Transverse Vibrations of a mass on string, superposition of two perpendicular SHMhaving periods in the ration 1:1 and 1:2.	**Lecture based learning**(chalk and talk) **Group teaching and learning**
September	Decay of free Vibrations due to damping. Differential equation of damped harmonic motion, types of motion, types of damping. Determination of damping co–efficient– Logarithmic decrement, relaxation time and Q–Factor. Electromagnetic damping (Electrical oscillator).	**Lecture based teaching learning** Chalk and talk **Any other (**seminars) **Self study**
October	Differential equation for forced mechanical and electrical oscillators. Transient and steady state behaviour. Displacement and velocity variation with driving force frequency, variation of phase with	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**

	frequency, resonance. Power supplied to an oscillator and its variation with frequency. Q– value and band width. Q–value as an amplification factor. Stiffness coupled oscillators, Normal co–ordinates and normal modes of vibration. Inductive coupling of electrical oscillators.	
November	Types of waves, wave equation (transverse) and its solution characteristic impedance of a string. Impedance matching. Reflection and Transmission of waves at boundary. Reflection and transmission of energy. Reflected and transmitted energy coefficients. Standing waves on a string of fixed length. Energy of vibrating string. Wave and group velocity.	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**

Course outcome

CO.1	Understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations
CO.2	Calculate logarithmic decrement relaxation factor and quality factor of a harmonic oscillator
CO.3	Use figures to understand simple harmonic vibrations of same frequency and different frequencies
CO.4	Solve wave equation and understand significance of transverse waves
CO.5	Solve wave equation of a longitudinal vibration in bars free at one end and also fixed at both the ends

Semester-Semester-4th

Faculty Name- Miss Mehak

Subject- ATOMIC AND MOLECULAR SPECTRA

DURATION	TOPIC	TEACHING TOOLS
January-February	**Introduction to Atomic Spectra:** Observation of spectra, Types of spectra, Light sources, Spectral analysis, Units in spectroscopy, Bohr's Theory, Spectral series, Representation of spectral lines by terms, Energy level Diagram, Bohr's correspondence Principle, Ritz combination Rule, Continuum at series limit, Evidences in favour of Bohr's Theory, Experimental confirmation of Bohr's theory, Frank-Hertz Experiment.	**Lecture based teaching learning** (Chalk and talk) **Group discussion**
March	**One Electrom Atomic Spectra:** Spectrum of Hydrogen atom, Line structure, Normal Zeeman effect, electron spin, Stern Gerlach experiment, spin orbit coupling, electron magnetic moment, total angular momentum, Hyperfine structure, examples of one electron systems, anomalous Zeeman effect, Lande g factor (Sodium D-Lines).	**Lecture based teaching learning** (Chalk and talk) **Any other** (assignment)
April	**Many Electron System Spectra:**Exchange symmetry of wave function, exclusion principle, shells, subshells in atoms, atomic spectra (Helium), spectra of alkaline earth atoms, LS coupling, selection rules,	**Lecture based teaching learning** (Chalk and talk)

	Regularities in atomic spectra.	
May	DInteraction energy ideas, X-ray spectra, Mosley law, Absorption spectra, Auger effect, Molecular bonding, Molecular spectra, selection rules, symmetric structure, Rotational Vibrational, electronic level and spectra of molecules, Raman spectra. Introduction to Raman spectra.issolution of Partnership Firms: Legal Position, Accounting for simple dissolution, Applications of rule in case of Garner Vs. Murray in case of insolvency of partner(s) (excluding piecemeal distribution and sale of a firm to a company).	**Lecture based teaching learning** (Chalk and talk)

Course outcome

CO.1	Describe theories explaining the structure of atoms and the origin of the observed spectra.
CO.2	Identify atomic effect such as Zeeman Effect and Stark Effect.
CO.3	Explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields.
CO.4	Understand interaction energy concepts, X-ray spectra, Moseley's law, absorption spectra, Auger effect, and molecular bonding, along with rotational, vibrational, and electronic spectra of molecules, and Raman spectroscopy.
CO.5	Study the dissolution of partnership firms, including legal aspects, accounting for simple dissolution, and the application of the Garner vs. Murray rule in cases of partner insolvency

Semester-Semester- 4th

Faculty Name- Dr. Jyoti Sharma

Subject- QUANTUM MECHANICS

DURATION	TOPIC	TEACHING TOOLS
January-February	**Formalism of Wave Mechanics:** Brief introduction to need and development of quantum mechanics, photoelectric effect, Compton effect, Wave particle duality, De broglie hypothesis, Uncertainity principle, Guassian wave packet. Operator correspondence. Normalization and probability interpretation of wave function. Superposition principle.	**Lecture based teaching learning** **Group discussion**
March	Expectation value, Probability current and conservation of probability. Admissibility conditions or wave function. Ehrenfest theorem, Eigen function and eigen value. Operator formalism, orthogonal system, expansion in eigen functions, Hermitian operator, simultaneous eigen function, equation of motion.	Lecture based teaching learning Informational based videos Any other (assignment)
April	**Application of Schrodinger wave equation to one dimensional problems:** Fundamental postulates of wave mechanics, Schrodinger's wave equation for a free particle and equation of a particle subject to forces. One dimensional step potential	Lecture based teaching learning Technology based learning Self study(library visit) seminars

	for $E>V_0$, one dimensional step potential for 0<E. one dimensional potential barrier of finite height and width, Quantum mechanical tunnelling effect, particle in one dimensional box with infinitely hard walls, one dimensional square well of finite depth	
May	Application of Schrodinger equation to three dimensional problems: Free particle in three dimensional rectangular box, Eigen wave function, Eigen values of momentum, energy and degeneracy, three dimensional harmonic oscillator (Cartesian coordinates) wave function, energy levels, degeneracy, Schrodinger's wave equation in spherical polar co-ordinates, Schrodinger wave equation for spherically symmetric potential for hydrogen atom, wave function of H atom, solution of $R(r),\Theta(\theta),\Phi(\phi)$ equations.	Lecture based learning Seminars Self study

Course outcome

CO.1	Students will be familiar with the main aspects of the historical development of quantum mechanics and be able to discuss and interpret experiments that reveal the wave properties of matter, as well as how this motivates replacing classical mechanics with a wave equation.
CO.2	Students will understand the central concepts and principles in quantum mechanics, such as the Schrödinger equation, the wave function and its interpretation, the

	uncertainty principle, the relation between quantum mechanics and linear algebra. This includes an understanding of elementary concepts in statistics, such as expectation values and variance.
CO.3	Students will have developed an understanding of why both analytic and numerical solutions are important in quantum mechanics, and have acquired experience in using both types of methods on quantum mechanical problems.
CO.4	Apply Schrödinger's wave equation to one-dimensional problems, including free particles, potential step, finite potential barriers, quantum tunneling, and particle in a box, to understand fundamental wave mechanics and quantum effects.
CO.5	Extend Schrödinger's equation to three-dimensional problems, solving for eigen functions, energy levels, and degeneracy in systems like the three-dimensional harmonic oscillator and hydrogen atom using spherical polar coordinates.

Semester-Semester-6th

Faculty Name- Dr. Jyoti Sharma

Subject- RADIATION AND PARTICLE PHYSICS

DURATION	TOPIC	TEACHING TOOLS
January-February	**Interaction of Radiation and Charged Particles With Matter:** Energy loss of electrons and positrons, Positrons annihilation in condensed media, Sopping power and range of heavier charged, derivation of Bethe-Bloch formula, interaction of gamma rays with matter.	Lecture based teaching learning Group discussion
March	**Nuclear Radiation Detection:** Gas-filled detectors, proportional and Geiger-Mueller counters, Scintillation detectors, semiconductor detectors, Cherenkov effect, solid state nuclear track detectors, bubble chambers, nuclear	Lecture based teaching learning Informational based videos Inquiry based learning Kinesthetic learning Expeditionary learning

	emulsions.	
April	**Accelerators:** Accelerators, linear accelerators, cyclic accelerators: cyclotron, synchrocyclotron, betatron, electron and proton synchrotron, phase stability, colliding beam machines: introduction to Large Hadron Collider and Fermilab Tevatron.	Lecture based teaching learning Technology based learning Self study Expeditionary learning Kinesthetic learning
May	**Elementary Particles:** Historical introduction, fermions and bosons, particles and antiparticles, Classification of particles, types of interactions, electromagnetic, weak, strong interactions, gravitational interactions, Quantum numbers and conservation laws, isospin, charge conjugation, Introduction to quarks and qualitative discussion of the quark model, high energy physics units.	Lecture based learning Learning through problem solving Kinesthetic learning Individual learning

Course outcome

CO.1	Understand the energy loss mechanisms of electrons, positrons, and heavier charged particles, including positron annihilation and stopping power, with the Bethe-Bloch formula. Analyze the interaction of gamma rays with matter and their energy transfer processes.
CO.2	Understand the principles and applications of various nuclear radiation detectors, including gas-filled detectors, Geiger-Mueller counters, scintillation detectors, semiconductor detectors, and Cherenkov effect.
CO.3	Understand the principles and types of accelerators, including linear accelerators, cyclotrons, synchrocyclotrons, betatrons, and synchrotrons for electrons and protons, with a focus on phase stability.

CO.4	Explore advanced colliding beam machines, such as the Large Hadron Collider and Fermilab Tevatron, and their role in high-energy particle physics.
CO.5	Understand the classification of elementary particles into fermions and bosons, including particles and antiparticles, and their interactions (electromagnetic, weak, strong, and gravitational).

Semester-Semester-6th

Faculty Name- Miss Mehak

Subject- NUCLEAR PHYSICS

DURATION	TOPIC	TEACHING TOOLS
January-February	**Nuclear Properties**: Constituents of nucleus, non-existence of electrons in nucleus, Nuclear mass and binding energy, features of binding energy versus mass number curve, nucleus radius, angular momentum and parity, nuclear moments: magnetic dipole moment and electric quadruple moment, properties of nuclear forces, Yukawa theory.	Lecture based teaching learning
March	**Radioactive Decays:** Modes of decay of radioactive nuclides and decay Laws, radioactive series and displacement law, radioactive dating, constituents of Cosmic rays, Alpha decay: Gamow's theory of alpha decay, barrier penetration as applied to alpha decay, Geiger Nuttal law, Beta decays: β-, β+ and electron capture decays, Neutrino	Lecture based teaching learning Inquiry based learning Kinesthetic learning

	hypothesis and its detection, parity violation in β decay, Gamma transitions: Excited levels, isomeric levels, Gamma transitions, internal conversion.	
April	**Nuclear Reactions:** Types of nuclear reactions, reactions cross section, conservation laws, Kinematics of nuclear reaction, examples of nuclear reactions, Q-value and its physical significance, compound nucleus, level width.	Lecture based teaching learning Technology based learning Self study
May	**Nuclear Models:** Liquid drop model, semi-empirical mass formula, condition of stability, evidence for nuclear magic numbers, Shell Model, energy level scheme, angular momenta of nuclear ground states, parity and magnetic moment of nuclear ground states.	Lecture based learning Learning through problem solving Kinesthetic learning Individual learning

Course outcome

CO.1	Demonstrate knowledge of fundamental aspects of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of radiation and matter.
CO.2	Discuss nuclear and radiation physics connection with other physics disciplines – solid state, elementary particle physics, radiochemistry, astronomy.
CO.3	Understand the types of nuclear reactions, reaction cross-sections, and the application of conservation laws in nuclear reactions.
CO.4	Analyze the kinematics of nuclear reactions, including the Q-value, its physical significance, and concepts like the compound nucleus and level width.
CO.5	Explore the Shell Model, energy level schemes, and the determination of angular momentum, parity, and magnetic moments of nuclear ground states.