Program: M.Sc. Physics

Programme Specific Outcomes

PSO1: Understand the depth knowledge of various subjects of Physics.

PSO2: Demonstrate skills and competencies to conduct wide range of scientific experiments.

PSO3: Identify their area of interest in academic and R&D.

PSO4: Perform job in various fields' viz. science, engineering, education, banking, business and public service, etc. with precision, analytical mind, innovative thinking, clarity of thought and expression, systematic approach.

PSO5: integrate and utilize concepts and techniques learned in Physics, Mathematics, and Chemistry courses including the essentials of mechanics, electromagnetic theory, quantum mechanics, and statistical mechanics (single, multivariable, and vector) calculus, ordinary differential equations, linear partial differential equations, linear algebra, and complex analysis

PSO6: Apply physical and mathematical principles to describe and explain phenomena in the fundamental and applied sciences.

PSO7: Obtain necessary and desired information from research books, journals, and people to solve problems.

Course Outcome

Semester- Ist

Course: Mathematical Methods of Physics-I

CO1: This subject provides knowledge about various mathematical tools employed to study physics problems.

CO2: Student will study beta and gamma functions,their evaluation and relations.

CO3: The students will study Legendre Polynomial and their properties.

CO4: This subject describes the special functions (Bessel functions of first and second kind,) and their recurrence relations.

CO5: The students will be able to use complex numbers and variables, Cauchy-Riemann conditions, Cauchy's Integral formula, Laurent expansion, Taylor's series Singularities, Calculus of residues.

CO6: This subject provides information about tensor and its basic operations

CO7: Under Tensors student will study different types of tensors (Contra variant and covariant) tensors, Application of tensors in coordinate transformations.

CO8: Student will study numerical methods (bisection method, Newton method etc) to solve set of equations.

Course: Classical Mechanics

CO1: Define and understand basic mechanical concepts related to the momentum of system of particles; angular momentum of system of particles; energy of the particles; the work of internal forces and internal potential energy; work of external forces and external potential energy; motion relative to the center of mass (momentum, angular momentum, kinetic energy) discrete and continuous mechanical systems.

CO2: Describe and understand Virtual work and D'Alembert's principle.

CO3: The Lagrange equations for holonomic and nonholonomic systems and Hamiltonian approaches in classical mechanics.

CO4: Describe and understand Hamilton's equations of motion equations for system like simple and compound pendulum, Harmonic oscillator, Motion of particle in central force field etc.

CO5: Describe and understand the statics of rigid bodies; tensor of inertia; principal moments of inertia; Euler equations of motion; motion of the Earth; precession; Euler angles.

CO6: Kinematics and Dynamics of rigid body in detail and ideas regarding Euler's equations of motion.

CO7: Poisson brackets; canonical transformation, Poisson bracket relations between components of linear and angular momenta and relative problems.

Course: Classical Electrodynamics

CO1: Understand basic about the Electrostatics problems

CO2: Develop the Ability to solve the problems regarding electric field.

CO3: Observe the effect of boundary conditions like Dirichlet and Neumann boundary conditions, Uniqueness theorem

CO 4: Observe the effect of Boundary value problems in electrostatics and its applications.

CO 5: Understand the operation of Green's function and solution of Poisson equation

CO 6: Understand the problem of Dirac delta function in spherical polar coordinates

CO 7: Formulate and employ the Equations of electrostatic field in a dielectric, Bound charge densities.

CO 8: Acquire knowledge on Magnetostatics and solve the problems like Bio savart law and amperes law.

CO 9: Develop knowledge on Time varying fields.

Course: Nuclear and Particle Physics

CO 1: This course has led the students to understand interaction of various types of radiation with matter which they observe in their daily life. It's easy for them now to relate the theory to practical. Students are also able to understand the detecting methods and instruments for different types of charged and neutral particles.

CO 2: This gives the detail study of alpha decay process and shows how alpha spectroscopy can help us to understand nuclear structure.

CO 3: This gives the detail study of beta decay process and various selection rules for process.

CO 4: In this students will learn the gamma decay process and their energetic and also the selection rules.

CO 5: Students will learn about the classification and properties of elementary particles. Also learn about the properties of fundamental forces.

CO 6: This gives the information about types of interactions and conservation of charge, parity and time reversal in these processes.

CO 7: In this students learn about discovery and properties of Pions and their exchange interactions.

CO 8: In this students learn about k-mesons about their discovery and decay modes and also about hyperons.

CO 9: This gives the study of quark model and multiplets and theories of fundamental interactions

Course: Electronics-I

CO1: Understand basic construction, equivalent circuits and characteristics of basic electronics devices.

CO2: Develop the Ability to understand the design and working of BJT / FET amplifiers.

CO3: Observe the effect of negative feedback on different parameters of an Amplifier and different types of negative feedback topologies.

CO4: Observe the effect of positive feedback and able to design and working of different Oscillators using Transistors

CO5: Understand the operation and design of multistage amplifier for a given specification.

CO6: Understand number representation and conversion between different representation in digital electronic circuits

CO7: Formulate and employ a Karnaugh Map to reduce Boolean expressions and logic circuits to their simplest forms.

CO8: Acquire knowledge on basic digital electronic gates

CO9: Develop knowledge on design trade-offs in various digital electronic families with a view towards reduced power consumption

CO10: Design and Analyse various combinational and Sequential logic circuits.

CO11:Learn about Counters and Shift Registers

Semester II

Course: Mathematical Methods of Physics– II

CO1: To analyse the exponential orders functions, Laplace transform, Inverse Laplace transforms and its properties.

CO2: Use of Laplace transforms for the solution of differential equations.

CO3: Distinguish the Hermite polynomials, Rodrigue's formula and solution of Hermite differential equation.

CO4:Analysethe different series (Fourier, Sine and cosine series).

CO5: Examine the Fourier integral theorem, Fourier transform and Parseveall's identity for Fourier series and transforms.

CO6: To analyse the Laguerre differential equation, solution and their properties.

CO7: Study of the D'Alembert and Fourier series solutions, Vibrations of a freely hanging chain and rectangular membrane.

CO8: Compare the discrete groups, Permutation groups, Lie group and group postulates.

Course: Advanced Classical Mechanics and Electrodynamics

CO 1: This subject extrapolates the knowledge about Hamilton-Jacoby theory which includes Hamilton-Jacobi equations for Hamilton principal and characteristic functions. Problems: Harmonic oscillator using Hamilton-Jacobi formulation and through action-angle variables

CO2: Student will study Special theory of relativity which helps to apply the space time correlation.

CO3: The students will study covariant formulation of four space and representation of various vectors in four-space and will study how it apply on covariant formulation of Force, momentum and energy equation in Minkowski space. By this students will able to solve the Applications of relativistic formulation in the study of motion under constant force and relativistic one dimensional harmonic oscillator.

CO4: This subject describes Small oscillations which includes Formulation of problem, Eigen value equation, Frequencies of free vibration and normal modes. By this students apply this to solve the problem Normal mode frequencies and eigen vectors of diatomic and linear tri-atomic molecule

CO5: The students will study Continuous systems and fields. By this students will able to examine the CO concept Stress-energy tensor and conservation laws, Hamiltonian formulation

CO6: This subject provides information about Maxwell inhomogeneous equations and conservation laws

CO7: Student will study Electromagnetic waves and wave propagation. By this students will able to recognize the concept of Electric and Magnetic field.

CO8: Student will study the Polarization concept by this they will understand the concept of reflection of light and use this knowledge how Waves in a conducting medium and skin depth.

Course: Quantum Mechanics

CO 1: Solution of the Schrodinger equation for the hydrogen atom that used for solve to finding the Eigen value also find the Spherical harmonics, Radial solutions

CO 2: Interpret of Rigid rotator for hydrogen atom that understand the behavior of a particle in free and fixed state.

CO 3: Solution for three dimensional square well potential to Generalize the important properties of tunneling effect and Study of Linear vector spaces to understand the analysis ability

CO 4: Study of Hermitian, unitary and projection operators and commutators to conclude how the wave function changed when operator operated on wavefunction.

CO 5: Study the Change of basis-Representation theory to examine the different representations of wave function

CO 6: Study Generalized uncertainty principle to examine the position and momentum of particle.

CO 7: Study Density matrix. Schrodinger, Heisenberg and interaction pictures to test the knowledge of time dependant and time independent wave functions and wave operators.

CO 8: Study the Symmetry and conservation laws to generalise the principle of conservation in space and wave function

CO 9: Examine the Solution of Simple harmonic oscillator and its properties in three dimensional.

CO 10: Matrix mechanical treatment of linear harmonic oscillator and its representations and solution in terms of matrix to examine the concept of energy Eigen values.

CO 11: Interpret creation and annihilation operators to understand how to increase or decrease in wavefunction.

CO 12: Interpret Matrix representations of J2,J-z, J+,J-; to understand the concept of spin of particle.

CO 13: AnalyseClebsch-Gordon coefficients and their properties and how to find the solution

CO 14: Addition of spin and orbital momentum to conclude the different concept of momentum.

CO 15: Determination of C.G. coefficients for ½+1/2 and ½+1 and Wigner-Eckart theorem to understand the addition of coefficients.

Course: Statistical Mechanics

CO 1: Students will get an idea for the macroscopic and microscopic states so that they will able to examine the connection between statistics and thermodynamics

CO 2: Students will analyse the methods of Ensemble and their representation.

CO 3: They will learn about Phase space so that they conclude the Liouville's theorem

CO 4: Students will analyse about the various methods of Micro canonical ensemble, Gibb's micro canonical distribution

CO 5: Students will test methods for Entropy of an ideal gas, Gibb's paradox, Sackur-Tetrode equation to conclude the concept of Entropy.

CO 6: Students will study methods to find the Partition function in phase space and how it will be helpful to evaluate on canonical ensembles

CO 7: Students will study about Grand canonical ensemble and its thermodynamics an apply it on Energy and Density fluctuations

CO 8: Generalize the Postulates of Quantum Statistical Mechanics and Density matrix

CO 9: Students will study Different ensembles in quantum statistical mechanics for different Ideal gases and apply it on ideal Fermi Gas, Ideal Bose Gas and Boltzman Gas

CO 10: Distribution function for different ideal gases and density of states for an ideal gas.

CO 11: Equation of state of an Ideal Fermi Gas and Degeneracy and analyse what is the Fermi energy at T=0 and at low temperatures

CO 12: Thermodynamics of an ideal Fermi gas and Free electron gas in metal

CO 13: Student will study about Bose Gas so that they extrapolate the concept of Equation of state of an Ideal Bose gas, Bose-Einstein condensation, Thermodynamics of an Ideal Bose gas and Black body radiation (The photon gas)

CO 14: Students will study about Phase transition so that they will able to interpret first and second order phase transition: the ClausiusClaperyon equation

CO 15: Students will study the Ising model in zeroth approximation, random walk and brownian motion and how it apply on Fick's diffusion formula, Fick law and Einstein relation.

Course:Electronics– II

CO1: Comparethe tuned primary and secondary circuits and how they are helpful in making amplifiers.

CO2: Differentiate betweenvarious power amplifiers (Class A, Class B and their Push pull configurations).

CO3: Analysethe need of Modulation and generation of AM, FM and SSB.

CO4: To study the operational amplifier, its classification and lay out of practical operational amplifiers

CO5: To study DC and AC characteristics of op-amp and how CMRR is calculate.

CO6: Demonstrate the various applications of op-amp (Adder,subtractor, Instrumentation amplifier, Log, antilog amplifier, Differentiator and integrator).

CO7: Distinguish the Square wave, TriangularwaveandSine wave generator.

CO8: To study the use of regulator and design of series regulator, IC regulators and 723 general purpose regulator.

CO9: To study about 555 timer circuit and compare its monostable and astable mode.

Semester III

Course: Condensed Matter Physics-I

CO1: Study of Bragg's Law of Diffraction to examine the interplaner spacing (d-spacing) of a crystal that used for identification and characterization purposes.

CO2: Determination of Reciprocal lattice and study of Brillion Zones to understand the important properties and behavior of the various crystal systems.

CO3: Analyse of structure factor and form factor which is a mathematical description of how a material scatters incident radiation.

CO4: Study of lattice vibrations of mono-atomic and diatomic linear lattices to examine the role of Phonon in many of the physical properties of solids, such as the thermal conductivity and the electrical conductivity.

CO5: Study of free electron gas model in one dimension and three dimensions to interpret the behavior of charge carriers in a metallic solid.

CO6: Use of the static properties of metals that are useful in various technological applications.

CO7: Study of the transport properties of metals such as Sommerfeld theory, Hall Effect and thermal conductivity.

CO8: Study of the synthesis, types and properties and classify various types of nano materials which offers the potential for new and faster kinds of computers, more efficient power sources and life-saving medical treatments.

CO9: Study of the various optical properties of crystals to determination the phenomenon of interaction of light with these materials.

CO10: Have knowledge about the physics of semiconductor materials.

CO11: Analyze the characteristics and theories in semiconductor materials in terms of crystal structures, charge carriers and energy bands.

CO12: Describe band structures of semiconductors.

CO13: Demonstrate the physical characteristics such as electronic structure and optical and transport properties, and current-voltage characteristics of semiconductors.

CO14: Explain how to find the Fermi energy level and carrier density in n-type and p-type semiconductors.

Course: Nuclear Physics

CO1. In this students will analyse the nuclear properties like nuclear radius, mass and abundance of nuclides, binding energy and semi-empirical formula and relation between angular momentum and parity. Also the methods of calculating such properties.

CO2. The students learn about the spin and orbital contribution to magnetic moment and methods of measuring these terms.

CO3. This tells about the properties of nuclear force and use of various models that tells about the interaction between nucleons.

CO4. In this students will study the various models that examine the detailed information about the nuclear structure.

CO5. The course is such designed to teach students about various types of nuclear reactions and classify their energetic.

CO6. Students will learn about the neutron sources and detectors and also the methods of slowing down the neutrons.

CO7.This discusses the various types of nuclear reactions and their properties.

CO8. Students analyse various methods of accelerating various types of particles to perform scattering experiments.

Course: Advanced Quantum Mechanics

CO1:- Understand Indistinguishability principle, Symmetry and antisymmetry of wave functions, Exchange operators,

CO2: Develop the Ability to solve Scattering problems of identical particles. Example to solve the: Hydrogen molecule, Spin statistic theorem, Slater determinant

CO3: Obtained the solution of wave function like Rayleigh Ritz variational method for ground & excited States, for example:- Ground state energy of hydrogen, helium and harmonic oscillator,

CO4: To solve the problems of Time Independent Perturbation Theory. First order and second order perturbation theory for nondegenerate case; Problems: Anharmonic oscillator, He-atom; Degenerate perturbation theory, Problems: Stark effect, Zeeman effect.

CO5: To solve the problems of Transition probability for constant and harmonic perturbation, Golden rule, Induced absorption and emission, Einstein coefficients; Problems: Radiative transitions.

CO6: Understand WKB Method for solve the problems of potential barrier

CO7: Formulate and implement of Collision Theory

CO8: Acquire knowledge on Partial wave analysis

CO9: Develop knowledge on different solutions related to Relativistic Quantum Mechanics:

Course:Computer Simulation in Physics

CO1: Students will get an idea for the Evaluation of polynomials and Root finding: Evaluation of truncated series: Fundamental iterative scheme.

CO2: Students will use the methods to find Solution of nonlinear equations (Newton-Raphson method, Secant method, Newton method for two dimensions).

CO3: They will solve Iterative methods for systems of Linear equations (Jacobi method, Gauss Seidal Iteration.)

CO4: Students will differentiate about Interpolation and Approximation.

CO5: Students will analyse methods for Linear and nonlinear curve fitting: Least squares approximation, Data linearization, and Piecewise and Cubic Spline interpolation.

CO6: Students will use mathematical tools like Differentiation and Integration using forward, backward and central difference operators; Error analysis, Trapezoidal and Simpson rules; Two and three dimensional integration for various problems

CO7: Students will study methods to solve solutions of Ordinary Differential equation (Taylor method, Runge-Kutta method and Predictor-Corrector method).

CO8: Students will study about Pseudo random numbers and their generation, Monte-Carlo integration.

CO9: They will examine Simulation of Physics Problems and Algorithm development.

Semester: IV

Course: Condensed Matter Physics-I

CO 1: Analyze various properties of different types of magnetic materials.

CO 2: Compare the behavior of Magnetization at absolute zero and its temperature dependence.

CO 3: Differentiate Hard and soft magnetic materials.

CO 4: Determine magnetic resonance and dielectric absorption of ferroelectric materials

CO 5: Examine traditional and high Tc superconductors, Meissner effect, Heat capacity, Energy gap and Isotope effect.

CO 6: Extrapolate the knowledge about basic ideas of BCS theory.

CO 7: Analyse macroscopic quantum interference, SQUIDS and its applications.

CO 8: Differentiate Plasmons, polaritons, polarons and Lattice defects

Course: Advanced Electronics

CO 1: To study the need of Analog to digital and digital to analog converter. CO CO 2:-Discuss various methods of generation of (A to D) and (D to A) signal and evaluate their performance.

CO 3: To study the use of Micro-Processor in daily life and block diagram of 8085 microprocessor.

CO 4: To categories the various memory in term of RAM and ROM and compare (Bipolar ROM, MOS ROM, Static RAM, Dynamic RAM).

CO 5: To study the interfacing concept and demonstrate the interfacing of Input device, output devices and Memory segment with 8085.

CO 6: To classify various types of instructions (Data transfer, Arithmetic, Logic, Branch, Rotote and compare) and their format in 8085.

CO 7: To study the Looping, Counting; and indexing concept and differentiate higher bit addition and data transfer instruction from lower bit instruction.

CO 8: To study about the Stack, Subroutine, conditional Call and Return Instructions of 8085.

CO 9: Classify various higher bits processors.

Course: Radiation Physics

CO1: Demonstrate a knowledge of fundamental aspects of Energy distribution of thermal neutrons, Effective cross section of thermal neutron and slowing down of reactor neutrons.

CO2: Calculate transport mean free path and scattering cross-section and Slowing down time, Resonance escape probability

CO3: Examine Neutron cycle and multiplication factor Neutron leakage and critical size, Nuclear reactors and their classification

CO4: Evaluate thermal Neutron diffusion, Neutron diffusion equation, Thermal diffusion length, Exponential pile, Diffusion length of a fuel-moderator mixture, Fast neutron diffusion and Fermi age equation, Correction for neutron capture

CO5: Analyse nuclear spectrometric data, Measurements of nuclear energy levels, spins, parities and moments

CO6: Calculation of g-factors and hyperfine fields.

CO7: Categorise experimental techniques used (or developed) for nuclear physics purposes and discuss their influence on development of new technologies

CO8: Apply radiation physics applications in medical diagnostics and therapy, energetics, geology, archaeology.

Course: Electronics Communication System

CO1: What is the use of modulation during communication and various types of Noise present during transmission.

CO: To study the AM, its frequency spectrum and calculate its power relations. Design of AM generation and receiver circuit.

CO3: To study various generation and receiver circuit of (SSB, DSBSC, Pilot carrier, ISB and VSB) and compare their output

CO4: To study the use of FM and evaluate its mathematical representation and frequency spectrum.

CO5:Demonstrate the transmission and receiver circuit of FM.

CO6:To study the basic principle of Radar and compare different Radar system (Pulsed radar, Moving target indication, CW Doppler radar, frequency modulated CW radar and phased array radars.

CO7: To study about various pulse communication modulation and compare the (Pulse amplitude modulation (PAM), pulse width modulation (PWM), pulse position modulation (PPM) and pulse code modulation (PCM).

CO8: Differentiate between Frequency division multiplexing and Time division multiplexing and design of different Communication link system (Fiber optics, microwave, tropospheric and, submarine cables.

CO9:Demonstrate the Frequency modulated microwave radio system and examine path characteristics and system gain

CO10:Study of optical fibers, optical sources, light detectors and their classification. Calculate losses occur in optical fiber cables.