DEPARTMENT OF PHYSICS, UNIVERSITY OF JAMMU, JAMMU

Programme Outcomes (POs) : MSc. Physics

PO1 M.Sc. Physics programme lays emphasis on providing students the in depth knowledge of core courses, creative laboratory courses, elective, optional and add on courses.

PO2 Enable students to develop insights into the techniques used in current fields and allow comprehensive experience of specialized research areas such as Condensed matter physics, Electronics, Nuclear and Particle physics and Nuclear Theory.

PO3 After completion of the M.Sc. programme, the students are well equipped to choose their branch of study for higher studies in Physics.

PO4 The programme also aims at equipping future teachers (at college as well school level) with a thorough grounding in the subject.

PO5 M.Sc. Physics programme also aims at providing a training ground for the mind of the students who wish to enter into other fields of work with logical thinking and critical attitude.

Programme Specific Outcomes (PSOs) : MSc. Physics

PSO1 Good exposure to understand the basic concepts of physics particularly concepts in mathematical physics, classical mechanics, quantum mechanics, statistical mechanics, Electronics, Electrodynamics and plasma physics, condensed matter physics, Nuclear and Particle Physics, Nuclear Theory.

PSO2 Understand basics of computational physics including numerical methods and programming practices.

PSO3 Provoking practical skill and hands on training on experiments in electronics, condensed matter physics and Nuclear and Particle physics.

PSO4 Research oriented practice in both theory and experimental physics.

PSO5 The career opportunities after M. Sc. programme include doing research in leading national and international universities, laboratories and research institutes, teaching at College and school levels. Some may engage in non academic jobs like officers and national securities.

Course Outcomes (Cos): Semester I

COs of the course "PSPHTC101-Mathematical Physics"

CO1 To have a good grasp of the basic elements of complex analysis, including the important integral theorems.

CO2 To determine the residues of a complex function and use the residue theorem and contour integration to compute certain types of integrals.

CO3 To be able to determine eigen values and eigenvectors and solve eigen value problems.

CO4 To understand the concepts of tensor variables and usefulness of tensor analysis.

CO5 To be able to identify and apply special mathematical functions appropriately in solving problems in physics and model real situations using different differential equations.

CO6 To learn the connection between Fourier series and integral transforms (Fourier and Laplace) and be able to use these integral transforms to solve mathematical problems relevant to the physical sciences.

COs of the course "PSPHTC102- Classical Mechanics"

CO1 To understand the Lagrangian and Hamiltonian formulations for discrete systems and their applications.

CO2 Get familiarize with the Canonical transformations and brackets.

CO3 Get familiarize with Hamilton-Jacobi equation and its applications.

COs of the course "PSPHTC103- Quantum Mechanics I"

CO1 To understand the general formalism of Quantum Mechanics, Linear vector spaces, Hilbert space, concepts of basis and operators, bra and ket notations.

CO2 Applications of Schrodinger equation to different potential wells.

CO3 Introduction to matrix formulation of quantum mechanics.

CO4 Introduction to quantum theory of angular momentum and Clebsch-Gordan coefficients.

COs of the course "PSPHTC104- Integrated Electronics I"

CO1 To enhance comprehension capabilities of students through understanding of semiconductor devices.

CO2 To understand the basic properties of semiconductors including band gap, charge carrier concentration, doping and charge carrier injection/excitation.

CO3 To understand the physical construction, working and operational characteristics of semiconductor devices including photo conductors, p-n junctions and BJTs.

CO4 To comprehend the ideas about the digital electronics.

CO5 To understand the working of various combinational logic circuits.

CO6 To understand the working of various sequential logic circuits including flip Flops, registers and counters in detail.

COs of the course "PSPHPC105- Laboratory Practicals"

CO1 To have practical knowledge of various optics experiments e.g. Diffraction at straight edge, Cauchy's constants and lasers.

CO2 To have practical knowledge of atomic and molecular, solid state and nuclear physics experiments e.g., B.H. Curve, Electron spin resonance, Four Probe, Hall effect, e/m by helical method, etc.

CO3 To develop experimental skills by performing electronics based experiments like Multivibrator, diode characteristics, Cathode Ray Oscilloscope, Hybrid Parameters, Unijunction Transistor, RC Coupled amplifier, logic gates , etc

Course Outcomes (Cos): Semester II

COs of the course "PSPHTC201- Quantum Mechanics II"

CO1 To learn about applications of Quantum Mechanics, time independent Perturbation theory and its applications to Harmonic oscillator, Stark effect and Zeeman effect.

CO2 To grasp the concepts of time dependent perturbation theory and its applications.

CO3 Introduction to dipole approximation and its application to ground state of isotropic Harmonic oscillator.

CO4 Introduction to variational technique and its application to ground state of Helium atom.

CO5 Introduction to WKB approximation and its applications to bound state problems and α-decay.

CO6 To learn about scattering theory, partial wave analysis and their applications to perfectly rigid sphere and square well potential.

CO7 To learn the method of Green's function and Born approximation and their applications to square well, Yukawa and screen coulomb potential.

COs of the course "PSPHTC202- Statistical Mechanics"

CO1 To explain statistical physics and thermodynamics as logical consequences of the postulates of statistical mechanics.

CO2 To learn the fundamental differences between quantum and classical statistics and learn about statistical distribution laws.

CO3 To study important examples of Ideal Bose systems and Fermi Systems.

CO4 To understand Phase transitions, Landau theory and Ising model.

CO5 To understand fluctuations and Langevin theory of Brownian motion.

COs of the course "PSPHTC203 - Integrated Electronics – II"

CO1 To understand the fundamentals and working of operational amplifiers.

CO2 To comprehend the characteristics of operational amplifiers and its applications.

CO3 To introduce the applications of linear integrated circuits & digital converters.

CO4 To know the operations of various analog and digital circuits.

CO5 To understand the fundamentals of antenna, radio receiver and Television.

CO6 To understand the concepts of microprocessor and memory devices.

COs of the course "PSPHTC206 - Electrodynamics and Plasma Physics "

CO1 To have a clear understanding of Maxwell's equations and electromagnetic waves.

CO2 Applications of Maxwell equations to the propagation of electromagnetic waves in metals, dielectrics and plasma field

CO3 To understand the special theory of relativity by including the relativistic electrodynamics.

CO4 To understand the complex physical phenomenon observed in Plasma.

COs of the course "PSPHPC205- Laboratory Practicals"

CO1 To have practical knowledge of various optics experiments e.g. diffraction at straight edge, Cauchy's constants and Lasers.

CO2 To have practical knowledge of atomic and molecular, solid state experiments e.g. B.H. Curve, Electron spin resonance, Four Probe, Hall effect, e/m by helical method, etc.

CO3 To develop experimental skills by performing electronics based experiments like Multivibrator, diode characteristics, Cathode Ray Oscilloscope, Hybrid Parameters, Unijunction Transistor, RC Coupled amplifier, logic gates , etc

CO3 Experimental skill development by performing electronics based experiments like Multivibrator, diode characteristics, CRO, H-parameters, UJT, RC Coupled amplifier, logic gates , etc.

Course Outcomes (Cos): Semester III

COs of the course "PSPHTC301 - Condensed Matter Physics (General)"

CO1 To expose the students to the basics of crystal physics.

CO2 To demonstrate the principle and hardware components of all available conventional and modern methods of diffraction.

CO3 To make them understand the existence of disorder/defects in crystalline materials and their role in physico-chemical properties.

CO4 To introduce magnetic class of materials, the theories, classification of magnetic materials and existence of magnetism duly supported by experimentation.

COs of the course "PSPHTC302-Nuclear and Particle Physics (General)"

CO1 An important outcome of the course is to develop an understanding of core physics at deeper levels, each stage revealing new phenomena and greater insight into the behaviour of matter and radiation.

CO2 Study of nuclear reactions and nuclear models is of paramount importance from the point of view of understanding the nuclear reaction mechanism and nuclear dynamics for the students.

COs of the course "PSPHTE303 – Condensed Matter Physics (Special)"

CO1 Discussion of lattice vibrations and thermal properties of solids.

CO2 To grasp the concept of phonons and interaction of electron with phonon.

CO3 To be able to explain low temperature phenomenon like superconductivity, BCS theory and elementary idea of high temperature superconductivity.

CO4 To understand the optical properties of metals and non-metals.

CO5 To understand Mossbauer effects of solids and its applications.

COs of the course "PSPHTE304 -Nuclear and Particle Physics (Special) "

CO1 Students will know about Symmetries and how they are useful in High Energy Physics.

CO2 Students get understanding of SU(2) Symmetry breaking , SU(3) generators, Quark model in detail

CO3 They also get concepts of Heavy Meson spectroscopy, Zweig rule , Isospin , Parity etc

CO4 Students study about various Resonances and also get understanding and usage of Feynman Diagrams and TOY theory and Bhabha Scattering.

COs of the course "PSPHTE305 –Nuclear Theory (Special I) "

CO1 Group Theory describes the mathematics underlying the concept of symmetry.

CO2 Describes how Conservation laws of physics are related to the symmetry of physical laws under various transformations.

CO3 Describes the Groups, subgroups, cyclic groups, normal subgroups, quotient groups, simple groups.

CO4 To understand the Lagrange's theorem, Cayley's theorem and its generalizations.

CO5 To analyse Group homomorphism, isomorphism, automorphism, and its applications.

CO6 To identify whether a given group is cyclic and find a generator for a subgroup of a given order.

CO7 To understand the reducible and irreducible groups.

CO8 Analysis of Orthogonal and Unitary Symmetric groups having crucial role in particle physics.

COs of the course "PSPHTE306-Electronics (Special I)"

CO1 Focus on analog communication systems.

CO2 Knowledge of different types of Radar and Satellite systems as well as on Computer Networking.

CO3 Placement opportunities in the electronic communication industry.

COs of the course "PSPHTO307-Material Physics (Open)"

CO1 To have basic understanding of the crystal physics.

CO2 To have basic understanding of the materials of technological importance.

CO3 To have a knowledge about Magnetic Materials.

CO4 To have basic understanding how diffraction takes place in crystalline materials.

CO5 To have basic understanding of Superconductivity and its applications.

CO6 To have knowledge about applications of nanomaterials.

COs of the course "PSPHPE308-Practicals in Condensed Matter Physics"

CO1 To introduce the concept of sample alignment for performing X-ray diffraction experiments for the analysis of single crystals and polycrystalline materials. The students will be offered practical training to know how the reciprocal lattice is generated from the direct lattice.

CO2 Training the students for carrying out the experimental work in the field of crystal"s physics and to integrate the concepts with experimentation.

CO3 The students would be prepared to integrate the theoretical and experimental concepts for utilization of this knowledge for practical/industrial applications.

COs of the course "PSPHPE309-Practicals in Nuclear and Particle Physics"

CO1 Students will have an exposure to work pertaining to High Energy Physics Experiments.

CO2 Students will be trained in handling the simulated data by using various experimental techniques /computer programming.

CO3 Students by performing various detector related experiments will enhance their exposure more if they join research in nuclear and particle physics.

COs of the course "PSPHPE310-Practicals in Nuclear Theory"

CO1 Demonstrate understanding of computational numerical methods and how they are used to obtain approximate solution to problems that cannot be solved analytically.

CO2 Familiarize with numerical integration, differentiation, numerical solution of differential equations, boundary value problems and of matrix problems.

CO3 Analyse and evaluate the accuracy of common numerical methods.

CO4 Devise numerical algorithms for theoretical models in programming languages.

CO5 The acquired skill will enable the students to write subroutines and subprograms in FORTRAN/C/ PYTHAN language and to work and understand existing codes for solving many body problems in Nuclear theory.

CO6 Gain necessary knowledge for tackling a broader spectrum of research problems.

COs of the course "PSPHPE311-Practicals in Electronics"

CO1 Understand basic analog and digital circuits and their applications.

CO2 Understand the basic concept of communication system.

CO3 Understand AM, FM and demodulation.

CO4 Understand antenna and radio wave propagation used in communication system.

Course Outcomes (Cos): Semester IV

COs of the course "PSPHTE401-Condensed Matter Physics (Special I)

CO1 Discussion on theoretical concept of crystal growth and different techniques in the laboratory for growing crystals.

CO2 Various types of defects observed in a solid/crystal. Calculation of defect density by different techniques.

CO3 Various laws associated with diffusion phenomenon under steady state and non steady state condition.

CO4 To understand relationship between macroscopic quantity (dielectric constant) with microscopic quantity (polarization), phenomenon in ferroelectrics.

CO5 Understanding the behavior of electron in solids and theories proposed by Drude, Matthiesen and Wiedemann-Franz.

COs of the course "PSPHTE402-Nuclear and Particle Physics (Special I)"

CO1 This course deals with Radiation through matter , where they understand Bethe-Bloch Formula , Bremsstrahlung process and Cerenkov Radiation etc.

CO2 This course is designed for the students to understand both Linear and Orbital Accelerators and finally understanding of Collider Experiments.

CO3 As Particle Detectors are main tools of HEP Experiments, this course gives clarity of various detectors like Emulsions , Bubble Chambers , GM counters etc

CO4 Also this course gives concepts of Gaseous Detectors, and advanced detectors like MWPC, TPC. Also it gives clarity of most important Energy measurement detectors like Calorimeters.

COs of the course "PSPHTE403-Physics of Liquid Crystals (Elective)"

CO1 To have a knowledge about liquid crystals and how liquid crystal is different from isotropic liquid.

CO2 To have basic understanding about various mesophases.

CO3 To understand how Reentrant phenomena in liquid crystals takes place.

CO4 To have a knowledge about pressure induced mesomorphism.

CO5 To have basic understanding regarding Phase identification with optical polarizing microscopy and Differential Scanning Calorimetry.

CO6 To have a knowledge about structure of lyotropic liquid crystal phases and biological membranes.

CO7 To have basic understanding how Liquid crystals behave in electric and magnetic fields.

COs of the course "PSPHTE404-Quantum Electrodynamics (Elective)

CO1 Quantum electrodynamics (QED) is the relativistic quantum field theory of electrodynamics which describes how light and matter interacts.

CO2 QED mathematically describes all phenomena involving electrically charged particles interacting by means of exchange of photons.

CO3 QED represents the quantum counterpart of classical electromagnetism giving a complete account of matter and light interaction.

CO4 Understanding the Klein Gordan equation for describing various quantum mechanical systems.

CO5 To get information about the spin of Klein Gordan particle.

CO6 In the context of quantum field theory, the Dirac equation is interpreted to describe quantum fields corresponding to spin-1/2 particles.

CO7 QED has served as the model and template for all subsequent quantum field theories like quantum chromodynamics.

CO8 Understanding hole theory and charge conjugation.

COs of the course "PSPHTE405-Condensed Matter Physics (Special II)"

CO1 To demonstrate Experimental Methods of Observing Dislocations in solids and their characterization using topographic techniques.

CO2 To introduce the Experimental Techniques for Single Crystal Data Collection by using visual estimation technique and CCD camera based methodology

CO3 Concepts of Surface and Interface Physics are required to be introduced to enable the students to get tuned to the merger of crystallography and materials science as one unit.

CO4 Introduction of the Science of small i.e., nanotechnology, its historical exposition, developmental stages of this subject to potential applications. To introduce the concept of SWNT and MWNTs, their preparation techniques and purification methodology.

COs of the course "PSPHTE406-Nuclear and Particle Physics (Special II)"

CO1 This course aims to consolidate the understanding of students about weak interactions which are responsible for beta decay.

CO2 Students will also grasp the concept about neutrino masses and neutrino oscillations.

CO3 A number of recent topics like Quantum Chromodynamics (QCD), Quark Gluon Plasma (QGP), quark quark interactions etc will broaden the perspective of the students regarding strong interactions and their mediating particles.

CO4 Students will also understand the concepts related to Weinberg Salam SU(2)xU(1) Model, spontaneous symmetry breaking, Higg's mechanism, Grand Unification Theory etc.

COs of the course "PSPHTE407-Nuclear Theory (Special II)"

CO1 Understand the introductory principles of quantum field theory.

CO2 Describe second quantization and related concepts.

CO3 Understand the method of Brillouin–Wigner Perturbation and the expansion of the scattering matrix.

CO4 Understand Wick Contractions, Feynman rules and draw Feynman diagrams for different interactions.

CO5 Grasp the concept of density matrix and its use in solving many body problems.

CO6 Introduction to the theoretical models for solving many body problems in Nuclear Theory.

CO7 Express observables in field theory in terms of annihilation and creation operators.

CO8 Introduction to BCS pairing theory for nuclei and its applications.

CO9 Provides the foundation for more advanced studies in quantum field theory.

CO10 Provides an opportunity to explore the possible research in nuclear theory.

COs of the course "PSPHTE408-Electronics (Special II)"

CO1 To train the students in the area of electronic communication skills.

CO2 The students will be able to contribute in digital and analog communication systems.

CO3 Placement opportunities in the electronic communication industry particularly mobile communication systems.

COs of the course "PSPHTO409-Modern Physics (Open)"

CO1 General introduction to Relativity theory and concept of frame of reference.

CO2 Understanding of the postulates of Special theory of relativity and be able to do the Lorentz transformations

CO3 Workout Time Dilation and Length contraction for the various velocities relative to velocity of Light.

CO4 Know the concept of relativistic mass and derive the mass and energy relation, energy momentum relation,

CO5 Knowledge about the phenomenon signifying particle nature and wave nature, concept of matter waves and De-Broglie relation and Uncertainty principle

CO6 Knowledge about the concept of the Electron Microscope, wave packet, wave function and postulates of wave mechanics.

CO7 Should be able to solve Schrödinger's wave equation for a particle in a box.

CO8 Know the Atomic structure and Rutherford atomic model.

CO9 Have information about the Hydrogen atom spectrum, Bohr's atom model and demonstrate how it explains the hydrogen line spectrum;

C10 Describe the Franck-Hertz experiment, Features of Alkali spectra, vector atom model and concept of quantum numbers.

CO11 Knowledge about nucleus, its properties, constituents, stability and nuclear forces.

CO12 Have information on radioactivity and various radioactive decays and their use like radioactive dating.

CO13 Introduction to the fundamental particles and interactions, their classification.

CO14 Introduction to the Standard Model and the GUT theory.

CO15 To be able to describe production, properties and applications of X-rays.

CO16 Continuous and characteristic X-ray spectra and Moseley's Law.

CO17 To appreciate the discovery of Cosmic rays and various type of cosmic showers.

CO18 Have general information on the properties of the cosmic rays and their composition.

CO19 To be able to differentiate muons and pions and to be able to calculate mean life of muon.

COs of the course "PSPHPE410-Project work in Condensed Matter Physics"

CO1 16 weeks experimental project based on the state-of-the art DST-XRD national facility, conventional film based X-ray techniques and other existing instruments like IR, UV, NMR, DSC, etc.

CO2 The project work is aimed at to make the students orient towards research in the most applied discipline of condensed matter physics.

CO3 To provide the trained human resource for research and industrial job opportunities.

COs of the course "PSPHPE411-Project work in Nuclear and Particle Physics"

CO1 Projects have been designed so as to provide exposure to students in various experimental aspects of High Energy Experiments.

CO2 This department is part of International Collaborative Experiments like ALICE experiment at CERN, Geneva and NOVA experiment at Fermilab, USA. So the Projects are designed to train them in few aspects of these International Experiments.

COs of the course "PSPHPE412-Project work in Nuclear Theory"

CO1 To familiarize with the research journals and databases in Nuclear Physics.

CO2 Gain a general comprehension of nuclear models.

CO3 To train the students for literature survey and extraction of experimental data for various nuclei of the nuclear periodic table.

CO4 Write subroutines and subprograms and execute the existing codes for theoretical calculation of various properties of nuclei.

CO5 Focus on how to work in a group and write a scientific report in the form of P.G. dissertation.

CO6 Learn to make power point presentation for oral presentation of their project work.

CO7 Explore the current research problems for pursuing further research in nuclear theory.

COs of the course "PSPHPE413-Project work in Electronics"

CO1 Hands on training on technology related to various electronic devices and systems.

CO2 Knowledge of microprocessor and microcontroller based electronics.

CO3 Placement opportunities in the Science and technology initiatives of the society and country.