Program Specific Outcomes: M.Sc. (Physics)

After the successful completion of the program, the student will be able to do the following

PSO 1. The Master of Science in Physics program provides the detailed functional knowledge of the fundamental theoretical concepts and experimental methods of physics. It will help the candidate to enhance her general competence, and analytical skills on an advanced level, and will prepare her according to the jobs needed in education, research or public administration.

PSO 2. The student will have the knowledge of the topics of the research conducted by researchers at the Department of Physics, and knowledge of a well-defined area of research within physics.

PSO 3. The student will have the understanding of the basic concepts of classical mechanics, quantum mechanics, statistical mechanics and electricity and magnetism to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws through logical and mathematical reasoning.

PSO 4. The student will learn to carry out experiments in basic as well as certain advanced areas of physics such as nuclear physics, condensed matter physics, spectroscopy, lasers and electronics.

PSO 5. The work course of project and assignment will give the students special expertise within one of the research areas represented at the Department of Physics which will result in some research experience within a specific field of physics, through a supervised project.

PSO 6. The student will be able to critically apply the knowledge gained during the course to scientific models and solve problems in the areas of electrodynamics, quantum mechanics, classical mechanics, statistical mechanics, and advanced mathematical methods.

PSO 7. **General competence**

The candidate will be able to

- Understand the role of physics in society and know the historical development of physics, its possibilities and limitations, and understands the value of lifelong learning.
- Gather, assess, and make use of new information.

M.SC. PHYSICS SEMESTER-I

COURSE CODE: MPHL-1391
ANALOG AND DIGITAL ELECTRONICS

COURSE OUTCOMES

After passing this course the student will be able to:

CO 1. Understand the concept of Electronic devices (MOSFET, UJT, SCR) and their applications.
CO 2. Demonstrate the concept of Electronic circuits: Operational Amplifier and its applications
CO 3. Use concept of Digital Principles for electronic conversions.
CO 4. Demonstrate application of sequential circuits.
CO 5.

SEMESTER-I

COURSE CODE: MPHL-1392

MATHEMATICAL PHYSICS

COURSE OUTCOMES OF MATHEMATICAL PHYSICS

On completion of this course a student will be able to:

CO 1. Understand and use, advanced mathematical methods and theories on various mathematical and physical problems.
CO 2. Identify different special mathematical functions.
CO 3. Understand Cartesian (X, Y, Z), Spherical polar (r, θ, φ) and Cylindrical (ρ, φ, z) co-ordinate systems and their transformation equations.
CO 4. Solve partial differential equations with appropriate initial or boundary conditions with Green function techniques
CO 5. Have confidence in solving mathematical problems arising in physics by a variety of mathematical techniques

Semester-1

COURSE CODE: MPHL-1393

CLASSICAL MECHANICS

COURSE OUTCOMES

CO 1. After the students complete this course they will be familiar with aspects of Classical Mechanics such as Lagrangian and Hamiltonian formulation, particle in central potentials, rigid body motion. These will form the essential background for other courses such as Quantum Mechanics, Electrodynamics and High Energy Physics that students would learn in the subsequent semesters.

CO 2. Students will learn the importance of Lagrangian and Hamiltonian mechanics over the Newtonian mechanics and be able to solve the complex problems on the equations of motion by applying these two techniques.

CO 3. Having successfully completed this course, students will be able to demonstrate knowledge and understanding of orbit problems using the conservation of angular momentum and total energy.

CO 4. Students will also be able to demonstrate understanding of rigid body motion using Euler theorem and Euler angles, which will help them to solve advanced problems pertaining to celestial mechanics.

SEMESTER-I

COURSE CODE: MPHL-1394

COMPUTATIONAL TECHNIQUES

COURSE OUTCOMES

On completion of this course a student will be able to:

CO 1. The very first outcome of the course is having knowledge about various programming languages, their need in research and development.

CO 2. The introduction to MATLAB gives a basic knowledge about syntaxes and procedures used in MATLAB to solve various mathematical problems.

CO 3. Understanding of interpolation of data from an experimental data with equal and unequal intervals.

CO 4. The students will be able to solve integration and differentiation numerically by using various methods.

CO 5. Understanding of various numerical methods to solve polynomial and transcendental equations gives an insight of working of these methods.

SEMESTER-I

COURSE CODE: MPHP-1395

ELECTRONICS LAB

COURSE OUTCOMES

After successfully completion of this lab student will be able to

CO1: Characterise and understand the applications of DIAC, TRIAC, UJT and SCR.

CO2: Investigate characteristics of MOSFET and Multivibrators.

CO3: understand experimentally working of Operational Amplifier and its applications

CO4: basics about Digital Logic circuits from logic gates to ALU.

SEMESTER-I

COURSE CODE: MPHP-1396

COMPUTER LAB

After completion of this lab Student will be

CO1: familiar with various MATLAB syntaxes and techniques to carryout simple calculations.

CO2: able to develop MATLAB programs to find roots of equations.

CO3: able to apply MATLAB commands to plot simple graphs in 2D.

CO4: able to write MATLAB programs to solve numerical integration, numerical differentiation and interpolation.

SEMESTER-II
COURSE CODE: MPHL-2391
QUANTUM MECHANICS-I

COURSE OUTCOMES OF QUANTUM MECHANICS

This course develops concepts in quantum mechanics such that the behavior of the physical universe could be understood from a fundamental point of view. It provides a basis for further study of quantum mechanics

CO 1. The very first outcome of the course is that the student will learn the mathematical tools needed to solve quantum mechanics problems. This will include complex functions and Hilbert spaces, and the theory of operator algebra and the concept that quantum states could be described in a vector space. Solutions of ordinary and partial differential equations that arise in quantum mechanics will also be studied.
CO 2. The student will be able to build connections between mathematical development and conceptual understanding.
CO 3. The student will be able to apply the concepts of quantum mechanics to solve the one and three dimensional problems of quantum mechanics to understand the basics of atomic structures and the wave mechanics of these atoms.
CO 4. The student will learn the basic concepts of spin and angular momentum and the role of spherical harmonics in determining the shape of electronic clouds around the nucleus. They will also learn about the utilization of simple harmonic oscillator and the role of Hilbert space in developing simple harmonic oscillator.

SEMESTER-II
COURSE CODE: MPHL-2392
ELECTRODYNAMICS-I

COURSE OUTCOMES

After passing this course the students will be able to:

CO1: understand the basic concepts of electrostatics and magnetism and related quantities and their calculations for different charge distribution as well as the behaviour of electric and magnetic field inside matter. The students will have the ability to solve the electrostatic problems by method of images helps.

CO2: demonstrate knowledge about the time-varying magnetic and electric fields and their effects by

CO3: understand the propagation of electromagnetic waves in conducting and insulating media.

SEMESTER-II

COURSE CODE: MPHL-2393

Condensed Matter Physics-I

Course Outcome of Condensed Matter Physics-I

After studying this course, the students will be able to understand:

CO1: Various structures of crystal. The students will be able to draw crystal planes through the knowledge of Miller indices.

CO2: Students have learned about crystal diffraction. How the diffraction takes place and the various methods through which it can be observed.

CO3: The students have learned about lattice vibrations through the concept of phonons. Different models of specific heat, i.e. Einstein model and hence Debye model of specific heat.

CO4: Students have studied about the Fermi Dirac statistics and its applications. Students will be able to find the distinction between metals and insulators, semiconductors.

SEMESTER-II

COURSE CODE: MPHL-2394

ATOMIC AND MOLECULAR SPECTROSCOPY

COURSE OUTCOMES

Students will have achieved the ability to

CO 1. Describe the atomic spectra of one and two valance electron atoms. the student will understand the relativistic corrections for the energy levels of the hydrogen atom and their effect on optical spectra and the key properties of many electron atoms

CO 2. Explain the change in behaviour of atoms in external applied electric and magnetic field.

CO 3. Explain rotational, vibrational, electronic and Raman spectra of molecules.

CO 4. Explain the role of Frank Condon principle in determining electronic spectra of the

molecule. The student will also learn about the dissociation and pre-dissociation energies.

CO 5. state and justify the selection rules for various optical spectroscopies in terms of the symmetries of molecular vibrations

COURSE CODE: MPHP-2395
CONDENSED MATTER PHYSICS LAB-I

COURSE OUTCOMES

Student upon completion of this course will be able to

CO 1. successfully apply the theoretical techniques presented in the course to practical problems

CO 2. Understand Hall Effect and demonstrate concept of Pn junction g-factor using ESR, formation and analysis of Hysteresis loop.

CO 3. Demonstrate experimental determination of Energy gap using Four Probe Method and characteristics of photovoltaic cell.

SEMESTER-II

COURSE CODE: MPHP-2396
SPECTROSCOPY LAB

Course Outcomes

On successful completion of the course students will be able to:

CO 1. develop analytical, laboratory skills through laboratory which involve the application of physics to various spectroscopy systems.

CO 2. successfully apply the theoretical techniques presented in the course to practical problems

CO 3. set up the Fabry Parot interferometer, Michelson Morley interferometer, Zeeman experimental instrument and constant deviation spectrometer.

SEMESTER III

COURSE CODE: MPHL-3391

QUANTUM MECHANICS-II

Course outcomes

CO 1. Quantum mechanics-II aim at the applications of quantum mechanics. The course should give deeper knowledge about the foundations of quantum mechanics and skills in problem solving in quantum mechanics.

CO 2. Make students familiar with various approximation methods applied to atomic, nuclear and solid-state physics, and to scattering.

CO 3. The students will learn the applications of Time-independent and time-dependent perturbation theory in quantum mechanics and will develop a knowledge and understanding of perturbation theory, level splitting, and radiative transitions;

CO 4. Develop a knowledge and understanding of the scattering matrix and partial wave analysis; and to solve quantum mechanics problems

SEMESTER III

COURSE CODE: MPHL-3392

Electrodynamics-II

Course outcomes

After passing this course the students will be able to:

CO1: Understand different types of waveguides. The transmission of electromagnetic signals through waveguide. The attenuation and loss of signal in waveguides

CO2: Correlate Einstein's special theory of relativity with classical mechanics and electrodynamics in terms of tensor notation.

CO3: Study the fields around electric dipole, magnetic dipole and electric quadruple. The transition of signal from full wave and half wave antennas.

CO4: Understand fields due to moving charges in terms of vectors and in terms of relativistic mechanics.

SEMESTER III

COURSE CODE: MPHL-3393

Condensed Matter Physics-I

Course Outcome of Condensed Matter Physics-I

After studying this course, the students will be able to understand:

CO1: Various structures of crystal. The students will be able to draw crystal planes through the knowledge of Miller indices.

CO2: Students have learned about crystal diffraction. How the diffraction takes place and the various methods through which it can be observed.

CO3: The students have learned about lattice vibrations through the concept of phonons. Different models of specific heat, i.e. Einstein model and hence Debye model of specific heat.

CO4: Students have studied about the Fermi Dirac statistics and its applications. Students will be able to find the distinction between metals and insulators, semiconductors.

SEMESTER III

COURSE CODE: MPHL-3394

NUCLEAR PHYSICS

Course Outcomes

Upon completion of this course, the student will be able to:

CO 1. Identify basic nuclear properties and outline their theoretical descriptions.

CO 2. Understand the nature of nuclear forces that bind atomic nuclei together and the structure and dynamics of nuclei.

CO 3. Apply the semi-empirical mass formula to evaluate the binding energy of a nucleus and other binding energy related properties.

CO 4. Describe the role of spin-orbit coupling in the shell structure of atomic nuclei, and predict the properties of nuclear ground and excited states based on the shell model.

CO 5. Understand the various decay properties of unstable nuclei such as beta decay, gamma decay, and parity violation.

CO 6. Compare different nuclear reaction mechanisms in relation to cross-sections, excitation functions and angular distributions.

COURSE CODE: MPHL-3395
CONDERNSED MATTER LAB-II

Course Outcomes

Upon completion of this course, the student will be able to:

CO 1. Understand the mechanism of domain formation in ferromagnetic materials and to

CO 2. find the energy losses in various ferromagnetic materials

CO 3. Understand the concept of Curie temperature.

CO 4. Understand the concept of charge storage mechanism in p-n junction diodes

CO 5. Understand the phonon and photon interactions in materials

CO 6. Will learn to work with the travelling, transmission and reflection of microwaves.

SEMESTER III
COURSE CODE: MPHL-3396
NUCLEAR PHYSICS LAB
Course Outcomes

Upon completion of this course, the student will be able to:

CO 1. Carry out experimental work using NaI (Tl) scintillation detector and GM counter in the field of radiation shielding and radioactive analysis of various materials.

CO 2. Understand the interaction of beta particles, alpha particles and gamma ray with matter.

CO 3. Understand the importance of statistical nature of radioactivity in the field of radioactive analysis.

CO 4. Investigate the attenuation power of various materials for alpha, beta and gamma radiation.

SEMESTER IV

COURSE CODE: MPHL-4391

PARTICLE PHYSICS

Course Outcomes

CO1: After completing this course the students will understand the fundamental principles and concepts governing particle physics. The students will learn various experimental techniques used in discovering the elementary particles and their various properties such as mass, lifetime, parity and spin.

CO2: Students will be able to understand the role of symmetries in particle physics. They will acquire basic knowledge on the fundamental forces of universe and various conservation laws followed in these forces (interactions).

CO3: Students will also learn the concept of CP violation in detail which will lead them to their knowledge about current area of research on the missing antimatter of universe.

CO4: The students will learn the Feynman rules and their application in calculating the cross sections for various particle interactions.

CO5: They will also be able to understand the theory of spontaneous breaking symmetry and its application to Higgs mechanism. Students will also have a broad overview of the standard model of particle physics and its predictions.

SEMESTER IV

COURSE CODE: MPHL-4392

CONDENSED MATTER PHYSICS-II

Course outcomes

CO 1. Condensed Matter Physics-II aim at the applications of Solid state Physics. The course should give deeper knowledge about magnetic materials.

CO 2. Make students familiar with various concepts like curie's temperature, super exchange interaction and properties of hysteresis loop.

CO 3. The students will have knowledge of superconductors and its types and how its properties can be applicable in the research field.

CO 4. Develop a knowledge and understanding of the optical properties and students will get the knowledge how these properties are beneficial in the field of research.

SEMESTER IV

COURSE CODE: MPHL- 4393 (OPT-II)

COURSE TITLE: RADIATION PHYSICS

Course outcomes

CO 1. Radiation Physics aim at study the knowledge of ionizing Radiation and Radiation Quantities.

CO 2. Make students familiar with various types of dosimeters.

CO 3. The students will have knowledge of Radiation effects and its protection.

CO 4. Develop a knowledge and understanding of the radiation shielding.

SEMESTER IV

COURSE CODE: MPHL- 4394 (OPT-III)

COURSE TITLE: REACTOR PHYSICS

Course Outcomes-

CO1. Reactor Physics aims to give an insight on functioning of Reactors.

CO2. To learn about Reactor safety and control

CO3.Types of reactors and detailed working of Indian nuclear reactors