COURSE OUTCOMES

M Sc Physics

Course Name: Classical Mechanics

Students will be equipped for advanced and specialized courses.The student learns to deal with particle mechanics at an advanced level and to learn the foundations of the classical theory of fields.

Course Name: Quantum Mechanics – I

Students will learn the mathematical formalism of Hilbert space, hermitian operators, eigen values, eigen states and unitary operators, which form the fundamental basis of quantum theory. Application to simple harmonic oscillators, hydrogen-like atoms and angular momentum operators will teach the students how to obtain eigen values and eigen states for such systems elegantly. The topic of density matrices that plays significant roles in quantum information theory and statistical mechanics will also help the students considerably.

Course Name: Electronics

A student of this course is expected to be able to understand the design and functional performance of electronic circuits using various semiconductor devices. In addition, the student will understand the functional properties and characteristics of semiconductor devices in analog & digital circuits using analog and digital signals.

Course Name: Mathematical Physics

Students will learn the required Mathematics techniques that may have not been covered in the courses in B.Sc. CBCS program and which will be useful in many other courses in MSc

Course Name: General Lab – I/II

At the end of this laboratory course, each and every student is expected to understand the basic concepts of electronics/nuclear physics through experiments, which would immensely help them in acquiring knowledge to tackle various competitive exam questions.

Course Name: Quantum Mechanics-II

Students will learn how to use perturbation theory to obtain corrections to energy eigen-states and eigen-values when an external electric or magnetic field is applied to a system. Scattering theory will teach them how to use projectiles to infer details about target quantum system.

Relativistic quantum mechanics will provide an exposure to how special relativity in quantum theory leads to intrinsic spin angular momentum as well as anti-particles.

Course Name: Statistical Physics

Understand how a probabilistic description of nature at the microscopic level gives rise to deterministic laws at the macroscopic level. Relate the concepts of entropy and temperature as defined in statistical mechanics to their more familiar versions in thermodynamics. Solve for the thermal properties of classical and quantum gases and other condensed systems from a 25 knowledge of their microscopic Hamiltonians. Appreciate that interactions between particles can explain the various phases of matter observed in nature, as well as the universality of critical exponents characterizing phase transitions.

Course Name: Electromagnetic Theory & Electrodynamics

A student having taken this course is expected to have a fair degree of familiarity with tensors and tensorial formulation of relativity and electrodynamics. In addition, s/he is expected to be 27 able to solve problems of motion of charged particles in various field formations as well as find the radiation patterns from different time varying charge and current densities.

Course Name: Solid State Physics

The students should be able to elucidate the important features of solid state physics by covering crystal lattices and binding, lattice dynamics, band theory of solids and semiconductors.

Course Name: General Lab – I/II

At the end of this laboratory course, each and every student is expected to understand the basic concepts of electronics/nuclear physics through experiments, which would immensely help them in acquiring knowledge to tackle various competitive exam questions.

Course Name: Nuclear & Particle Physics

Students will extend the understanding of fundamental forces by studying nuclear and weak forces. Understanding of nuclear structure and reaction dynamics will provides knowledge of nuclear-nucleon interaction. Students will also understand particle physics through this Course. Knowledge of uclear detectors and the interaction of radiation with matter will also be imparted to the students.

Course Name: Computational Physics (Lab)

A student having taken the course would be expected to be proficient in programming in the language (C/C++). In addition, it is also expected that the student would be able to write programs for solving various problems in Physics using techniques like Summing up of infinite series, solving differential equations and using numerical integration.

Course Name: Physics at the Nanoscale – I (Theory)

The learner will be able to comprehend the significance of nanoscience and nanotechnology and its applications in various fields. The students will have in-depth knowledge on the behavior of various class of materials in reduced dimensions.

Course Name: Nanomaterials – I (Lab.)

The students will get a better understanding of the concepts studied by them in the theory course and correlate with experimental observations. In addition, the students are exposed with thermal, microscopic, electrical and spectroscopic methods of characterization of nanomaterials.

Course Name: Advanced Electronics – I (Theory)

A student of this course is expected to have enhanced awareness of the constant evolution in the physics of semiconductor devices and materials, the basic device design along-with the standard technological procedures adapted in the semiconductor industry for IC manufacturing and mass production of semiconductor devices.

Course Name: Advanced Electronic – I (Lab.)

The student will gain practical knowledge of designing, assembling, and testing electronic circuits as well as understanding troubleshooting.

Course Name: Advanced Nuclear Physics-I (Theory)

Students will gain the basic understanding of the theory behind nuclear experimental technologies to identify particles and radiation, principles of accelerators, beam optics, vacuum technology, nuclear electronics, digital pulse processing, data acquisition and detector technology. After completing this course students will be equipped with advanced skill and understanding required to perform nuclear and particle physics experiment with accelerator facilities exists in the world. It will further provide knowledge of nuclear techniques applied in different field for societal needs.

Course Name: Advanced Nuclear Physics-I (Lab.)

The student will gain practical knowledge of radiation sources and ability to identify various types of particles and radiations using different detectors. Experimental skill development by radiation and they will gain a hands on experience withβ,γperforming basic practical on nuclear electronics including data acquisition and data processing

Course Name: Lasers & Spectroscopy-I (Theory)

Students learn to assign the point groups to polyatomic molecules (including diatomic) and to predict the nature of their vibrational spectra depending on their symmetry using group theoretical treatment. The complete picture of rotational, vibrational and electronic spectra of polyatomic molecules will be comprehended. This kind of specialization is expected to provide a larger scope for research in the various related and interdisciplinary areas. The basics of the laser and some spectroscopic techniques using laser taught in this course will be 47 an added asset.

Course Name: Lasers and Spectroscopy– I (Lab.)

The student would be equipped with an in-depth knowledge of laser-based metrologies; 49 spectroscopic techniques that can be applied in wide-ranging fields spanning semiconductors, pharmaceutical, chemical, food-processing industries, to name a few.

Course Name: Advanced Solid State Physics-I(Theory)

The students should able to elucidate the important features of advanced topics in solid state physics by covering dielectric and optical properties, magnetism, and superconductivity.

Course Name: Advanced Solid State Physics– I (Lab.)

The students will get a better understanding of the concepts studied by them and correlate both theory and experiments. The students will learn about the various materials characterization techniques and analysis.

Course Name: General Theory of Relativity and Cosmology-I

Students will be trained in tensor analysis and tensor calculus. This course will teach the formalism of general relativity (GR). They will learn how to obtain an exact solution of GR, namely, the Scwarzschild solution.

Course Name: Astrophysics – I

Students will demonstrate a basic understanding of various aspects of observational astronomy. How data is acquired and interpreted to obtain physical properties of a variety of astronomical objects.

Course Name: Condensed Matter Physics-I

A student of this course is expected to understand thoroughly the concepts of lattice dynamics and neutron scattering theory along with their application in Mossbauer spectroscopy. In addition, the students would be able to perform various analytical as well as numerical calculations needed for understanding the quantum theory of solids.

Course Name: Plasma Physics –I

On completion of the course the student shall be able to: Define, using fundamental plasma parameters, under what conditions an ionised gas consisting of charged particles (electrons and ions) can be treated as a plasma. Distinguish the single particle approach, fluid approach and kinetic statistical approach to describe different plasma phenomena. Classify the electrostatic and electromagnetic waves that can propagate in magnetised and non-magnetised plasmas, and describe the physical mechanisms generating these waves. Define and determine the basic transport phenomena such as plasma resistivity, diffusion (classical and anomalous) and mobility as a function of collision frequency and of the fundamental parameters for both magnetised and non-magnetised plasmas. Formulate the conditions for a plasma to be in a state of thermodynamic equilibrium, or non-equilibrium, and analyse the 61 stability of this equilibrium and account for the most important plasma instabilities. Explain the physical mechanism behind Landau damping and make calculations in this area using kinetic theory

Course Name: Particle Physics –I

Relativistic dynamics, esp. in the context of multiparticle interactions. The role of symmetries, both discrete and continuous in understanding particle interactions and their classification. SU(3) and quark model. Based on observables, drawing up a theory of particle interactions. Fermi theory of beta decay.

Course Name: Quantum Field Theory-I

The students will learn about the role played by symmetries in studying classical and Quantum Field theories. Two different formalisms namely covariant quantization and pathintegral quantization will be taught. They will learn how to apply these in computing treelevel scattering amplitudes and cross-sections in various quantum Field theories including Quantum Electrodynamics.

Course Name: Advance Mathematical Physics

The understanding of the classification of finite groups will be achieved. Upon completion of this course, students should be able to use these concepts in various fields, particularity in crystallography. Students will be able to learn the different analytical techniques for solving integral equations and construct Green's functions for many important boundary value problems.