COURSE OUTCOMES (COs)

SEMESTER 1

PH010101: MATHEMATICAL METHODS IN PHYSICS – I

CO1	Familiarize the theorems in vector analysis and solve the mathematical problems related to the theorem
CO2	Differentiate between the types of matrices and to find the solution for linear equations
CO3	Explain the elementary probability theory and different theoretical distributions
CO4	Explain about tensors, its applications and properties
CO5	Familiarize tensor differentiation

PH010102: CLASSICAL MECHANICS

CO1	Remember the methods involved to study motion of a system
CO2	Apply this concepts to formulate basic principle
CO3	Explain the need of canonical transformation to solve some simple problems
CO4	Understand Poisson and Lagrange brackets with their properties
CO5	Apply Hamilton-Jacobi equation in harmonic oscillator problem
CO6	Analyze central force problem to solve Kepler's law
CO7	Solve Lagrange's equations of motion for small oscillations

PH010103: ELECTRODYNAMICS

CO1	Explain Maxwell's equations in matter and Poynting's theorem
CO2	Explain laws of reflection, refraction as outcomes of electromagnetic boundary conditions
CO3	Understand the idea of electromagnetic wave propagation through waveguides

	and transmission lines
CO4	Express the laws of electrodynamics under relativistic methods
CO5	Explain the concept and principle of electromagnetic radiation

PH010104: ELECTRONICS

CO1	Explain the characteristics and applications of FET devices
CO2	Describe the concept of Op Amp as a differential amplifier
CO3	Differentiates between voltage series and voltage shunt feed-back amplifier
CO4	Identifies the functions of integrator and differentiator
CO5	Describes the compensating circuits and different filter circuits
CO6	Explains analog modulation , working of AM and FM receivers

PH010105: GENERAL PHYSICS PRACTICALS

CO1	Describe the methodology of science and the relationship between observation and theory
CO2	Practice the methodology by performing laboratory exercises
CO3	Acquire necessary skills to produce accurate measurements and tabulate properly.
CO4	Understand data and draw inferences wisely
CO5	Rediscover concepts of physics through optical and mechanical experiments
CO6	Express their knowledge and ideas orally and in writing

<u>SEMESTER II</u>

PH010201: MATHEMATICAL METHODS IN PHYSICS – II

CO1	Comprehend the application of mathematical concepts needed to solve problems

	in physics as well as other areas of science, and acquire practical skills in the use of these methods
CO2	Explain the basic elements of complex mathematical analysis, including the integral theorems, obtain the residues of a complex function and use the residue theorem to evaluate definite integrals in solving physical problems
CO3	Apply integral transform (Fourier and Laplace) to solve mathematical problems of interest in physics
CO4	Apply functions like Alpha, Beta, Dirac Delta, Gamma and Green function to solve mathematical problems of interest in physics
CO5	Solve partial differential equations that are common in physical sciences by making use of standard methods like separation of variables
CO6	Elaborate the orthogonal polynomials of special functions

PH010202 QUANTUM MECHANICS-I

CO1	Explain mathematical tools of Quantum Mechanics
CO2	Apply Dirac formulation to state kets, operators and bras
CO3	Explain measurements, observables and uncertainty relations
CO4	Analyze the Quantum Dynamics of a system
CO5	Explain the general formalism of angular momentum

PH010203 STATISTICAL MECHANICS

CO1	Explain the fundamentals of thermodynamics, Carnot cycle, statistics and distributions
CO2	Grasp the basis of ensemble approach in statistical mechanics to a range of situations
CO3	Explain the fundamental differences between classical and quantum statistics and learn about quantum statistical distribution laws

CO4	Discuss various phenomena in solids using statistical mechanics.
CO5	Develop and apply Ising model and mean field theory for first and second order phase transitions

PH010204: CONDENSED MATTER PHYSICS

CO1	Recognize different types of Materials and their Classification
CO2	Explain the Free Electron Theory of Metals
CO3	Interpret Band Theory of Metals and semiconductors
CO4	Discuss the Dielectric Properties of Solids
CO5	Explain the Superconductivity phenomena and related theorems
CO6	Solve problems related to metals, semiconductors, dielectric materials, magnetic materials and superconductivity

PH010205: ELECTRONICS PRACTICAL

CO1	Design and construct different circuits based on op amp
CO2	Design different oscillators , filters, amplifiers circuits for various frequencies
CO3	Select the appropriate integrated circuit models to build a given application

<u>SEMESTER – III</u>

PH3C09 QUANTUM MECHANICS – II

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

CO 1	Outline the foundations of quantum mechanics
CO 2	Apply the knowledge on the fields of non-relativistic and relativistic quantum mechanics like time-dependent perturbation theory, scattering theory, relativistic wave equations, and second quantization.
CO 3	Apply theoretical studies and calculations of quantum mechanics in atomic and subatomic level problems
CO 4	Reinstate independent knowledge from literature and effectively impart it to peers

PH3C10 COMPUTATIONAL PHYSICS

CO 1	Familarize with the mathematical skills in the field of numerical analysis
CO 2	Analyse different numerical methods, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations and evaluate their accuracy
CO 3	Compare the calculation and interpretation of errors in numerical methods
CO 4	Apply the numerical analysis to obtain approximate solutions to otherwise intractable mathematical problems., in the field of science and engineering
CO 5	learn effective communication on solution methods and results

PH3EC1 SOLID STATE PHYSICS

CO 1	Familarize with the basic theories of electronic structure of materials and defects and dislocations and how they help to tune the properties of materials
CO 2	Apply solid state theory to describe physical behaviour of solids and electronic devices and develop new semiconductor devices
CO 3	Discuss the lasing principle and current crystal lasers
CO 4	Analyse the electrical and optical properties of materials and how they helped to develop new technological advances relevant in our lives and in future

PH3EC2 CRYSTAL GROWTH TECHNIQUES

CO 1	Compare the different crystal growth techniques
CO 2	Motivates for individual development and provide opportunity to explore basic research aptitude
CO 3	Discuss the development of current optoelectronic devices
CO 4	Engage in lifelong learning and adapt to changing needs of profession and society and get updated with current state-of-art

SEMESTER - IV

PH4C11 ATOMIC AND MOLECULAR PHYSICS

CO 1	Explain the role of atoms and molecules in the development of physics and analysing the structure of matter
CO 2	Describe the behaviour of atoms in external electric and magnetic field, which gives the foundation for analysing theoretical models and experimental results in the concerned fields
CO 3	Describe the basics of different spectroscopic methods and their applications in characterisation of research samples relevant in all fields of applied science
CO 4	Describe electron and nuclear magnetic resonance spectroscopy and their application in material science and medical field

PH4C12 NUCLEAR AND PARTICLE PHYSICS

CO 1	Explain the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of radiation and matter;
CO 2	Discuss the smallest building blocks of the universe and inspect the unanswered questions about dark matter, antimatter and the origin and evolution of the universe.
CO 3	Design new ideas in fundamental research and apply them to develop higher theoretical models and experimental applications
CO 4	Describe the various particle interactions and their correlation, basic laws of particle physics and how they are applied to study the particle properties and their behaviour in the subatomic world.
CO 5	Critical evaluate theoretical predictions using quantum mechanical reasoning

PH4EC3 NANOSTRUCTURES AND CHARACTERIZATION

CO 1	Apply the basic principles of physics to describe scientific phenomena in nanoscale and qualitatively explain how the nanoparticle size can affect the morphology, crystal structure, reactivity, and electrical properties
CO 2	Compare and contrast advanced characterisation methods for measurement, observation, and fundamental understanding of phenomenon at nanomaterials

CO 3	Describe the nano systems in quantum realm by applying principles of quantum mechanics in nanmaterials
CO 4	specialize in theoretical and experimental techniques and plan for a career in academia and Nano technology driven industry
CO 5	Engage in lifelong learning and adapt to changing needs of profession and society and get updated with current state-of-art

PH4OE3 THIN FILM AND NANO SCIENCE

CO 1	Compare different methods of synthesis of thin films and inorganic nanoparticles and nanostructures
CO 2	Apply the knowledge to evaluate and select the proper synthesis method best suited for fabricating nanostructured materials of various inorganic compounds
CO 3	Analyse the basic ethical, health-related and environment-related concerns with respect to nanoparticles in general.
CO 4	specialize in theoretical and experimental techniques and plan for a career in academia and Nano technology driven industry
CO 5	Engage in lifelong learning and adapt to changing needs of profession and society and get updated with current state-of-art

PH3P03 COMPUTATIONAL PHYSICS PRACTICALS

CO 1	Illustrate and visualise the problems and the solutions using computer simulations
CO 2	Identify the role of computer models and simulations in the solutions of physical problems
CO 3	Familiarise with programming languages like C++ and apply them to solve physical problems using numerical methods
CO 4	Construct foundation of computational methods for specialised interests an research
CO 5	Identify leadership as well as effective communication with the team
CO 6	Identify interpersonal skills and responsibility like working in a group, time management, acquiring information through literature, and presenting the

	work in a scientific language

PH4PC4 MATERIAL SCIENCE PRACTICALS

CO 1	Investigate research equipment (microscope, oscilloscope, etc.) and apply them for materials analysis and data acquisition.
CO 2	Examine and conduct experiments which measures materials properties and apply the conceptual knowledge to analysis the experimental data.
CO 3	Identify leadership as well as effective communication with the team
CO 4	Identify interpersonal skills and responsibility like working in a group, time management, acquiring information through literature, and presenting the work in a scientific language

PH4D05: PROJECT/DISSERTATION

CO 1	Execute a significant research-based project
CO 2	lead and manage projects through collaboration with others
CO 3	Synthesize novel materials, characterize and analyse data to cultivate research findings
CO 4	Identify the ethical issues related to a researcher in publishing and practising
CO 5	Utilize findings from research for advanced education
CO 6	Report and publish research findings in internationally accepted written formats
CO 7	specialize in theoretical and experimental techniques and plan for a career in academia and Nano technology driven industry
CO 8	Engage in lifelong learning and adapt to changing needs of profession and society nd get updated with current state-of-art

PH4V06: VIVA VOCE

CO 1	Effectively communicate the acquired knowledge in a timely manner
CO 2	Identify areas of research in relevant theoretical/experimental field