Course Outcomes (CO)

Semester I

MPHYCC-1 Classical Mechanics

CO 1 Understand the Lagrangian and Hamiltonian approaches in classical mechanics.

CO 2 Solve the mechanics problems and Analyse the results using Lagrange and Hamilton equa-tions of motion.

CO 3 Learn the classical background of Quantum mechanics and get familiarized with Poisson brackets and Hamilton -Jacobi equation.

CO 4 Gain in-depth knowledge of Central force motion, rigid body and small oscillations.

CO 5 Understand basic concepts and features of special and general theory of relativity.

MPHYCC-2 Mathematical Physics

CO 6 Acquire knowledge of Linear differential equations and special functions.

CO 7 Solve and Analyse the problems based on linear differential equations and special functions.

CO 8 Implement Greens functions in various physical problems.

CO 9 Apply group theory and integral transforms to Solve mathematical problems pertaining to Physics.

CO 10 Understand elementary tensor analysis and Analyse the fundamental operations related with tensors and its types.

MPHYCC-3 Quantum Mechanics

CO 11 Knowledge of mathematical foundations, techniques and basics of quantum mechanics.

CO 12 Learn the theory of quantum dynamics related to Schrodinger, Heisenberg and interaction pictures.

CO 13 Understand time dependent and time independent perturbation theory and Implementing this to advance physical problems.

CO 14 Gathering in-depth knowledge about scattering theory and applying it to spherically sym-metric potential problems.

CO 15 Ability and Competency for the explanation of relativistic quantum mechanics.

MPHYCC-4 Practical Paper Lab-I

CO 16 Design and Application of the different experiments and evaluation of the results pertaining to different branches of Physics (Condensed Matter Physics, Optics, Magnetism, Atomic and mole-cular Physics).

CO 17 Analysing and Evaluating the results obtained from the experiments performed, and Create hybrid/novel experiments based on them.

Semester II

MPHYCC-5 Modeling and Simulation

CO 1 Learn Object Oriented Program with reference to C++, Objects, Classes, Encapsulation etc. Understand elementary features of Python, Java and Fortran.

CO 2 Develop Python programs and Utilize it to solve scientific problems. Apply, Analyse and Evaluate scientific and/or mathematical problems using Scilab and R programming.

CO 3 Understand and Acquire knowledge of ODE and PDE. Apply these to various problem solv-ing related to Physics and Mathematics.

CO 4 Interpret and Analyze data using Jacobi method for Matrix Inversion for solving Eigenvalue problems.

CO 5 Gain an ability to Apply Monte Carlo Simulation for the solution of physical problems.

MPHYCC-6 Electrodynamics and Plasma Physics

CO 6 Acquire Knowledge about the Time varying Electromagnetic fields, Maxwell equations, Scalar and Vector Potentials.

CO 7 Understand the concept of Electromagnetic Waves (EMW) and its interaction with matter on macroscopic scale. Apply theory of propagation of EMW between conducting planes, Wave guides and Cavity resonator on various problems pertaining to Physics.

CO 8 Learn the theory of radiation from localised time varying sources, and the charge particle dynamics.

CO 9 Gain in depth knowledge of relativistic electrodynamics and Apply it to electric and magnetic entities.

CO 10 Provide basic concepts of Plasma Physics and derive moment equations from Boltzmann equation. Attain knowledge about Debye potential, plasma confinement, Alfven wave etc.

MPHYCC-7 Electronics I

CO 11 Understand and Analyse various types of Transistors through studying their structure, working and characteristics.

CO 12 Gather detailed information about BJT biasing, amplifiers and models, feedback unit and its effect on parameters, and Oscillators.

CO 13 Acquire detailed explanation of construction, working and characteristics of Operational Amplifiers (OP-AMPs). Analyze and Evaluate the different functions and applications of OP-AMP.

CO 14 Fundamental concepts of different types of Logic Gates, Minimisation techniques, etc. Exemplifying Registers, Counters and Comparators.

CO 15 Gain an in-depth learning of Microprocessors and Microcontrollers, Assembly language instructions, Microcontroller architecture and Interfacing.

MPHYCC-8 Statistical Mechanics

CO 16 Understand and Comprehend the statistical basis of thermodynamics by studying phase space, types of ensemble, statistical equilibrium etc.

CO 17 Learn the basic idea about the statistical distributions, partition function, thermodynamical potentials, entropy and their interpretation.

CO 18 Impart the knowledge about Quantum statistics and its applications such as quantum ensembles, density matrix, ideal Fermi gas, Bose condensation, liquid He II, Chandrashekhar limit, Ising model, superfluidity, random walk etc.

CO 19 Acquire good knowledge of Non Equilibrium processes and Non Equilibrium thermodynam-ics and their features.

MPHYCC-9 Practical Paper Lab-II

CO 20 Understand the fundamental concepts and relevance of finding solutions to physical and/or mathematical problems using computational methods.

CO 21 Gain an ability to Apply and Evaluate physical principles to real-world problems.

CO 22 Simulation and/or Mathematical Modelling to predict the behaviour or outcome of a physical system.

Semester III

MPHYCC-10 Atomic and Molecular Physics

CO 1 Acquire knowledge about Atomic spectroscopy of one and two valence electron atomic systems. Ability to illustrate Zeeman effect, Paschen Back effect and stark effect.

CO 2 In-depth knowledge of Rotational, vibrational, electronic and Raman spectra of molecules. Structure determination by Raman spectroscopy. Analyze the spectroscopic studies of various types of molecules.

CO 3 Understand the details of the change in the behavior of atoms in external applied electric and magnetic fields. Extensive study of Molecular potential, electronic and nuclear wave functions, Molecular orbital theory etc.

CO 4 Understand IR techniques and instrumentation of Raman, NMR and IR. Analyze the Infrared, NMR and Spin Resonance Spectroscopy results of the solid state materials.

CO 5 Learn the principle, working and various types of applications of Laser. Relevance of Laser devices, Laser communication, LIDAR, Optical computing. Importance of the use of Laser in medical applications.

MPHYCC-11 Condensed Matter Physics

CO 6 Study the basics of crystal Physics such as lattice, crystal, Bragg law, Laue and powder diffraction. Apply the concept of Structure in solids. Analyze and Determine the Crystal structure of the solids by using powder XRD technique.

CO 7 Learn the behavior of electrons in solids including the concept of energy bands and effect of the same on the properties of the solid state materials.

CO 8 Gain a thorough knowledge of magnetic, optical and dielectric properties of the solid state compounds. Ability to Analyze the various types and nature of magnetic and dielectric characteristics of the materials.

CO 9 Basic concept and idea of superconductivity. Understand Meissner effect, London equation, types of lattice defects and use these in the study of new and/or novel solid materials problems.

MPHYCC-12 Electronics II (Analog and Digital Electronics)

CO 10 Study and Understand operational amplifiers and linear devices. Gather knowledge about 555 IC timer, Schmitt trigger, VCO, Phase Locked Loops (PLL) and their important applications.

CO 11 Acquire knowledge about the Importance and Relevance of the applications of operational amplifier.

CO 12 Learn about digital circuits and sequential circuits. Concept of Logic families, Flip flop, Register, Counter, Multiplexer, Encoder, Converters etc.

MPHYCC-13 Nuclear and Particle Physics

CO 13 Acquire detailed and in depth knowledge about Nuclear forces (Exchange forces, nucleon-nucleon scattering, Deuteron problem, Yukawa interactions etc).

CO 14 Understand and Gather vital information about the nuclear reactions, their kinematics, nuclear reactors, mechanisms of nuclear fission and fusion, and nuclear models.

CO 15 Ability to impart the knowledge about nuclear decay (beta decay, gamma decay), Spontaneous decay, internal conversion etc.

CO 16 Fundamental concept of Elementary Particles, their classification, symmetry and its application to decay and scattering processes, study of conservation laws and symmetry.

MPHYCC-14 Practical paper Lab-III

CO 17 Apply the concepts of Analog Electronics (Transistor biasing, RC Coupled amplifier, SCR, FET, MOSFET, Tunnel and Gunn diode etc) and Digital Electronics (A/D and D/A Converters, Dif-ferent types of flip flops, Counters, Encoders and Decoders etc), Interpret, Acquire and Evaluate the results obtained from the experiments.

CO 18 Devising experiments based on the experience Gained and Conceived through careful thought and deliberation.

Semester IV

Elective Courses (EC)

MPHYEC - I A Advanced Quantum Mechanics

CO 1 Learn the theory of scattering in depth and Gain a thorough knowledge of the features and properties pertinent to Scattering theory applied to the case of a continuous spectrum and different approximation methods. Applications of scattering theory to various problems related to nuclear physics, particle physics etc.

CO 2 Significance of relativistic quantum mechanics compared to non-relativistic quantum mechan-ics. Concepts of spacetime description of SWE, KG equation, Dirac Interpretation of negative ener-gy, etc.

CO 3 Understand the field quantization and the related topics pertinent to it. Exposure to quantum field theory and universal interactions.

CO 4 Fundamental Concept of the relations between two independent physical theories: thermody-namics and quantum mechanics. Understand and Grasp that, how the two independent theories ad-dress the physical phenomena of light and matter.

MPHYEC - I H Nano Science

CO 5 Learn the basic understanding that NanoScience is a convergence of physics, materials science and biology, dealing with the manipulation of materials at atomic and molecular scales. Gain

knowledge about the Application and Scopes of Nanoscience, Naonomaterials; their properties and characteristics and Nanostructures.

CO 6 Gather a detailed information and Comprehend the illustration and description of various types of Synthesis and Characterisation techniques of Nanomaterials.

CO 7 Learn the underlying physics of Magnetic and Dielectric materials. Exemplify these materials and illustrate them with respect to their respective physical properties.

CO 8 Acquire Knowledge and Understand the field of smart materials and structures, together with its current status and potential benefits.

CO 9 Understand the field of Multiferroic Materials leading to the discovery of different types of multiferroics, the microscopic origin of their properties and to Explore the ways and means to find similar multiferroic behavior in systems that one has been studying all along.

Practical Paper Lab-IV

CO 10 Preparing and Characterising nanomaterials of various compounds in nanopowder and/or nanofiber, solid state and thin film form. Interpreting the data, Analyze and Evaluate the results.

CO 11 Estimating and Predicting the physical (electrical, magnetic, optical,etc) behaviour of the Nanostructured compounds modified and/or doped by various elements.

CO 12 Relevance of the bio-synthesized environmental friendly nanomaterials and Comparing them with their chemically synthesised counterparts. Comparing, Corelating and Evaluating the findings.

CO 13 Development of small prototypes / products / devices (eg. Sensors, Actuators) based on the experiments performed. Illustrate their functions, Analyse the results, Evaluate the outcome and Test its feasibility.