MARIAN COLLEGE KUTTIKKANAM
(AUTONOMOUS)

MSC PHYSICS
POs, PSOs & COs

TABLE OF CONTENTS

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INTEGRATED MASTER OF SCIENCE IN PHYSICS

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1: Develop in depth knowledge of various branches of Physics.

PSO2: Demonstrate skills and competencies to conduct wide range of scientific experiments and research in Physics.

PSO3: Capable of analyzing and solving problems using reasoning skills based on concepts of Physics

PSO4: Develop the knowledge, skills and attitudes necessary to pursue further studies in Physics and research in Physics.

PSO5: Demonstrate understanding of the concepts from basic and applied branches of Mathematics to solve problems in Physics.

PSO6: Demonstrate proficiency in problem-solving techniques using the computation techniques.

PSO7: Develop the fundamental theories, concepts and applications in different basic areas of chemistry

PSO8: Ability to apply fundamentals of electronics in various domains of electronic systems.

PSO9: Understand the diverse applications of various fields of applied science and carry the knowledge and applications of basic sciences to community.

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PSO10: Develop in depth knowledge in specialization area Quantum Nanostructures/Flexible Electronics.

PSO11: Develop communication skills for reporting the results in journals and oral presentation.

COURSE OUTCOMES (CO)

IPH2001: Mechanics Core Physics Theory

CO1: Apply particle dynamics, conservation laws and the theories of collisions.

CO2: Discuss inverse square law of force and central force motion.

CO3: Explain the harmonic motion, different types of oscillators.

CO4: Explain the material properties like elasticity and fluid dynamics.

CO5: Identify the basics of classical mechanics.

IPH2002: Thermal Physics

CO1: Explain laws of thermodynamics -zeroth law, first law and second low

CO2: Explain the concept of Ideal gas, heat engine.

CO3: Explain the concepts based on entropy and Maxwell's equations.

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CO4: Define the basics of statistical formulations. Prerequisites: Basic mechanics, reasoning power, initiative skills and basic mathematics.

IPH2003: Basic Electronics

CO1: Explain the fundamentals of diodes, circuits and its applications.

CO2: Explain the basics of transistor properties, biasing and circuit design.

CO3: Apply the theory and working of amplifiers and Oscillator circuits.

CO4: Explain the principle, working and application of devices like FET, UJT and operational amplifiers.

CO5: Illustrate the AM and FM modulation and demodulation.

IPH2009: Relativity, Waves and Optics

CO1: Explain the preliminary concepts of different frame of references.

CO2: Explain the basic concepts of relativity

CO3: Illustrate the superposition of oscillations.

CO4: Explain the nature of travelling waves and stationary waves.

CO5: Explain the details of geometrical optics and optical components.

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IPH2010: Basic Electrodynamics

CO1: Explain the electrostatic fields and potentials of physical systems and electric properties of matter

CO2: Explain the properties of electric steady current and different network theorems.

CO3: Calculate the magneto static field associated with a steady current.

CO4: Explain the magnetic properties of matter.

CO5: Differentiate Laplace's equation, method of images

CO6: Distinguish the properties of electromagnetic induction and time dependent fields.

CO7: Explain the properties of time dependent electric circuits.

CO8: Explain the Maxwell's equations and electromagnetic waves.

IPH2018: Mathematical Physics

CO1: Discuss the solution of first and second order differential equations

CO2: Demonstrate the skills of modelling physical problems in terms of differential equations.

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CO3: Describe the theoretical framework of the existence and uniqueness of Solutions

CO4: Describe the behavior nonlinear systems and its stability

CO5: Solve numerically initial value problems described by differential equations. Prerequisites: Knowledge of basic mathematics

IPH2019: Classical Electrodynamics

CO1: Explain the properties of EMW, interaction in a medium and at interface.

CO2: Understand the details relativistic electrodynamics.

CO3: Able to explain the properties and behavior of different sources of radiation.

CO4: Explain the properties of wave guide, transmission line and guided wave.

IPH2020: Modern Optics

CO1: Analyze the details of interference and interferometry.

CO2: Analyze the details of Fresnel's and Fraunhofer diffraction and its applications.

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CO3: Explain the polarization of light and associated properties.

CO4: Explain the coherence nature of optical sources

CO5: Illustrate matrix method for the analysis of optical systems.

IPH2028: Mathematical Physics – II

CO1: Demonstrate the method of power series to solve differential equations

CO2: Discuss the properties of special function

CO3: Understand various partial differential equations in physics and their solutions.

CO4: Demonstrate the skills in applying the methods of Fourier series and Laplace transforms.

CO5: Understand the variational problem and Euler's equation and its applications in physics

Prerequisites: Basic knowledge in Mathematics, differential equation.

IPH2029: Basic Quantum Mechanics

CO1: Analyse the development of quantum mechanics.

CO2: Explain the basics and postulates of quantum mechanics.

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CO3: Interpret Schrodinger equation and harmonic oscillators.

CO4: Observe the application of quantum mechanics.

IPH2037: Mathematical Physics – III

CO1: Define complex numbers and their properties

CO2: Describe the fundamental properties of analytical functions

CO3: Demonstrate the skills in applying contour integrals

CO4: Demonstrate skills in applying Taylor and Laurent series

CO5: Demonstrate the skills in applying residue theorem

Prerequisites : Basic knowledge in mathematics, complex variables.

IPH2038: Solid State Physics

CO1: Explain the basic idea bout crystal structures and X-ray diffraction.

CO2: Identify theories of inter-atomic forces and thermal properties in metals.

CO3: Explain the free electron model, Bloch's theorem and energy bands and theory of semiconductors.

CO4: Explain the dielectricand magnetic properties of materials and superconductivity.

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IPH2039: Atomic and Molecular Physics

CO1: Explain the early developments of different atom models and atomic spectra.

CO2: Explain the concept of molecular structure.

CO3: Explain the origin and properties of molecular spectra.

CO4: Illustrate the theory of Raman Spectroscopy

CO5: Illustrate NMR and ESR spectroscopy and its instrumentation.

IPH2046: Mathematical Physics – IV

CO1: Discuss basic properties of matrices and linear transformation

CO2: Determine eigenvalues and eigenvectors and its applications

CO3: Understand the definition of tensors and their properties

CO4: Demonstrate skills in describing four vectors in special relativity

CO5: Describe basic framework of tensor calculus and general relativity.

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IPH2047: Nuclear and Particle Physics

CO1: Understand the interior of nucleus and interaction between nucleons.

CO2: Explain the theory of radioactivity.

CO3: Understand the interaction of radiation with matter.

CO4: Explain the fundamentals of particle accelerator and nuclear energy.

CO5: Explain on particle physics.

IPH2048: Classical Mechanics

CO1: Explain Hamiltonian mechanics, variational principle and Lagrange's equations

CO2: Apply small oscillations and rigid body dynamics

CO3: Explain Canonical Transformations, Hamilton-Jacobi theory and -central force problems

CO4: Illustrate Fluid dynamics Prerequisites: Basic knowledge in mathematics and physics

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IPH2055: Advanced Electronics

CO1: Studies the fundamentals of op-amp and properties and effect of negative feedback

CO2: .Studies the various applications of Op amp and circuits

CO3: Studies the properties of different transducers and devices using it.

Prerequisites: Basic knowledge in mathematics, electronics and physics

IPH2056: Statistical Mechanics

CO1: Understand the foundations of statistical mechanics.

CO2: Explain the classification of identical particles and Maxwell distribution.

CO3: Illustrate the Planck distribution and quantum statistics.

CO4: Explain the characteristics of Phase transitions, fluctuations and interacting systems.

IPH2057: Advanced Quantum Mechanics

CO1: Explain the basic mathematical tools of Quantum Mechanics

CO2: Explain the theoretical frame work of quantum mechanics

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CO3: Illustrate the angular momenta and its addition

CO4: Describe the necessity of approximation methods and time independent techniques

IPH2058: Condensed Matter Physics

CO1: Illustrate crystal structure and symmetry

CO2: Explain free electron theory, band theory of materials

CO3: Illustrate imperfections and dislocations in crystals

CO4: Explain Lattice dynamics of solid and magnetic properties of solids.

CO5: Explain details of nanomaterials

IPH2062: Mathematical Physics – V

CO1: Understanding of advanced methods of solution of differential equations

CO2: Demonstrate the skills in applying the concepts of special functions.

CO3: Describe partial differential equation in physics and their solutions

CO4: Demonstrate skills in formulating integral equations and their solutions.

CO5: Describe the properties of probability distributions apply statistical tools

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IPH2063: Advanced Atomic and Molecular Physics

CO1: Explain the theory atomic spectroscopy.

CO2: Explain the theory and application of microwave and IR spectroscopy.

CO3: Explain the theory and instrumentation of Raman spectroscopy and Electronic Spectroscopy of molecules.

CO4: Explain the theory and instrumentation of ESR and Mossbauer Spectroscopy

IPH2064: Advanced Quantum Mechanics - II

CO1: Explain the principles of time dependent perturbations.

CO2: Explain the phenomena of scattering in quantum mechanical view.

CO3: Explain relativistic formulations of quantum mechanics.

CO4: Explain the second quantization principles.

IPH2065: Astronomy and Astrophysics

CO1: Observe different constellations and classify stars accordingly.

CO2: Explain the basics of seasonal changes.

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CO3: Interpret the fundamental equations in stellar evolution.

CO4: Analyze basic theories of formation of solar system.

CO5: Discuss criterion, formation and evolution of stellar objects.

CO6: Understand basics of Milky Way and other extra galactic systems.

IPH2006: Physics Lab- Mechanics and Thermal Physics

CO1: Demonstrate experiments in mechanics, solid material properties, fluids, thermal Physics,thermal properties.

IPH2013: Physics Lab - Waves, Optics, Electricity and Magnetism

CO1: Demonstrate experiments of sound, waves and Optics and Electricity, magnetism and electrical circuits.

IPH2021: Physics Lab- Computational Physics Lab – I

CO1: Apply the mathematical concepts to formulate a computational problem

CO2: Demonstrate skills in writing computer programs, executing it and interpreting the results.

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IPH2022: Physics Lab- Electronics, Modern Optics and Electrodynamics

CO1: Demonstrate experiments using semiconducting diodes, transistors, ICs 555, 741 and demonstrate experiments of optics and electromagnetic waves.

IPH2030: Physics Lab- Computational Physics Lab – II

CO1: Apply the mathematical concepts to formulate a computational problem

CO2: Demonstrate skills in writing computer programs, executing it and interpreting the results.

IPH2031: Physics Lab - Mechanics and Basic Quantum Mechanics

CO1: Demonstrate experiments in Mechanics, modern physics and basic concepts of quantum mechanics

IPH2040: Physics Lab- Computational Physics Lab – III

CO1: Apply the mathematical concepts to formulate a computational problem

CO2: Demonstrate skills in writing computer programs, executing it and interpreting the results.

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IPH2041: Physics Lab- Solid State Physics and Atomic and Molecular Physics

CO1: Demonstrate experiments in solid state physics, semiconductors, conductors, insulators, atomic and molecular spectroscopy.

IPH2049: Physics Lab- Computational Physics Lab – IV

CO1: Apply the mathematical concepts to formulate a computational problem

CO2: Demonstrate skills in writing computer programs, executing it and interpreting the results

IPH2050: Physics Lab- Classical Mechanics and Nuclear Physics

CO1: Demonstrate experiments using GM counter and verification of problems in nuclear physics by numerical techniques and demonstrate experiments in mechanics and computational analysis of mechanical systems.

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IPH2059: Physics Lab- Advanced Electronics

CO1: Demonstrate experiments using transistors, ICs and simulation of electronic circuits.

IPH2060: Physics Lab- Statistical Mechanics Lab

CO1: Demonstrate simulations of statistical systems.

IPH2066: Physics Lab- Condensed Matter Physics

CO1: Demonstrate experiments in solid state physics

IPH2067: Physics Lab- Quantum Mechanics

CO1: Demonstrate simulations of quantum mechanical systems and principles.

IPH2051A: Flexible Electronics

CO1: Categorize the printed electronics and its possibilities in the industry

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CO2: Explain varies flexible electronics products and its challenges

CO3: Establish about different derivatives in the process and methods used in flexible electronics

CO4: Describe the opportunities of various flexible electronics applications and products

IPH2052A: Physics Lab- Flexible Electronics

CO1: Develop characterization of optoelectronic devices.

CO2: Design and perform fabrication of energy saving/efficient flexible lamp devices.

1. Characteristics of printed diodes.

2. Characteristics of printed capacitors.

3. Characteristics of photovoltaic cells

4. Characteristics of photodiode

5. Characterization of OLED

6. Characterization of inverted solar cell

7. ESFL circuit design

8. ESFL tooling

9. ESFL blending

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IPH2051B: Nanoscience and Nanotechnology

CO1: Develop the basics of nanomaterials.

CO2: Illustrate the synthesis of zero, one, two dimensional nanomaterials.

CO3: Illustrate the electronic and photonic application of nanomaterials.

CO4: Illustrate the nanomaterial characterization techniques.

Prerequisites: Basic physics, mathematics and chemistry.

IPH2052B: Physics Lab- Nanomaterials

CO1: Report characterization of nanomaterials.

CO2: Design characterization of nanomaterials.

1. Determination of lattice parameters using XRD for cubic systems

2. Determination of lattice strain and particle size from XRD

3. Preparation of nanoparticles by Sol Gel method

4. Preparation of nanoparticles embedded polymers: optical properties

5. Preparation of thin film by chemical bath deposition: Optical properties.

6. Dip coating - preparation of multilayer films

7. Optical properties of thin films prepared by PVD

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8. Any two equivalent experiments.

IPH2069A: Quantum Heterostructures

CO1: Describe the structure and properties of semiconductor heterostructures

CO2: Apply quantum mechanical ideas to construct band structure.

CO3: Describe the electronic structure of low dimensional systems

CO4: Illustrate the background information for studying quantum transport.

IPH2070A: Transport in Nanostructures

CO1: Describe the physics of modern nanoelectronic devices.

CO2: Discuss in detail the transport properties of mesoscopic systems.

CO3: Prepare the student to use advanced computational tools in nanoelectronics.

CO4: Prepare the student to understand the research works in this area

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IPH2071A: Nano-Optics and Nanophotonics

CO1: Explain the optical properties of nanao-structures.

CO2: Explain detailed study of emerging areas like photonic crystals and plasmonics

CO3: Develop skills needed to apply computational methods for designing Nano-optical structures.

CO4: Illustrate the research work in Nanophotonics

IPH2072A: Physics Lab- Synthesis and Characterization of Nanomaterials

CO1: Report characterization of nanomaterials.

CO2: Design characterization of nanomaterials.

IPH2073A: Physics Lab- Nanostructures Lab: 54, Credit: 1

CO1: To learn the skills needed to solve essential practical problems at research level using computational method

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IPH2074: Project

CO1: Develop the depth of knowledge in Physics .

CO2: Evaluate an independent research project.

CO3: Focus the knowledge of contemporary issues in their chosen field of research.

CO4: Produce an ability to present and defend their research work to a panel of experts.

IPH2004: Mathematics- I

CO1: Explain basic matrix properties, operations, and to solve applications in physical systems.

CO2: Solve problems in differential calculus and its applications.

CO3: Apply partial derivatives.

CO4: Explain application of trigonometric functions and series.

IPH20011: Mathematics- II

CO1: Explain the properties of integral calculus and its applications.

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CO2: Illustrate the properties of integrals and use integrals to solve problems in physics.

CO3: Explain the properties and applications of double and triple integrals.

CO4: Illustrate the periodic functions using Fourier series.

IPH2023: MathematicS- III

CO1: Apply vector valued functions in the application of physics.

CO2: Apply integrals in physics related applications.

CO3: Explain the properties of analytic geometry and use analytic geometry in physical systems.

CO4: Explain the abstract algebraic functions.

IPH2042: Mathematics- IV

CO1: Explain ordinary differential equation and use it in physics problems.

CO2: Illustrate the properties and application of special functions.

CO3: Explain the properties of partial differential equation and solve problems using it.

CO4: Explain the function of complex numbers and its applications.

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IPH2005: Chemistry - I

CO1: Understand the structure of the atom, chemical bonding and intermolecular forces such as hydrogen bonding.

CO2: Explain the periodic properties of atoms and the concept of chemical equilibrium.

CO3: Illustrate the basic principles of Analytical Chemistry including various laboratory operations for qualitative and quantitative analysis, methods of separation and purification, an reporting of analytical data.

CO4: Understand various chromatographic techniques.

IPH2012: Chemistry - II

CO1: Understand the fundamental concepts in organic chemistry and structure of organic molecules.

CO2: Explain various types of organic reactions and their mechanisms in brief.

CO3: Understand stereochemistry and conformation of some simple organic molecules

CO4: Familiarize with natural and synthetic polymers, biodegradability and environmental hazards.

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IPH2024: Chemistry - III

CO1: Explain solid state chemistry including symmetry, crystal structure, magnetic, conductivity and optical properties of solids.

CO2: Understand chemistry of the liquid state, colligative properties and properties of liquid crystalsExplain the behaviour of gases and gas laws.

CO3: Illustrate surface phenomena such as adsorption and properties and applications of colloids.

CO4: Explain phase equilibria, distribution law and its applications.

IPH2032: Chemistry - IV

CO1: Understand principle and applications of various spectroscopic methods such as rotational, uv,visible and infrared spectroscopy.

CO2: Explain first, second and third laws of thermodynamics including their significance.

CO3: Explain fundamental concepts of kinetics, catalysis and photochemistry.

CO4: Understand principles of electrochemistry including conductance in solutions, conductometrictitrations, galvanic cells, fuel cells, emf measurements and potentiometric titrations.

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IPH2014: Chemistry Lab- I

CO1: Perform quantitative analysis using volumetric estimations.

CO2: Carry out characterization of organic compounds using physical and chemical methods.

IPH2033: Chemistry Lab- II

CO1: Do chemical characterization of substances using various physico-chemical parameters such as viscosity, CST, transition temperature, heat of solution etc.

CO2: Perform various instrumental techniques such as potentiometry, conductometry and colorimetry

ICE2001: English Language Skills – I

CO1: Identify the distinct sounds in English words

CO2: Choose the right words while writing/talking about everyday life

CO3: Use expressions appropriate for various social occasions

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CO4: Articulate words and sentences clearly stressing the right syllables

ICC2002: English Language Skills- II

CO1: Write sentences adhering to tense rules

CO2: Correct common errors such as punctuation and capitalization

CO3: Identify the key points in a piece of writing

CO4: Write CVs and cover letters

IPH2015: Environmental Science

CO1: Illustrate the importance of ecosystems, biodiversity and its conservation.

CO2: Illustrate the details of environmental pollution, social issues and the environment

CO3: Illustrate different types of non-renewable and renewable energy sources solar energy

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IPH2034: Research Methodology in Science

CO1: Explain the history of science, philosophy of science and scientific facts.

CO2: Explain the meaning of research, design, development and analysis of research.

CO3: Define hypothesis and research methods..

CO4: Do to data collection, sampling and statistical analysis

CO5: Prepare scientific reports, journal papers and project proposals.

CO6: Explain the environmental and ethical impacts, IPR, plagiarism citation and acknowledgement.

IPH2043: Human Rights

CO1: Analyse the development of human rights and different human right act in UN

CO2: Analyse the human rights in Indian scenario

CO3: Analyse the and impact of environment and human rights.

CO4: Analyse the Conservation of natural resources and human rights

Prerequisites: Basic concepts of Social Science.

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IPH2007: Latex Programming

CO1: Write ordinary text, mathematical formulae as equations

CO2: Organize texts using formatting

CO3: Illustrate insertion of symbols and operators in texts

CO4: Create array, table, header, font bibliography.

IPH2008: Programming In Python-I

CO1: Understand the structure of a python program and how it works

CO2: Understand the basic control structures

CO3: Apply the structure of a python program and how it works, basic control structures. Prerequisites : Basic computer science, programming, physics and mathematics

IPH2016: Life inspiring Skills

CO1: Develop communication competency and report writing skills

CO2: Practice interview and group discussion

CO3: Develop critical thinking process and problem solving skills

CO4: Formulate better team dynamics, ethics and human values

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IPH2017: Programming in Python-II

CO1: Demonstrate how Python can handle U data using statistical methods

CO2: Describe how set theory operations can be done using python

CO3: Perform representative task in practice.

CO4: Apply the structure of a python program and handle data using statistical methods ,set theory operations

IPH2025A: Summer Project - I

CO1: Identification of research/industrial/academic problem, preparation of methodology of work, time bound planning.

CO2: Report the use of sophisticated instrumentation/software and enhance academic scenario through practical experience.

CO3: Develop the ability to analysis data collection, interpretation of observation and capability to make inferences

CO4: Develop new knowledge and experience to contribute in the startup programs.

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IPH2026: Yoga Exercises For Sound Health

CO1: Apply idea about Yoga

CO2: Illustrate limits and methods in five aspects: Food, Work, Sleep, Sex and Thought

CO3: Practice a whole body exercise and Kayakalpa

CO4: Practice different Pranayam and Mudras

IPH2027: Machine Learning Using Python - I

CO1: Understand the general features of machine learning

CO2: Understand how python tools necessary for numeric, visualization and manipulation of data

CO3: Apply the general features of machine learning, python tools necessary for numeric, visualization and manipulation of data

IPH2035: Health and Emergency Care

CO1: Understand the importance of physical activities on health.

CO2: Observe and identify different types of injuries.

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CO3: Able to do different life saving first aids like 1. CPR, 2. Heimlich Maneuver.

IPH2036: Machine Learning Using Python - II

CO1: Apply Scikit-lear dataset

CO2: Describe how linear and polynomial reUression is performed

CO3: Perform representative computational task in practice.

CO4: Apply the general features of machine learning, linear and polynomial regression is performed

IPH2025B: Summer Project - II

CO1: Identification of research/industrial/academic problem, preparation of methodology of work, time bound planning.

CO2: Report the use of sophisticated instrumentation/software and enhance academic scenario through practical experience.

CO3: Develop the ability to analysis data collection, interpretation of observation and capability to make inferences

CO4: Develop new knowledge and experience to contribute in the startup programs..

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IPH2044: Foundation   in Reasoning

CO1: Develop proficiency in formulating and solving problems in diverse fields.

CO2: Develop the logical reasoning ability of students.

CO3: Develop the arithmetic reasoning ability of students.

CO4: Develop the verbal reasoning ability of students.

CO5: Improves the non-verbal reasoning ability of students

IPH2045: Machine Learning Using Python - III

CO1: Describe classification problem

CO2: Understand Classification using support vector machines

CO3: Apply Classification using support vector machines

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IPH2053: Plant Propagation

CO1: Identify and asses the quality of different types of soils.

CO2: Develop an understanding of propagation techniques.

CO3: Practice different types of artificial propagation techniques like layering, grafting and budding.

IPH2054: Machine Learning Using Python - IV

CO1: Apply classification using K-means

CO2: Describe Unsupervised learning using K-means

CO3: Perform typical computational task related to the units practically

CO4: Apply Classification using support vector machines

IPH2025C: Summer Project - III

CO1: Identification of research/industrial/academic problem, preparation of methodology of work, time bound planning.

CO2: Report the use of sophisticated instrumentation/software and enhance academic scenario through practical experience.

CO3: Develop the ability to analysis data collection, interpretation of observation and capability to make inferences

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CO4: Develop new knowledge and experience to contribute in the start-up programs.

IPH2061: Observational Astronomy

CO1: Visualize an idea about astronomy and optical telescopes

CO2: Visualize an idea about celestial objects like Stars, Galaxies and the Universe

CO3: Visualize the evolution of universe.

CO4: Practice to identify different planets, stars and constellations

IPH2068: Finishing School

CO1: Develop the capacity to confidently face interviews, GD and secure placements in reputed companies

CO2: Develop the essential professional skills that will help students to lead a successful career.

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