MES COLLEGE MARAMPALLY

DEPARTMENT OF PHYSICS

M.Sc Programme Outcomes

The Master of Science in Physics programme provides the candidate with knowledge, general competence, and analytical skills on an advanced level, needed in industry, consultancy, education, research, or public administration.

Upon completion of M.Sc Physics programme students will be able to:

Knowledge

- have substantial knowledge in physics, basic knowledge in mathematics, and knowledge in supported fields like computer science.
- have some research experience within a specific field of physics, through a supervised project (the Master Thesis).
- have advanced knowledge in some areas in physics.
- were familiar with contemporary research within various fields of physics.

Skills

- have the background and experience required to model, analyse, and solve advanced problems in physics.
- were able to apply advanced theoretical and/or experimental methods, including the use of numerical methods and simulations.
- can combine and use knowledge from several disciplines.

M Sc Physics

COURSE CODE	COURSE	OUTCOME
Semester 1		
PH1C03	Electrodynamics	➢ Describe and understand the basic concepts underpinning electricity and magnetism such as potential and field. ➢ Understand the relationship between electric and magnetic fields. ➢ Calculate the electrostatic and magnetic fields produced by static and moving charges in a variety of simple configurations. ➢ Identify and apply appropriate theoretical techniques to solve a range of different problems in electromagnetism.
PH1C02	Classical mechanics	➢ Solve complicated physical problems using the principle of least action. ➢ Describe the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems. ➢ Understand the fundamentals of the mechanics of continuous systems
PH1C01	Mathematical methods in physics 1	➢ Explain the fundamental concepts of a special topic in mathematical physics. ➢ Demonstrate accurate and efficient use of specific mathematical physics techniques. ➢ Demonstrate capacity for mathematical reasoning through analysing, proving and explaining concepts from mathematical physics
PH1C04	Electronics	➢ Describe the circuit elements and theorems from the first principles. ➢ Analyse the time responses of first-order switching circuits (RL and RC). ➢ Explain the operation of basic electronic devices (diode and operational amplifier), theirs uses and limitations.

		➢ Be fluent in using electronic equipments (e.g. Oscilloscope and signal generator) for analysing electronic circuits with resistors, capacitors, inductors and diodes.
Semester 2		
PH2C05	Mathematical methods in physics 2	➢ Explain the fundamental concepts of a special topic in mathematical physics. ➢ Demonstrate accurate and efficient use of specific mathematical physics techniques. ➢ Demonstrate capacity for mathematical reasoning through analysing, proving and explaining concepts from mathematical physics
PH2C06	Quantum mechanics 1	➢ Identify and understand the kinds of experimental results which are incompatible with classical physics and which required the development of a quantum theory of matter and light ➢ Interpret the wave function and apply operators to it to obtain information about a particle's physical properties such as position, momentum and energy ➢ Solve the Schroedinger equation to obtain wave functions for some basic, physically important types of potential in one dimension, and estimate the shape of the wavefunction based on the shape of the potential ➢ Understand the role of uncertainty in quantum physics, and use the commutation relations of operators to determine whether or not two physical properties can be simultaneously measured
PH2C08	Condensed matter physics	➢ Be able to account for interatomic forces and bonds ➢ Be able to account for how crystalline materials are studied using diffraction, including concepts like the Ewald sphere, form factor, structure factor, and scattering amplitude. ➢ Be able to perform structure determination of simple structures ➢ Understand the concept of reciprocal space and be able to use it as a tool ➢ Know the significance of Brillouin zones ➢ Be able to calculate thermal and electrical properties in the free-electron model ➢ Know Bloch's theorem and what energy bands are ➢ Know the fundamental principles of semiconductors, including pn-junctions, and be able to estimate the charge carrier mobility and density.

		➢ Be able to account for what the Fermi surface is and how it can be measured ➢ Know basic models of magnetism
PH2C07	Thermodynamics and statistical mechanics	➢ Apply classical equilibrium thermodynamics to make physical predictions. ➢ Describe the effects of quantum mechanics on statistical mechanics. ➢ Apply statistical mechanics to condensed matter systems and to such examples as the Bose and Fermi gases, and superconductors. ➢ Explain how the order parameter is used in describing phase transitions.
Semester 3		
PH3C09	Quantum Mechanics 2	➢ Identify and understand the kinds of experimental results which are incompatible with classical physics and which required the development of a quantum theory of matter and light ➢ Interpret the wave function and apply operators to it to obtain information about a particle's physical properties such as position, momentum and energy ➢ Solve the Schroedinger equation to obtain wave functions for some basic, physically important types of potential in one dimension, and estimate the shape of the wavefunction based on the shape of the potential ➢ Understand the role of uncertainty in quantum physics, and use the commutation relations of operators to determine whether or not two physical properties can be simultaneously measured
PH3C10	Computational physics	➢ Understand and be able to describe the basic mathematical-numerical descriptions of physical systems ➢ Be able to formulate, interpret, analyze and use mathematical-numerical descriptions of fundamental and applied problems in physics, ➢ Be able to estimate uncertainties in mathematical-numerical descriptions of physical systems.
PH3ME1	Solid state physics	➢ have an understanding of the elastic properties of solids and lattice vibrations. ➢ have an understanding of the properties of metals on the basis of the free and nearly-free electron gas models. ➢ have an understanding of the essence of density functional theory and its underlying building blocks. ➢ have an understanding of the magnetic properties of

		condensed matter. ➢ have an understanding of the optical properties of solids and the relation to their electronic properties.
PH3ME2	Crystal growth techniques	➢ be able to explain crystal growth and epitaxy and the necessary concepts in thermodynamics and kinetics ➢ be able to explain the connection between growth parameters and the quality and properties of the grown material ➢ be able to evaluate and select a crystal growth method, suitable for a specific situation ➢ be able to scientifically present issues related to crystal growth, orally or in writing
Semester 4		
PH4C12	Nuclear and particle physics	➢ Analyse production and decay reactions for fundamental particles, applying conservation principles to determine the type of reaction taking place and the possible outcomes ➢ Describe the role of colour in the strong force, and appreciate why going from strong interactions between quarks to nuclear structure is a currently unsolved problem 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
PH4C11	Atomic and molecular physics	➢ Explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields ➢ State and justify the selection rules for various optical spectroscopies in terms of the symmetries of molecular vibrations ➢ Demonstrate a grasp of bonding types in molecules
PH4OE1	Optoelectronics	➢ Use principles of physics to analyze and design the following optoelectronic components – LEDs, lasers, photodiodes, and photovoltaics. ➢ Be familiar with the tools and processes used in fabricating the following optoelectronic components - LEDs, lasers, photodiodes, and photovoltaics. ➢ Understand metrics of optoelectronics devices and be able to incorporate them into systems for optimal performance.

PH4EC3	Nanostructures and Characterization	➢ Understand the fundamental principles of nanotechnology and their application to biomedical engineering. ➢ Apply engineering and physics concepts to the nano-scale and non-continuum domain. ➢ Demonstrate a comprehensive understanding of state-of-the-art nano-fabrication methods. ➢ Evaluate processing conditions to engineer functional nanomaterials. ➢ Evaluate current constraints, such as regulatory, ethical, political, social and economical, encountered when solving problems in living systems.