

	<b>Program: B.Sc - Physics, Mathematics, Computer Science (PMC)</b>				
	<b>PHYSICS</b>				
	<b>PO code</b>	<b>Program Outcomes</b>			
	PO1	Provide a firm foundation in every aspect of physics and to explain a broad spectrum of modern trends in physics			
	PO2	Develop experimental, computational and mathematical skills of students			
	<b>Semester</b>	<b>Course Code</b>	<b>CourseName</b>	<b>COC ode</b>	<b>CO</b>
	I	PHY1C	Physics I	CO1	Understand the importance of frames of reference-inertial and non-inertial frames.
				CO2	Significance of mass distribution and axis of rotation in moment of inertia.
				CO3	Appreciation of oscillations to determine acceleration due to gravity.
				CO4	Significance of Kepler's contribution to understand gravitation.
				CO5	Understand elastic properties of solids and identify the materials suitable for different uses.
				CO6	Understanding motion under various forces.
				CO7	Acquire knowledge of basic forces in fluids at rest and in motion.
	II	PHY2A	Physics II	CO1	Understand the kinetics of transport phenomena in gases .
				CO2	Learning the basic principles of heat engines and refrigerators.
				CO3	Create awareness of critical constants and its significance.
				CO4	Learning the thermodynamic relations connecting entropy, enthalpy and free energy.
				CO5	Learn the basic principles of statistical mechanics, interpretation of temperature.

				CO6	Learn the methods of attaining low temperature.
				CO7	Basic understanding of different modes of heat transfer and its applications.
	III	PHY3A	Physics III	CO1	Understanding of principles of electrostatics and application in electromagnetism.
				CO2	Application of effect of electrical current in magnetic field and effect of thermo e.m.f.
				CO3	Describe and explain the generation of magnetic fields by electrical currents and vice versa.
				CO4	Use methods of vector calculus to solve problems in electromagnetism
				CO5	Describe and explain electrodynamics, Maxwell's equations, energy density of e.m. waves and their applications.
				CO6	Determine the transient containing R, L and C components
				CO7	Determine the condition of oscillation in LCR circuit and significance of resonance in LCR circuits.
	IV	PHY4C	Physics IV	CO1	Understanding of different aspects of waves and their applications
				CO2	Practical application of ray optics.
				CO3	Study of various interference patterns using coherence sources.
				CO4	Understanding resolving power of optical instruments using the diffraction properties of electromagnetic wave.
				CO5	Understanding the principle and application of LASER
				CO6	Understanding the transverse nature of electromagnetic waves and application of polarized light.

	V	PHY5C	Physics V	CO1	Familiarize with the main aspects of the historical development of quantum mechanics.
				CO2	Understand the concepts of the uncertainty principle
				CO3	Discuss and interpret experiments that reveal the wave nature of matter.
				CO4	Understand the central concepts and principles in quantum mechanics, such as the Schrödinger equation, the wave function and its statistical interpretation.
				CO5	Able to solve the Schrödinger equation on your own for simple systems.
				CO6	Analyze and study circuits for regulation, rectification, addition and amplification of voltages.
				CO7	Study of cathode ray oscilloscope to analyse waveforms
		PHY6C	Physics VI	CO1	Understand the three basic statistics .
	V			CO2	Prove the nonexistence of hypothetical ether, understand the limitations of Newtonian mechanics and learn special theory of relativity
				CO3	Provide in depth study of the atom and atomic spectra
				CO4	Study the effect of magnetic and electric field in atomic spectra
				CO5	Study of molecular spectra to analyse rotation vibration spectra
				CO6	Learn scattering of light
				CO7	Understand Raman effect to analyse Raman spectra
	VI	PHY7B	Physics VII	CO1	Study of X-ray spectra and X-ray diffraction to analyse crystal structure
				CO2	Understand basic ideas of crystal structure
				CO3	Understand Fermi level and Fermi energy in semiconductors



			the issue or problem at hand.		
		PO3	Formulate and develop mathematical arguments in a logical manner.		
		PO4	Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.		
		PO5	Understand, formulate and use quantitative models arising in physical sciences, business and other contexts.		
	<b>Semester</b>	<b>CourseCode</b>	<b>CourseName</b>	<b>COCode</b>	<b>CO</b>
	I	MAT1M AI	Mathematical Analysis-I	CO1	. Define and recognize the basic properties of the field of real numbers. Define and recognize the basic properties of the field of real numbers
				CO2	Improve and outline the logical thinking.
				CO3	. Have the knowledge of the series of real numbers and convergence.
				CO4	Define and recognize the series of real numbers and convergence
				CO5	Shown the ability of working independently and with groups.
				CO6	Studying Leibnitz theorem – Roll’s theorem, Langrange’s Mean Value theorem, Taylor’s theorem- Maclarurin’s expansion. theorem and Cauchy criteria.
	II	MAT2M AIIA	Mathematical Analysis-II	CO1	. Define and recognize the differentiability of real functions and its related theorems

				CO2	Have the knowledge of real functions-limits of functions and their properties. Interpret how to Know the differentiability and related theorems
				CO3	Define and recognize the basic topological properties of R Define and recognize the continuity of real functions ,
				CO4	Interpret how to Know the continuity using the internet.
				CO5	. Studying the differentiability of real functions and related theorems .
				CO6	Skill of solving problems on Fourier series.
	III	MAT3DE A	Differential Equations	CO1	Apply the concepts of Ordinary Differential Equations and Partial Differential Equations for their resolution and developed the knowledge to solve problems in higher order ordinary linear differential equations, Methods of finding Complementary function and Particular integral.
				CO2	Understand the difficulty of solving problems analytically and capable to formulate and solve problems in concepts like simultaneous differential equations, Legendre's linear differential equation and Cauchy's linear differential equation.
				CO3	Recognize and work with problems in Second Order Ordinary Differential Equations with variable coefficient with various methods and developed skills to understand concepts like Special functions.
				CO4	Able to work and apply concepts in Second order linear partial differential equations, canonical form for parabolic, elliptic and hyperbolic equations.

				CO5	Use computational tools to formulate and solve problems of one-dimensional heat and wave equation and two-dimensional Laplace equation using Fourier series
				CO6	Analyze real world problems and recognize when partial differential equations are appropriate, formulate problems about them, creatively model these (using technology, if appropriate) to solve the problems using multiple approaches, judge if the results are reasonable, and then interpret and clearly communicate the results.
	IV	MAT4A GR	Algebra - Groups and Rings	CO1	Assess properties implied by the definitions of groups and rings.
				CO2	Use various canonical types of groups (including cyclic groups) and canonical types of rings (including Quotient rings).
				CO3	Analyze and demonstrate examples and theorems of subgroups, normal subgroups and quotient groups.
				CO4	Analyze and demonstrate examples of Subring, Integral domains, Ideals, Maximal Ideals and quotient rings.
				CO5	Use the concepts of isomorphism and homomorphism for groups and rings.
				CO6	Produce rigorous proofs of propositions arising in Fundamental theorem of homomorphism in groups and rings.
				CO7	Apply problem-solving using advanced algebraic techniques applied to diverse situations in physics, engineering and other mathematical contexts.
	V	MAT5CA	Complex Analysis	CO1	The student realizes the importance of fundamental concepts of complex analysis

					and their role in modern mathematics and applied contexts
				CO2	The student will be able to analyze the ideas of complex differentiation and complex integration in a coherent and meaningful manner and use appropriate techniques for solving related problems and for establishing theoretical results.
				CO3	The student gains knowledge about Complex Number System and understands the relation to other existing number systems
				CO4	The student will develop the critical thinking ability by proving mathematical conjectures and establishing theorems
				CO5	The student gains competence to understand the operations with complex numbers, use the complex derivatives function, use and operate analytic functions, demonstrate knowledge of integration in the complex plane, use the Cauchy integral theorem and Cauchy integral formula, manipulate and use power series, understand residues and their use in integration, demonstrate the understanding of conformal mappings
				CO6	The student will be able to appreciate the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations
	V	MAT5LA A	Linear Algebra	CO1	Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, Eigenvalues and eigenvectors, orthogonality and

					diagonalization. (Computational and Algebraic Skills).
				CO2	Use visualization, spatial reasoning, as well as geometric properties and strategies to model, solve problems, and view solutions, especially in $R^2$ and $R^3$ , as well as conceptually extend these results to higher dimensions. (Geometric Skills).
				CO3	Critically analyze and construct mathematical arguments that relate to the study of introductory linear algebra. (Proof and Reasoning).
				CO4	Use technology, where appropriate, to enhance and facilitate mathematical understanding, as well as an aid in solving problems and presenting solutions (Technological Skills).
				CO5	Communicate and understand mathematical statements, ideas and results, both verbally and in writing, with the correct use of mathematical definitions, terminology and symbolism (Communication Skills).
				CO6	Work collaboratively with peers and instructors to acquire mathematical understanding and to formulate and solve problems and present solutions (Collaborative Skills).
	VI	MAT6EE DG	Elementary Differential Geometry	CO1	Compute the curvature and torsion of space curves.
				CO2	Understand the notion of Serret-Frenet frame for space curves.
				CO3	Understand definition of directional derivative and gradient and illustrate

					geometric meanings with the aid of sketches.
				CO4	Calculate directional derivatives and gradients and apply gradient to solve problems involving steepest ascent and normal vectors to level curves.
				CO5	Compute double integrals and triple integrals and change of variables. Can compute triple integrals in rectangular, cylindrical and spherical coordinates and illustrate its geometric meaning with the aid of sketches, and apply it to compute integrals over regions.
				CO6	Understand the integral theorems: Green's , Gauss divergence and Stoke's and also its applications.
	VI	MAT6E OTC	Optimization Techniques	CO1	The student will understand the importance of optimization of industrial process management
				CO2	The student will be able to apply basic concepts of mathematics to formulate an optimization problem
				CO3	The student will analyze and appreciate variety of performance measures for various optimization problems
				CO4	The student can develop and promote research interest in applying optimization techniques in problems of Engineering and Technology
				CO5	The student will be able to solve a multi-objective problem through weighted and constrained methods
	VI	MAT6N AA	Numerical Analysis	CO1	Understand the importance of computers and the role of approximations and errors in the implementation and development of numerical methods.



				CO3	Analyze the problem and design efficient algorithms using problem solving techniques
				CO4	Analyze control structures and functions to solve the given problem
				CO5	Understand and implement different Operations on arrays, pointers, structures and unions
				CO6	Implement file Operations in C programming for a given application
	II	COM2D SA	Data Structures	CO1	Understand fundamental concepts of data structures, space and time complexity
				CO2	Design algorithms for various operations (creation, insertion, deletion and traversal) on linear data structures
				CO3	Design algorithms for various operations (creation, insertion, deletion and traversal) on non-linear data structures
				CO4	Explain the applications of data structures
				CO5	Implement various searching and sorting techniques
				CO6	Implement the data structures using a programming language
	III	COM30 SUPA	Operating Systems and Unix Programming	CO1	Understand the structure and functionalities of an Operating System and use system calls to perform process operations in UNIX.
				CO2	Understand CPU Scheduling algorithms.
				CO3	Describe different memory management techniques.
				CO4	Describe different disk space allocation methods and free space management techniques.
				CO4	Learn basic UNIX commands and apply to manage file processing operations, filters and system administration.
				CO6	Write and execute shell scripts to perform different tasks.

	IV	COM4S DA	Software Engineering and Database Management Systems	CO1	Understand software characteristics and process models
				CO2	Explore different phases of Software Development Life Cycle
				CO3	Understand and apply software testing methods on simple applications
				CO4	Understand DBMS architecture and data models
				CO5	Gain knowledge of relational data base concepts and build normalized databases
				CO6	Design DML, DCL,TCL queries to extract information from the databases
	V	COM5O OPCA	Object Oriented Programming Concepts using Java	CO1	Understand object oriented principles and analyze language fundamentals
				CO2	Apply the principles of Object oriented programming and write simple java programs, debug and execute them
				CO3	Handle exceptions efficiently and apply threading techniques to improve program efficiency
				CO4	Understand the hierarchy of I/O streams and write programs to handle file operations
				CO5	Design dynamic and interactive applets and implement event handling mechanism
				CO6	Design and develop applications with Graphical User Interface
		COM5W PA	Web Programming	CO1	Design and develop web pages using HTML, Javascript, DHTML and XML
				CO2	Understanding the .net architecture and apply Object Oriented programming concepts to model real world objects
				CO3	Understand C# concepts
				CO4	Getting introduced to ASP.net techniques and controls

				CO5	Gain knowledge of state management and data binding
	VI	COM6C GA	Computer Graphics	CO1	Familiarize with graphics display devices and its applications
				CO2	Understand OpenGL application programming interface to build graphics applications
				CO3	Learn basic graphics algorithms to build simple objects and apply geometric transformations on 2D & 3D objects
				CO4	Understand clipping algorithms and apply it for line, point and text clipping
				CO5	Comprehend graphics visualization techniques in 3D scenes
				CO6	Learn various graphics interactive programming techniques to create animations
				COM6E CNC	Computer Networks
	CO2	Know the physical layer and procedures involved in data transmission, signal encoding, multiplexing and switching mechanisms			
	CO3	Familiarize the role of Media Access Control(MAC) Sub layer, IEEE standards for LANs and Error Detection and Correction of codes through the Data Link Layer			
	CO4	Understand the importance of Routing Algorithms, Congestion Control and elements of Internet transfer protocols in the transport layer			
	CO5	Understand the purpose of DNS, Cryptography and Firewalls to demonstrate security and authentication			