DEPARTMENT OF MATHEMATICS

Programme Outcomes (POs):

PO1: KNOWLEDGE AND APPLICATION- Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevance in day-to- day life. Also be able to apply the fundamental principles, concepts and methods in key areas of science and multidisciplinary fields. Demonstrate problem solving, analytical and logical skills to provide solutions for scientific requirements.

PO2: PROFESSIONALISM AND ETHICS- Demonstrate accountability and professionalism that is rooted in ethical, altruistic, moral, and humanistic principles.

PO3: LEADERSHIP AND SOCIAL ACUITY - Capable of taking responsibilities as a leader and demonstrate responsiveness to the regional and national environments developing abilities to manage challenges for nation building.

PO4: DIGITAL COMPETENCE: Able to use technology and skills to process information and data for the benefit of the society.

PO5: COMMUNICATION AND TEAM WORK- Interact effectively with stakeholders, fostering an environment of team work, mutual respect and shared decision making skills. Develop innovative skills, leadership quality and ethical values.

PO6: CRITICAL, LOGICAL AND RATIONAL THINKING - Acquire the ability for objective, rational, logical, and unbiased analysis of factual evidence to form a judgement or conclusion. Enhance the process of rational thinking, problem solving and analytical evaluation from different perspectives. Acquire basic knowledge on logic, tools and techniques for formulating problems in to a model.

PO7: ENLIGHTENED AND EFFECTIVE CITIZENSHIP - Cultivate progressive citizenship for a knowledge society, for peace and prosperity of nations and the world. Develop clear, rational and progressive thinking. Participate in decision-making concerning the society and upholding national development, integrity, unity and fraternity.

PO8: SUSTAINABLE DEVELOPMENT - Understand, organise and promote the principle of human development goals by sustaining the ability of natural systems, natural resources and ecosystem services upon which the economy and society depends.

PO9: Proficiency with the ability to qualify competitive and professional examinations.

PO10: LIFE-LONG PROCESS OF LEARNING: Cultivate the proficiency to engage in continuous reflective learning in the context of technological and scientific advancements.

Programme Specific Outcomes (PSOs):

PSO1: MATHEMATICAL FOUNDATION AND RIGOR: Demonstrate a deep understanding of core mathematical concepts including calculus, algebra, real and complex analysis, linear algebra, number theory, and differential equations, enabling students to approach problems with logical precision and analytical rigor.

PSO2: PROBLEM SOLVING AND ANALYTICAL THINKING: Apply mathematical reasoning and problem-solving techniques to model and solve real-world problems across disciplines such as physics, engineering, economics, and computer science.

PSO3: COMPUTATIONAL AND TECHNOLOGICAL PROFICIENCY: Utilize mathematical software tools (e.g., MATLAB, Mathematica, Python) to visualize, simulate, and analyze mathematical models, enhancing computational skills and digital literacy.

PSO4: STATISTICAL AND PROBABILISTIC REASONING: Understand and apply principles of probability and statistics, including distributions, limit theorems, and stochastic processes, to analyze data and make informed decisions under uncertainty.

PSO5: ABSTRACT STRUCTURES AND ALGEBRAIC SYSTEMS: Explore and manipulate abstract algebraic structures such as groups, rings, fields, and modules, and understand their applications in cryptography, coding theory, and theoretical computer science.

PSO6: ADVANCED ANALYTICAL TECHNIQUES: Master advanced topics in real and complex analysis, including convergence, continuity, differentiability, integration, and series expansions, with applications in mathematical modeling and theoretical research.

PSO7: INTERDISCIPLINARY APPLICATIONS AND MODELING: Develop and analyze mathematical models for physical, biological, and social systems using differential equations and linear algebra, fostering interdisciplinary thinking and innovation.

PSO8: RESEARCH ORIENTATION AND HIGHER STUDIES READINESS: Build a strong foundation for pursuing postgraduate studies and research in mathematics and related fields, with the ability to engage in independent inquiry and critical evaluation of mathematical literature.

PSO9: COMMUNICATION AND COLLABORATION: Communicate mathematical ideas effectively through written, oral, and visual means, and collaborate in diverse teams to solve complex problems and present findings clearly.

PSO10: ETHICAL AND LIFELONG LEARNING PERSPECTIVE: Cultivate a sense of mathematical curiosity, ethical responsibility, and a commitment to lifelong learning in the evolving landscape of science and technology.

PSO11: PREPARATION FOR HIGHER STUDIES AND CAREERS: Equip students with the necessary knowledge and skills to pursue advanced studies or careers in education, research, data science, actuarial science, finance, and related fields.

PSO 12: Playing a constructive role as a responsible citizen in the society.

Semester	Course Code	Course Title	Course Outcomes (COs)
I	CORE- I	Calculus & Analytic Geometry	• Trace a curve and find asymptotes. • Calculate integrals of typical type using reduction formulae, etc. • Calculate arc length, surface of revolution and know about conics • Calculate triple products, gradient divergence, curl.
	CORE- II	Introduction to Algebra and Number Theory	• Understand the equivalence relations and concept of group with different examples. • Understand the properties of cyclic groups, rings, and integral domain. • Know divisibility and division algorithm and find *gcd* using Euclidean Algorithm. • Solve linear Diophantine equations, find least common multiples,solve linear congruence applying the Chinese remainder theorem.
II	CORE III	Real Analysis-I	• Learn basics of real number system and test countability of a set. • Know on sequence of real numbers and their basic properties. • Test convergence of an infinite series. • Find limit and continuity of functions and test uniform continuity of functions.
		Algebra-I	• Understand permutation groups with some results and application in Rubik's cube. • Understand the concept of homomorphisms, isomorphisms, normal subgroups and factor groups. • Explore more properties of rings and ideals rigorously. • Get introduced to the concept of reducibility and irreducibility of

			polynomials and concept of unique factorization domain.
III	CORE- V	Probability	• Learn the basics of probability and random variables with axioms of probability. • Know the discrete and continuous distributions and learn how to calculate mean, variance and moments of them. • Learn on limit theorems with their applications and know about the conditional expectations. • Learn on Markov chains and their applications.
	CORE- VI	Differential Equations-I	• Get the idea to solve first order linear ordinary differential equations of different types those are arising in physical problems. • Get the idea to solve second order linear ordinary differential equations of different types those are arising in physical problems. • Get basic ideas of first order partial differential equations, its formulation in two, three variables and variable separable method for identify the solutions. • Get idea to solve various mathematical models of ODEs and PDEs which may be helpful for simulation process.
	CORE- VII	Linear Algebra	• Determine basis and the dimension of a finite-dimensional vector space, know the relation between rank and nullity of a linear transformation. • The relation between matrix and linear transformation. • To find solution of system of linear equations, compute eigenvalues, eigenvectors of a matrix and linear transformation. • About orthogonality of vectors and application of it to different form of

			matrix, introduced to different operators.
IV	CORE- VIII	REAL ANALYSIS-II	• Learn working out problems on derivatives of function and their applications. • Learn about Riemann Integration and their properties including Improper Integrals. • Learn on pointwise and uniform convergence of power series. • Learn to calculate value of improper integrals.
	CORE- IX	Complex Analysis-I	• Understand the geometric aspects of complex numbers system, convergence of series of complex numbers. • Understand the significance of complex differentiability, analyticity and construction of analytic functions from given harmonic functions. • Relate the notion of line integral, Cauchy fundamental theorems on integrals and its applications. • Classify the nature of singularities, properties of zeros and poles and be able to know the applications of residue theorem.
	CORE- X	Algebra-II	• Know on finite abelian groups, the class equation and Sylow's theorems. • Know on applications of Sylow's theorems and test the simplicity of groups. • Learn on group action, composition series, nilpotent groups and solvable groups. • Solve problems in modules and related results.

V	CORE- XI	Real Analysis-III	• Find the Fourier series of a function. • Calculate Riemann Stieltjes integrals and know whether a function is of bounded variation or not. • Learn how to define derivatives on R^n including the existence of partial derivatives, inverse function theorem and implicit function theorem. • Learn about metric spaces and their topological properties.
	CORE-XII	Differential Equations-II	• Understand first order nonlinear ordinary differential equations and existence of solutions • Learn the methods to find solutions of second order linear ordinary differential equations with constant coefficients and variable coefficients. • The different methods for solving first and second order partial differential equations and can take more courses on wave equation, heat equation, diffusion equation, gas dynamics, nonlinear evolution equations etc. All these courses are important in engineering and industrial applications for solving boundary value problems. • Get idea to solve various mathematical models of ODE and PDE which may be helpful for simulation process.
	CORE- XIII	Numerical Analysis & Scientific Computing	• Understand the errors in computation, find the roots of algebraic and transcendental equations, familiarize with convergence, advantages and limitations of those numerical techniques, learn to apply Gauss−Jacobi, Gauss−Seidel methods to solve system of linear equations. • Get aware of using interpolation techniques to solve polynomials.

			• Learn numerical differentiation and integrations by using different techniques. • Understand the techniques to find approximate solutions of ODE and PDE.
VI	CORE-XIV	Multivariable Calculus	• Learn the concept of limit, continuity and differentiations of functions of more than one. • Understand the maximization and minimization of multivariable functions with the given constraints on variables. • Learn about inter-relationship amongst the line integral, double, and triple integral formulations. • Familiarize with the Green's, Stokes' and Gauss divergence theorems and their applications.
	CORE- XV	Differential Geometry	• Understand the notion of plane curves, space curves, curvature, torsion and the existence of space curves. • Learn the theory of surfaces and learn to calculate first fundamental forms. • Learns on geodesics on a surface and learns to calculate curvatures. • Learns calculating second fundamental forms, curvatures and discovers minimal surfaces.