DEPARTMENT OF MATHEMATICS

PROGRAMME NAME: MSc MATHEMATICS

PROGRAMME OUTCOMES (PO)

PO1. Inculcate critical thinking to carry out scientific investigation objectively without being biased with preconceived notions.
PO2. Equip the student with skills to analyze problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions.
PO3. Prepare students for pursuing research or careers in industry in mathematical sciences and allied fields
PO4. Imbibe effective scientific and/or technical communication in both oral and writing.
PO5. Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematical sciences.
PO6. Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO.1. Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.
PSO.2. Inculcate mathematical reasoning.
PSO.3.Prepare and motivate students for research studies in mathematics and related fields.
PSO.4. Provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.
PSO.5. Provide advanced knowledge on topics in pure mathematics, empowering the students to pursue higher degrees at reputed academic institutions.
PSO.6. Good understanding of number theory which can be used in modern online cryptographic technologies.
PSO.7. Nurture problem solving skills, thinking, creativity through assignments, project work.
PSO.8 Assist students in preparing (personal guidance, books) for competitive exams e.g. NET, GATE, etc.

COURSE OUTCOMES			
Semester	**Course Code**	**Course title**	**Course outcome**
I	MAT1C01	Basic Abstract Algebra	CO1. Identify and analyze different types of Algebraic structures to understand and use the fundamental results in algebra. CO2. Analyze and implement the concept of homomorphism and isomorphism between groups and rings for solving different types of problems. CO3. Applying the concept of group action and sylow - theorems. CO4. Understand the concept of finitely generated abelian groups, ideals and fields helps to explore the existing results.
I	MAT1C02	Linear Algebra	CO1: Make better understanding linear transformation and related concepts - isomorphism, matrix of linear transformation, linear functional and the double dual of linear transformation CO2. Gives an overview of characteristic values, annihilating polynomials, invarient subspaces, diagonalization and triangulation. CO3. Enable students to understand the concepts of elementary canonical form, the rational canonical form and Jordan form. Given then an idea about inner product spaces. CO4. Students can gain the skill like modeling of problems and matrix manipulation.
I	MAT1C03	Real Analysis	CO.1 Students achieve a good grasp of the basic concepts of real analysis. CO.2. Understand the basics of metric spaces and generalize the concepts of limits, continuous functions in metric spaces. CO.3. Apply the concepts of derivatives, Mean value theorems for vector valued functions in different fields. CO.4. Recognize the differences between bounded variation and total variation of functions. CO.5. Understand the concept rectifiable curves.
I	MAT1C04	Basic Topology	CO.1. Introduce the concepts of topological space and the basic definitions such as open sets,neighbourhoods, interior, exterior, closure and their axioms for defining topological spaces. CO.2. Understand the concepts of bases and Sub bases. Create new spaces from old ones. CO.3. Highlight the features of continuity, connectedness, homeomorphism, topological properties.

I	MAT1C05	Differential Equations	CO.1. Apply various power series methods to obtain series solution of differential equations. CO.2. Ability to handle differential equation and solve them under appropriate assumption. CO.3. Discuss various kinds of special functions indetail, their properties and relation. CO.4. Students will have working knowledge of basic application problems described by homogeneous linear system with constant coefficients. CO.5. Introduce Picard's theorem and enable them to solve approximation problems.
II	MAT2C06	Advanced abstract algebra	CO1. Enable students to understand Unique Factorization Domains, Euclidean Domains, Gaussian Integers and Multiplicative Norms, Introduction to Extension Fields CO2.Understand the concept of Algebraic Extensions,Geometric Constructions, Finite Fields, Automorphisms of Fields. CO3. Analyze the concept of Isomorphism Extension Theorem, Splitting Fields, Separable Extensions. Galois Theory
II	MAT2C07	Measure and Integration	CO1: Introduce the definition and properties of lebesgue outer measure. CO2: Understand the concept of measurable sets ,and construction of non-measurable sets ,measurable functions of a real variable CO3. Enable students to understand Riemann and lebesgue integral, concept of Abstract measure spaces
II	MAT2C08	Advanced Topology	CO1:Enable students to review the fundamentals of topology CO2:Understand the concept of compactness and relation between various forms of compactness CO3: Recognize how points of space are separated by open sets and understand the separation axioms CO4: Acquire knowledge about metrizability andhomotopy of paths
II	MAT2C09	Foundations of Complex analysis	CO1: Design, analyze and implement the concept ofAnalytic Functions, Complex Integration , Power Series representation of Analytic Functions Zeroes of an analyticfunction , Cauchy's Theorem and Integral Formula , Goursat' sTheorem CO2: Analyze different type of Singularities, Classification of singularities, Residues,The Argument Principle, the Maximum Modulus Theorem, the Maximum Principle, Schwarz's Lemma . CO3: Understand the concept of Compactness and Convergence in the

			Space of Analytic functions, the Spaces of continuous functions C(G, Ω), Spaces of analytic functions,the Riemann Mapping Theorem, Weierstrass Factorization Theorem.
II	MAT2C10	Partial differential equations and integral equations	CO1**:** Solving first order partial differential equation using Method of Charpits and Jacobi. Introduce the nonlinear first order pde CO2: Identify and solve different types of second order pde including the solution of One dimensional Wave Equation. . Laplace's Equation and discuss Problems - The Cauchy Problem, The Dirchlet Problem , Introduce integral equation. CO3 :Develop skills in the formulation, solution understanding and interpretation of pde Models
III	MAT3C11	Number theory	CO1:Make a better understanding of divisibility and related algorithms CO2: Discuss the distribution of primes and introduce various arithmetical functions and related results CO3: Enable students to understand the definition and basic properties of congruences. CO4:Introduce the concept of quadratic residues and quadratic reciprocity law, Primitive roots , Introduce the concept of coding and cryptography CO5: Gives an overview of algebraic number theory
III	MAT3C12	Functional Analysis	CO1: Introduce the Concept of normed linear spaces and innerproduct spaces, Bounded linear operators between these spaces . CO2:Make a better understanding of orthonormal sets, approximation and optimization and discuss the Projection and Riesz representation theorems CO3:Enable students to compare the differences between Banach and Hilbert Spaces CO4:Students achieve a good idea to show that certain spaces of functions are complete
III	MAT3C13	Complex Function Theory	CO1: Introduce Elliptic Functions, Simple periodic functions, Doubly periodic functions, The Riemann Zeta function and related results. CO2 : Discuss Runge's Theorem , Simple Connectedness, Mittag Lefler's Theoerem, Mondromy Theorem ,Harmonic Functions CO3: Understand basic Properties of harmonic functions, Sub harmonic and super harmonic functions, entire Functions, Jensen's formula
III	MAT3C14	Advanced real Analysis	CO1: Make better understanding of Sequence and series of Functions. Uniform Convergence,UniformConvergence and Continuity,UniformConvergence and Integration,Uniform Convergence

			and Differentiation, Equicontinous Family of Functions, The Stone-Weierstrass Theorem, CO2: Introduce Some Special Functions and realated algorithms CO3 : Discuss more about Linear Transformations, Differentiation, The InverseFunction Theorem, The Implicit Function Theorem.
IV	MAT4C15	Operator theory	CO1: Introduce the concept of Spectrum of a Bounded Operator, Weak and Weak* Convergence CO2: Discuss about the Spaces of Bounded Linear Functionals; Reflexivity, Compact Operators on Normed Spaces, Spectrum of a Compact Operator. CO3: Understand the concept of Bounded Operators on Hilbert Spaces, Adjoints, Normal, Unitary and Self Adjoint Operators, Spectrum and Numerical Range, CompactSelf Adjoint Operators.
IV	MAT4C16	Differential Geometry	CO1. Introduce the concept of Graphs and Levels Sets, Vector Fields, The Tangent Space, Surfaces, Vector fields on Surfaces, Orientation CO2: Give an overview of the Gauss map, Geodesics, Parallel Transport The Weingarten Map, Curvature of Plane Curves. CO3: Understand the concept of arc Length and Line Integrals, Curvature of Surfaces, Parameterized Surfaces, and Local Equivalence of Surfaces and Parameterized Surfaces.
IV	MAT4D01	Project work	CO1. Inculcate a taste for research in mathematics CO2. Develop oral and written presentation skills
IV	MAT4VO1	Viva –Voce	CO1.To evaluate the students perfomance apart from the Written exam CO 2.To check how far the students attain the various Course objective .

LIST OF ELECTIVES

Semester	Course code	Course tittle	Course outcome
IV	MAT4E02	Fourier and wavelet analysis	CO1: They are able to Construct Wavelets on Zn, the First Stage. and Construct Wavelets on Zn,the Itration Step. Introduce the concept of the Haar System, the Shannon wavelets and the Daubechies's D6 wavelets on Zn. CO2: Understand l^2 (Z), Complete Orthonormal sets in Hilbert Spaces l^2 (Z),and The Fourier transforms and convolution on l^2 (Z), First Stage Wavelets on Z, CO3: Discuss about L^2 (R) and Approximate Identities.
III	MAT3E01	Graph theory	CO1:Discuss Ramsey's theorem, gives an overview of graph coloring,chromatic number CO2: Understand the concept of Planargraphs Dual graphs, Bridges and realated theorems . CO3: Discuss the idea of network. C04:Developing an ability to recognize and handle those problems where a graphtheoretical Framework is useful to study