Name of the Programme	Master of Science in Mathematics
Short Name of the Programme	MSc Mathematics
Code of the Programme	MTH

PROGRAMME OUTCOMES - POs

Sl. NO	CO No:	Programme Outcomes
1	PO 1	Acquire the ability to apply the basic principles of logic and science to thoughts, actions and interventions.
2	PO 2	Perceive knowledge as a comprehensive, interrelated and integrated faculty of the human mind.
3	PO 3	Generate hypothesis and articulate assent or dissent by employing both reason and creative thinking.
4	PO 4	Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.
5	PO 5	Develop self-critical abilities and the ability to view positions, problems and social issues from plural perspectives.
6	PO 6	Participate in nation building by adhering to the principles of scientific temper, sovereignty, socialism, secularism, democracy and the values that guide a republic.
7	PO 7	Develop gender sensitive attitudes, environmental awareness, the ability to understand and resist various kinds of discriminations and empathetic social awareness about various kinds of marginalization.
8	PO 8	Understand the issues related to the current environmental problems and apply the principles of science for a sustainable development in an interdisciplinary manner.
9	PO 9	Develop communication skill in English and local languages through different media.
10	PO 10	Learn to articulate analysis, synthesis, and evaluation of situations and themes in a scientific manner.
11	PO 11	Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.
12	PO 12	Attain a high level of scientific excellence, and develop hand-pick and apply appropriate techniques, resources and modern technologies for sustainable development.

PROGRAMME SPECIFIC OUTCOMES - PSOs

Sl. NO	CO No:	Programme Specific Outcomes
1	PSO 1	A solid understanding of graduate level algebra, analysis and topology.
2	PSO 2	Using their mathematical knowledge to analyse certain problems in day to day life.
3	PSO 3	Identifying unsolved yet relevant problems in a specific field.
4	PSO 4	Undertaking original research on a particular topic.
5	PSO 5	Communicate mathematics accurately and effectively in both written and oral form.
6	PSO 6	Conducting scholarly or professional activities in an ethical manner.

COURSE OUTCOMES - COs

Semester	Course code	Course Title	CO No:	Course Outcomes

	MTH1C01	ALGEBRA - I	CO1	Learn factor group computation.
			CO2	Understand the notion of group action on a set.
			CO3	Learn Sylow theorems and its applications.
			CO4	Understand the notion of free groups.
			CO5	Understand the concept rings of polynomials.
			CO6	Learn group presentation.
	MTH1C02	LINEAR ALGEBRA	CO1	Learn basic properties of vector spaces.
			CO2	Understand the relation between linear transformations and matrices.
			CO3	Understand the concept of diagonalizable and triangulable operators and various fundamental results of these operators.
			CO4	Understand Primary decomposition Theorem.
			CO5	Learn basic properties inner product spaces.
	MTH1C03	REAL ANALYSIS I	CO1	Learn the topology of the real line.
			CO2	Understand the notions of Continuity, Differentiation and Integration of real functions.
			CO3	Learn Uniform convergence of sequence of functions, equicontinuity of family of functions, and Weierstrass theorems.
1	MTH1C04	DISCRETE MATHEMATICS	CO1	Understand the fundamentals of Graph Theory
			CO2	Learn the structure of graphs and familiarize the basic concepts to analyze different problems in different branches.
			CO3	Acquire a basic knowledge of formal languages, grammar and automata.
			CO4	Learn equivalence of deterministic and nondeterministic finite accepters.
			CO5	Learn the concepts of partial order relation and total order relation.
	MTH1C05	NUMBER THEORY	CO1	Be able to effectively express the concepts and results of number theory.
			CO2	Learn basic theory of arithmetical functions and Dirichlet multiplication, averages of some arithmetical functions.
			CO3	Understand distribution of prime numbers and prime number theorem.
			CO4	Learn the concept of quadratic residues and Quadratic reciprocity laws.
			CO5	Get a basic knowledge in Cryptography.
	MTH2C06	ALGEBRA II	CO1	Learn different types of extensions of fields.
			CO2	Learn automorphisms of fields.
			CO3	Get a basic knowledge in Galois Theory.
			CO4	Learn how to apply Galois Theory in various contexts.
	MTH2C07	REAL ANALYSIS II	CO1	Learn why and for what the theory of measure was introduced.
			CO2	Learn the concept of measures and measurable functions.
			CO3	Learn Lebesgue integration and its various properties.
			CO4	Learn how to generalize the concept of measure theory.
			CO5	Learn that a measure may take negative values.
			CO1	Be proficient in the abstract notion of a topological space, where continuous function are defined in terms of open set not in the traditional $\varepsilon - \delta$ definition used in analysis.

2	MTH2C08	TOPOLOGY	CO2	Realize Intermediate value theorem is a statement about connectedness, Bolzano weierstrass theorem is a theorem about compactness and so on.
			CO3	Learn the concept of quotient topology.
			CO4	Learn five properties such as T0, T1, T2, T3 and T4 of a topological space X which express how rich the open sets is. More precisely, each of them tells us how tightly a closed subset can be wrapped in an open set.
	MTH2C09	ODE AND CALCULUS OF VARIATIONS	CO1	Learn the existence of uniqueness of solutions for a system of first order ODEs.
			CO2	Learn many solution techniques such as separation of variables, variation of parameter, power series method, Frobeniious method etc.
			CO3	Learn method of solving system of first order differential calculus equations.
			CO4	Get an idea of how to analyze the behavior of solutions such as stability, asymptotic stability
			CO5	Get a basic knowledge of Calculus of variation.
	MTH2C10	OPERATIONS RESEARCH	CO1	Learn graphical method and the simplex algorithm for solving a linear programming problem.
			CO2	Learn more optimization techniques for solving the linear programming models - transportation problem and integer programming problem.
			CO3	Learn optimization techniques for solving some network related problems.
			CO4	Learn sensitivity analysis and parametric programming, which describes how various changes in the problem affect its solution.
	MTH3C11	MULTIVARIABLE CALCULUS AND GEOMETRY	CO1	Be proficient in differentiation of functions of several variables.
			CO2	Understand curves in plane and in space.
			CO3	Get a deep knowledge of Curvature, torsion, Serret-Frenet formulae.
			CO4	Learn Fundamental theorem of curves in plane and space.
			CO5	Learn the concept of Surfaces in three dimension, smooth surfaces, surfaces of revolution.
			CO6	Learn explicitly tangent and normal to the surfaces.
			CO7	Get a thorough understanding of oriented surfaces, first and second fundamental forms surfaces, gaussian curvature and geodesic curvature and so on.
	MTH3C12	COMPLEX ANALYSIS	CO1	Learn the concept of (complex) differentiation and integration of functions defined on the complex plane and their properties.
			CO2	Be thorough in power series representation of analytic functions, different versions of Cauchy's Theorem.
			CO3	Get an idea of singularities of analytic functions and their classifications.
			CO4	Learn different versions of maximum modulus theorem.
	MTH3C13	FUNCTIONAL ANALYSIS	CO1	Learn the concept of normed linear spaces and Hilbert spaces.
			CO2	Learn various properties operators defined on both normed and Hilbert spaces.
			CO3	Understand the concept dual space.

3			CO4	Learn the completeness of the space bounded linear operators.
	MTH3C14	PDE AND INTEGRAL EQUATIONS	CO1	Learn a technique to solve first order PDE and analyse the solution to get information about the parameters involved in the model.
			CO2	Learn explicit representations of solutions of three important classes of PDE Heat equations Laplace equation and wave equation for initial value problems.
			CO3	Get an idea about Integral equations.
			CO4	Learn the relation between Integral and differential Equations.
	MTH3E01	CODING THEORY	CO1	The basics of coding theory.
			CO2	Learn to detect and correct the error patterns.
			CO3	Learn to implement the fundamental concepts in linear algebra to coding theory.
			CO4	Understand about different types of coding and decoding methods and develop the problem solving ability.
			CO5	Attain the skills to represent cyclic codes in terms of polynomials.
	MTH3E02	CRYPTOGRAPHY	CO1	Understand the fundamentals of cryptography and cryptanalysis.
			CO2	Acquire a knowledge of Claude Shanon's ideas to cryptography, including the concepts of perfect secrecy and the use of information theory to cryptography.
			CO3	Learn to use substitution -permutation networks as a mathematical model to introduce many of theconcepts of modern block cipher design and analysis including differential and linear cryptoanalysis.
			CO4	Familiarize different cryptographic hash functions and their application to the construction of message authentication codes.
	MTH3E03	MEASURE AND INTEGRATION	CO1	Learn how a measure will be helpful to generalize the concept of an integral.
			CO2	Learn how a smallest sigma algebra containing all open sets be constructed on a topological space which ensures the measurability of all continuous function and how a measure called Borel measure is defined on this sigma algebra which ensures the integrability of a hugeclass of continuous functions.
			CO3	Understand the regularity properties Borel measures.
			CO4	Realize a measure may take real values even complex values.
			CO5	Learn to characterize bounded linear functionals on L_p.
			CO6	Learn product measure and their completion.
	MTH3E04	PROBABILITY THEORY	CO1	Understand the concept of random variables, probability and distribution function of a random variable.
			CO2	Apply the knowledge of convergence a sequence of random variables almost surely, in probability and distribution.
			CO3	Apply the knowledge of central limit theorem in relevant situations.
			CO4	Develop problem solving techniques to solve real world problems.

			CO5	Able to translate real world problems into probability models.
			CO6	Evaluate and apply moments and characteristic functions and understand the concept of inequalities.
4	MTH4C15	ADVANCED FUNCTIONAL ANALYSIS	CO1	Understand the notions of Fredholm theory of compact Operators and their properties
			CO2	Apply the theory to understand and solve some problems of integral equations at an appropriate level of difficulty.
			CO3	Describe the construction of the spectral integral.
			CO4	Recognize the fundamentals of Banach spaces and Banach Algebras.
	MTH4E05	ADVANCED COMPLEX ANALYSIS	CO1	Get a deep knowledge about the space of continuous functions from an open set in the complex plane to a region of the complex plane.
			CO2	Learn a technique to extend the domain over which a complex analytic function is defined.
			CO3	Understand that there is a unique conformal map f of the unit disk onto a simply connected domain of the extended complex plane such that f(0) and arg f'(0) take given values.
			CO4	Express some functions as infinite series or products.
	MTH4E06	ALGEBRAIC NUMBER THEORY	CO1	Understand that abstract algebra may be used to solve certain problems in Number Theory.
			CO2	Learn about arithmetic of algebraic number fields.
			CO3	Understand that the familiar unique factorization property may fail in the case of ring of integers of some quadratic fields while a unique factorization theory holds for ideals of ring of integers of a number field.
			CO4	Learn finiteness of class numbers.
			CO5	Understand that the notions of algebraic numbers may be applied to prove Kummer's special case of Fermat's Last Theorem.
	MTH4E07	ALGEBRAIC TOPOLOGY	CO1	Learn how basic geometric structures may be studied by transforming them into algebraic questions.
			CO2	Learn basics of homology theory and apply it to get a generalization of Eulers formula to a generalpolyhedral.
			CO3	Learn to associate a group called fundamental group to every topological space.
			CO4	Learn that two objects that can be deformed into one another will have the same homology group and that homemorphic spaces have isomorphic fundamental groups.
			CO5	Learn Brouwer fixed point theorem and related results.
	MTH4E08	COMMUTATIVE ALGEBRA	CO1	Basic properties of commutative rings, ideals and modules over commutative rings.
			CO2	Learn uniqueness theorem for a decomposable ideal.
			CO3	Learn integrally closed domain and valuation ring.
			CO4	Understand the basic theory of Noetherian and Artin Rings.
	MTH4E09	DIFFERENTIAL GEOMETRY	CO1	Understand how calculus of several variables can be used to develop the geometry of n dimensional oriented n- surface in
			CO2	Understand locally n- surfaces and parametrized n- surfaces are the same.

		CO3	Develop a knowledge of the Gauss and Weingarten maps and apply them to apply them to describe various properties of surfaces.
MTH4E10	FLUID DYNAMICS	CO1	Learn the concept of Equation of Motion and how they relate the dynamics of flow to the pressure and density fields.
		CO2	Learn the concepts of streaming motions and Aerofoils.
		CO3	Learn the concepts of Sources and Sinks.
		CO4	Get an idea of Stream function and its uses to plot stream lines which represent trajectories of particles in a steady flow.
MTH4E11	GRAPH THEORY	CO1	Learn different types of graphs.
		CO2	Learn the concept matching in graphs and related results.
		CO3	Understand what is meant by coloring.
		CO4	Learn Planar Graphs.
MTH4E12	REPRESENTATION THEORY	CO1	Learn the concept of G-Modules and commutant algebra.
		CO2	Learn the concepts of orthogonality relations and the finite abelian groups.
		CO3	Learn the concepts of induced representations and normal subgroups.
MTH4E13	WAVELET THEORY	CO1	Learn the concept of discrete Fourier Transforms and its basic properties.
		CO2	Learn how to construct Wavelets on $\mathbb{Z}N$ and $\mathbb{Z}$.
		CO3	Learn Wavelets on $\mathbb{R}$ and construction of MRA.