

## Program: B.Sc(Mathematics)

### Program Outcome(PO)

- Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
- A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning
- Ability to analyze a problem, identify and define the computing requirements, which may be appropriate to its solution.
- Introduction to various courses like group theory, ring theory, field theory, metric spaces, number theory
- Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- Ability to pursue advanced studies and research in pure and applied mathematical science.

### PROGRAM SPECIFIC OUTCOME (PSO)

- Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.
- Formulate and develop mathematical arguments in a logical manner
- Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.
- Understand, formulate and use quantitative models arising in social science, Business and other contexts.

### Course Outcome

#### B.Sc.: Bachelor of Science in Mathematics

Bachelor of Science in Mathematics is a 3 years duration undergraduate course in science stream. Students fond of doing mathematics can study BSc Mathematics after which they have good scope and career options in the field of analytics, software development, and banks.

B. Sc. – PART I		
COURSE CODE	COURSE TITLE	DESCRIPTION
Mathematics Paper-I	Algebra And Trigonometry	Elementary operations on matrices, Inverse of a matrix, Application of matrices to a system of linear, Transformation of equations, Mappings, Equivalence relations and partitions. Congruence modulo. Definition of a group, Homomorphism and Isomorphism of groups. The fundamental theorems of homomorphism. Introduction, De-Moivre's theorem and its applications. Direct and inverse circular

Mathematics Paper-II	Calculus	$\varepsilon - \delta$ definition of the limit of a function. Basic properties of limits, Asymptotes. Curvature. Tests for concavity and convexity. Points of inflexion. Multiple points, Integration of transcendental functions. Reduction formulae. Quadrature, Degree and order of a differential equation. Linear differential equations of second order.
Mathematics Paper-III	Vector Analysis And Geometry	Scalar and vector product of three vectors, Vector integration. Theorems of Gauss, Green, Stokes and problems based on these, General equation of second degree, Sphere. Cone. Cylinder, Central Conchoids. Paraboloids. Plane sections of coincides. Generating lines.

### B. Sc. – PART II

COURSE CODE	COURSE TITLE	DESCRIPTION
Mathematics Paper-I (Paper Code – 0848)	Advanced Calculus	Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences, Continuity, Sequential continuity, Properties of continuous functions, Chain rule of differentiability, Partial differentiation Change of variables, functions, two variables, Beta and Gamma
Mathematics Paper-II (Paper Code - 0849)	Differential Equations	Series solutions of differential equations- Power series method, Bessel and Legendre, Functions and their properties-convergence, Laplace Transformation - Linearity of the Laplace transformation, Lagrange's solution, Partial differential equations of second and higher orders
Mathematics Paper-III (Paper Code - 0850)	Mechanics	Analytical conditions of Equilibrium, Forces in three dimensions, Poinsett's central axis, Simple harmonic motion, Elastic strings, Kepler's laws of motion, velocities and acceleration in tangential and normal directions, Motion in a resisting medium, motion of particles of varying

### B. Sc. – PART III

COURSE CODE	COURSE TITLE	DESCRIPTION
Mathematics Paper-I (Paper Code – 0898)	Analysis	REAL ANALYSIS, Series of arbitrary terms. Convergence, divergence and Oscillation, Riemann integral. Inerrability of continuous and monotonic functions, COMPLEX ANALYSIS, Complex numbers as ordered pairs. Geometric representation of Complex numbers., METRIC SPACES, Definition and examples of metric spaces, Dense subsets. Blaire Category theorem.
Mathematics Paper-II (Paper Code - 0899)	Abstract Algebra	Group-Auto morphisms, inner auto morphism, Ring Theory-Ring homomorphism. Ideals and Quotient Rings, Definition and examples of vector spaces, Linear transformations and their representation as matrices, Inner Product Spaces-Cauchy-Schwarz inequality
Mathematics Paper-III (Paper Code - 0903)	Programming in C & Numerical Analysis	Programmer's model of a computer, Decisions control structures. Decision statements, Numerical Analysis, Solution of Equations, Difference Schemes, Linear Equations, Iterative Methods, Ordinary Differential Equations, Multi-step Methods, Polynomial Approximation using Orthogonal Polynomials, Monte Carlo Methods Random number generation
Practical Based on Mathematics Paper-III	Programming in C & Numerical Analysis Lab	Implementing basic mathematical calculation using C programming

## **Program: M.Sc(Mathematics)**

### **Program Outcome(PO)**

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

### **PROGRAM SPECIFIC OUTCOME (PSO)**

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

## Course Outcome

### M.Sc.: Master of Science (Mathematics)

Apply the knowledge of mathematical concepts in interdisciplinary fields, Understand the nature of abstract mathematics and explore the concepts in further details. Model the real-world problems in to mathematical equations and draw the inferences by finding appropriate solutions. Employ confidently the knowledge of mathematical software and tools for treating the complex mathematical problems and scientific investigation.

M. Sc. : Mathematics– First Semester		
COURSE CODE	COURSE TITLE	DESCRIPTION
Paper I	Advanced Abstract Algebra (I)	Groups - Normal and Subnormal series., Field theory- Extension fields, Perfect fields. Finite fields. Primitive elements. Normal extensions, Splitting field, Auto morphisms of extensions, Solution of polynomial equations by radicals
Paper II	Real Analysis (I)	Sequences and series of functions, pointwise and uniform convergence, Power series, uniqueness theorem for power series, Functions of several variables, linear transformations, Jacobians, extremum problems with constraints, Partitions of unity, Differential forms, Stoke's theorem
Paper III	Topology	Countable and uncountable sets. Infinite sets and the Axiom of Choice, Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighborhood Systems, Separation axioms; their Characterizations and basic properties. Urysohn's lemma, Compactness and finite intersection property, Compactness in metric spaces.
Paper IV	Complex Analysis (I)	Complex integration, Cauchy-Goursat. Theorem, Maximum modulus principle, Residues. Cauchy's residue theorem, Definitions and examples of conformal mapping Bilinear transformations, Spaces of analytic functions
Paper V	Advanced Discrete Mathematics (I)	Formal Logic-Statements. Symbolic Representation and Tautologies. Quantifiers, Homomorphism of semigroups and monoids, Lattices- Lattices as partially ordered sets. Their properties. Lattices as Algebraic Systems. Sublattices, Direct products, and Homomorphisms., Direct Products and Homomorphisms, Sentential Forms. Language generated

**M. Sc. : Mathematics– Second Semester**

<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>DESCRIPTION</b>
Paper I	Advanced Abstract Algebra (II)	Modules - Cyclic modules, Linear Transformations - Algebra of linear transformation, Canonical Forms - Similarity of linear transformations, Smith normal form over a principal ideal domain and rank. Fundamental structure theorem for finitely generated modules over a Principal ideal domain and its applications to finitely generated abelian groups, Rational canonical form
Paper II	Real Analysis (II)	Definition and existence of Riemann-Stieltjes integral, Lebesgue outer measure. Measurable sets, Measures and outer measures, The Four derivatives. Lebesgue Differentiation Theorem. Differentiation and Integration, Functions of Bounded variation. The L -spaces.
Paper III	General and Algebraic Topology	Tychonoff product topology in terms of standard sub-base and its characterizations, Product spaces, separation axioms connectedness, Embedding and metrization, Nets and filter. Topology and convergence of nets, The fundamental group and covering spaces-Homotopy of paths
Paper IV	Advanced Complex Analysis (II)	Weierstrass' factorisation theorem, Uniqueness of direct analytic continuation, Harmonic functions on a disk, Order of an entire function, Montel Caratheodory and The Great Picard theorem
Paper V	Advanced Discrete Mathematics (II)	Graph Theory, Spanning Trees, Kruskal's Algorithm, Directed Graphs, Directed Trees, Introductory Computability Theory, Finite Automata, Deterministic Finite Automata

**M. Sc. : Mathematics– Third Semester**

<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>DESCRIPTION</b>
Paper I	Integration Theory and Functional Analysis (I)	Integration Theory, Signed measure, Decomposition into absolutely continuous and singular parts, Regularity of measures on locally compact spaces, Riesz Lemma, Weak convergence and bounded linear
Paper II	Partial Differential Equations and Mechanics (I)	Partial Differential Equations, Transport Equation-Initial Value Problem, Energy Methods. Holonomic and Non-holonomic systems, Poisson's Identity. Jacobi-Poisson Theorem, Distributions
Paper III (A)	Fundamentals of Computer Science-Theory and Practical (OOPs and DS)	Object Oriented Programming-Classes and Scope, Overloaded functions and operators, Data Structures-Analysis of algorithms, q, W, O, o, w notations ; Sequential and linked representations, Trees: Binary tree- search tree, Sorting: Insertion sort
Practical Based on Paper III (A)	OOPs (C++) and Data Structure Lab	Implementing basic mathematical calculation using C++ and Visual C++ programming, MFC, Windows Programming. Constructor, Destructor, Inheritance, Practical work on stacks queues linked list, trees, Binary tree, Circular linked list, Quick sort, Bubble sort, Heap sort
Paper IV (A)	Operations Research (I)	Operations Research and its Scope. Necessity of Operations Research in Industry, Algorithms for Linear Programming-Dual Simplex Method, Assignment Problems, Network Analysis-Shortest Path Problem
Paper V (A)	Programming in C (with ANSI features) Theory and Practical (I)	An overview of programming. Programming language. Different kinds of Integer Constants, Conditional Branching. Looping. Nested Loops, Precedence and Associativity. Unary Plus and Minus operators, Arrays and Memory
Practical Based on Paper V(A)	Programming in C Lab	Implementing basic mathematical calculation using C programming

**M. Sc. : Mathematics– Fourth Semester**

<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>DESCRIPTION</b>
Paper I	Functional Analysis (II)	Uniform boundedness theorem, complex linear spaces and normed linear spaces., Solvability of linear equations in Banach spaces. The closed Range Theorem, Inner product spaces, Projection theorem.
Paper II	Partial Differential Equations & Mechanics	Partial Differential Equations, Non-linear First Order PDE-Complete Integrals, Fourier and Laplace Transform, Asymptotics, Stationary Phase, Analytical Dynamics, Condition of canonical character
Paper III (A)	Operating System and Database Management System	Database Systems-Role of database systems, , Introduction to relational algebra and relational calculus., SQL, I/O management, concurrency and Security, network & distributed systems
Practical Based on Paper III (A)	DBMS Lab	SQL statements, create, modify, structured query language, information technology students need to develop a frontend design of a software using VB and oracle/access.
Paper IV (A)	Operations Research (II)	Dynamic Programming, Game Theory-Two-Person, Zero-Sum Games, Integer Programming-Branch and Bound Technique, Applications to Industrial Problems, Nonlinear Programming-One/and Multi-Variable
Paper V (A)	Programming in C (with ANSI Features) (II)	Storage Classes-Fixed vs. Automatic Duration. Scope. Global variables, Pointers Pointer Arithmetic. Passing Pointers as Function Arguments, Declarations and Calls. Pointers to Functions, Structures and Unions
Practical Based on Paper V(A)	Programming in C Lab	Implementing basic mathematical calculation using C programming