DEPARTMENT OF MATHEMATICS

B Sc (Mathematics) Programme

Programme Outcomes:

After completing S. Y. B. Sc (Mathematics) Programme students will be able to:

- **PO1:** Explain the importance of Mathematics and investigate the real world problems and learn to how to apply Mathematical ideas and models to those problems.
- **PO2:** Mathematics apply to rigorous, analytic, highly numerate approach to analyze, execute tasks and solve problems in daily life and at work.
- **PO3:** Recognize the power of abstraction and generalization, and to carry out investigative Mathematical work with independent judgment.
- **PO4:** Investigate and apply Mathematical problems and solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods.
- **PO5:** Identify the type and solve abstract mathematical problems and give geometrical interpretation of various concepts.
- **PO6:** Recognize connections between different subjects in Mathematics.
- **PO7:** Develop an understanding of the underlying unifying structures of mathematics (sets, relations and functions, logical structure) and the relationships among them.
- **PO8:** Conduct self-evaluation, and continuously enrich them through lifelong learning.
- **PO9**: Communicate and interact effectively with different audiences and collaborate intellectually and creatively in diverse contexts, while emphasizing the importance of clarity and precision in communication and reasoning.
- **PO10**: Formulate and analyze mathematical problems, precisely define the key terms, and draw clear and reasonable conclusions.

Programme Specific Outcomes (only 3)

- **PSO1:** Help the students to enhance their knowledge in soft skills and Computing skills.
- **PSO2:** Enable the students to equip knowledge in various concepts involved in functions of single variable.
- **PSO3:** Enable the students to equip knowledge in various concepts involved in Calculus and geometry.

F.Y. B Sc (Mathematics)

Course MT111: Algebra-I (SEM - I)

After successfully completing this course, students will be able to:

CO1: Define the terms gcd, lcm, relation, equivalence relation and equivalence classes.

- **CO2:** Mathematical Induction, Theory of Congruence's to apply properties to find the remainder of a number when divided by other number, residue classes and problems.
- **CO3:** Concepts of integers, finding gcd by Euclidean Algorithm, supremum, infimum, solving problems using first principle of Mathematical induction and strong induction. Calculate gcd of numbers, remainder using congruence properties
- **CO4:** To study of Complex numbers and their properties and different operation of complex numbers.

Course MT121: Geometry (SEM - II)

After successfully completing this course, students will be able to:

- **CO1:** Define Conic, Translation, Rotation, Centre, dcs, drs, etc. by using basic concepts. Change of axes: translation and rotation. , General equation of second degree in two variables , Reduction to standard form, center of conic, nature of conic.
- **CO2:** Direction cosines and direction ratios, Equation of plane, Normal form, Transform to the normal form, Plane passing through three non-collinear points, Intercept form, Angle between two planes. Distance of a point from a plane, Distance between parallel planes, Systems of planes, two sides of planes, Bisector planes.
- **CO3:** Equations of a line in Symmetric and unsymmetrical forms, Line passing through two points, Angle between a line and a plane. , Perpendicular distance of a point from a plane, Condition for two lines to be coplanar and its used to solve problems.
- **CO4:** . Equation of a sphere in different forms, plane section of a sphere. Equation of a circle, sphere through a given circle Intersection of a sphere and a line, Equation of tangent plane to sphere.

Course MT112: Calculus-I (SEM - I)

After successfully completing this course, students will be able to:

- **CO1:** Real numbers, Algebraic and Order Properties of R, Order properties of R, Well-Ordering Property of N. Arithmetic Mean-Geometric mean inequality, Bernoulli's inequality. Absolute value function and its properties, triangle inequality and its consequences, neighborhood of a point on real line. The Completeness Property of R: Definitions of Upper bound, Lower bound, supremum, infimum of subsets of R, completeness property of R. Applications of the Supremum Property: Archimedean property and its consequences, The density theorem and its problem.
- **CO2:** Sequences and Their Limits: examples of sequences of real numbers, limit of sequence and uniqueness of limit, Examples on limit of sequence. Limits Theorems: Definition of bounded sequence, Algebra of limits. Monotone Sequences, Monotone convergence theorem and examples. Subsequences and Bolzano -Wierstrass Theorem, Definition of subsequence and examples, Divergence criteria, Monotone Subsequence theorem, Bolzano -Wierstrass theorem.
- **CO3:** Limits, Functions and their Graphs, domain and range, graphs of functions, representing a function numerically, Vertical line test, piecewise defined functions, increasing and decreasing functions, even and odd functions symmetry, common functions, Limits of Functions, Definition of cluster point and examples, definition of limit of a function, sequential criterion for limits, divergence criteria. Limit Theorems, Squeeze theorem. Some extension of limit concepts: one-sided limits, infinite limits.
- **CO4:** Continuous Functions, sequential criterion for continuity, Divergence criterion, combination of continuous functions. Continuous Functions on Intervals, Boundedness theorem, The minimum -maximum theorem, Location of root theorem, Bolzano's intermediate value theorem. Continuous function maps closed bounded interval to closed bounded interval, Preservation of interval theorem.

Course MT122: Calculus-II (SEM – II

After successfully completing this course, students will be able to:

- CO1: Define the terms differential equation, order, degree, Bernoullis equation, selforthogonal Recall definitions of the topics in calculus, The Mean Value Theorems:
- CO2: L' Hospital Rule and Successive Differentiation and used to solved problems.
- CO3: Linear first order equations. Separable equations. Existence and Uniqueness of solutions of nonlinear equations Describe the methods of solving integration using partial fraction, substitution of trigonometric, logarithm, exponential functions and differential equations problems using variable separable form, exact equations, homogenous, non-homogenous, etc..
- CO4: Transformation of nonlinear equations to separable equations. Exact differential equations. Integrating factors. Determine the solution of first order and higher degree differential equation using method of solvable for p, solvable for x, solvable for y and lagranges equation and Cairauts equation

Course MT103: Mathematics Practical

- CO1: Calculate gcd of two numbers using Euclidean algorithm and perform reverse process., radius and centre of sphere using formula
- CO2: Calculate remainder using Fermat's Theroem.
- CO3: Solving examples by Induction
- CO4: Properties and problems of real numbers, Supremum and infimum evaluation.
- CO5: Calculate limit using definition derivative, integration using partial fraction, substitution of trigonometric, logarithm, exponential functions, differential equations variable separable form, exact equations, homogenous, nonhomogenous, etc.
- CO6: Solution of Ordinary D.E.
- CO7: Exact D.E.
- CO8: Linear and Bernoulli's D.E. and its solutions
- CO9: Evaluation of limits using Hospitals rule.
- CO10: Real numbers and its examples.
- CO11: Sequences and its types, Increasing and Decreasing sequences. Convergence and divergence of sequences.
- CO12: Limits and Continuity and problems.
- CO13: Conic sections and transformation and rotation of Axis.
- CO14: Planes and Bisector Planes.

CO15: Lines and Skew Lines.

CO16: Sphere and Problems.

CO17: Maxima Software and its used to solve problems in Paper-I and II.

S. Y. B Sc (Mathematics) (Sem - III)

Course MT231: Calculus of Several Variables

After successfully completing this course, students will be able to:

- CO1: Recall the definitions of multivariable functions, Describe the concepts and solve simple examples of bounded sets, domain, range and level curves.
- CO2: Recognize all the definitions and concepts by giving examples of limit and continuity.
- CO3:.To compute partial derivatives of functions. Determination of differentiable function and used correct by chain rules. To compute approximate value using differential.
- CO4: To compute maxima and minima of the function and its applications.
- CO5: Choose appropriate method for solving examples in multiple integrals by using double or triple integrals.

Course MT232(B): Graph Theory

After successfully completing this course, students will be able to:

- CO1: Recall basics definitions of graphs, types of graphs and its properties.
- CO2: Determination of graphical sequence.
- CO3: Determination of isomorphism of graphs, subgraphs, types of subgraphs. Connected and disconnected graphs, Understanding theorems, Euler and Hamilton graphs and its applications.
- CO4: Recall the terms trees, spanning tress, and computation of minimal spanning trees.
- CO5: Understanding of prefix and postfix of expressions.
- CO6: Understanding of cut sets, connectivity and theorems on it.

CO7 : Understanding of Fundamental cut sets and circuits.

Course MT233: Practical based on MT231, MT232(B)

- CO1: Evaluation and testing of continuous functions
- CO2: Calculate partial derivatives and differentiability of function in two variables
- CO3: Problems on chain rule and Euler theorem.
- CO4: Determination of maxima and minima of functions
- CO5: Calculate area and volume for function using double and triple integration
- CO6: Drawing of graphs and testing of graphical sequences.
- CO7: Determination of isomorphic graphs, complement of graph, subgraphs, Euler and Hamiltonian graphs.
- CO8: Computation of minimal tress, and prefix and postfix expression using binary trees.

S. Y. B Sc (Mathematics) (Sem – IV)

Course MT221: Linear Algebra

After successfully completing this course, students will be able to:

- CO1: Understanding of Row echelon form of a matrix, reduced row echelon form of a matrix. rank of a matrix.
- CO2: Determination of solution of system of linear equations, Consistency of homogeneous and non-homogeneous system of linear equations.
- CO3: Understand vectors and its properties, vector spaces and Subspaces.
- CO4: Determination of Linear Dependence and Independence vectors, basis set.
- CO5: Determination of dimension of a Vector Space, Row, Column and Null Space of a matrix. Rank and nullity.
- CO6: Understanding of linear transformations, problems.
- CO7: Concept of Kernel and range of a linear Transformation, Rank-Nullity theorem.
- CO8: Concept of Composite and Inverse Transformation. Matrices and Linear Transformation. Basic Matrix Transformations in R2 and R3 and Linear Isomorphism.

Course MT243(B) Dynamical Systems

After successfully completing this course, students will be able to:

- CO1: Recall the evaluation technique of Eigenvalues and Eigenvectors and Diagonalization.
- CO2: Recall the first order planar system, The Logistic Population Model, Second-Order Differential Equations, Planar Linear Systems, Solving Linear Systems.
- CO3: Concept of Phase portrait and real and Complex Eigenvalues, Repeated Eigenvalues Changing Coordinates

CO4: Recall The Trace-Determinant Plane, Exponential of a matrix.

Course MT243: Practical based on MT241, MT242(B)

After successfully completing this course, students will be able to:

- CO1: List solutions of linear equations
- CO2: Discuss linear independence and basis set
- CO3: Concept of Row spaces, column spaces and null spaces.
- CO4: Solve examples of finding rank, nullity using dimension theorem
- CO5: Solve the problems Eigen values and eigen vectors.
- CO6: Solve the problems of planar system and first order systems
- CO7: Solve the phase portraits.
- CO8: Calculate Trace-Determinant Plane and Exponential of a matrix.