

## **Program Outcome and Course Outcome for B.Sc. Mathematics**

### **Programme Outcome of B.Sc. Mathematics:**

- 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.

### **Course Outcome**

#### **B. Sc. I (Mathematics)**

##### **Course Title:- Algebra and Trigonometry (Paper-I)**

- Introduction to the properties of integers, equivalence relations and equivalence class.
- Introduction to define group and subgroup.
- Explain the significance of the notions of cosets, normal subgroups, and quotient groups.
- Analyze consequences of Lagrange's theorem.
- Learn about structure preserving maps between groups and their consequences.
- Know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains, and fields.

- Evaluate trigonometric and inverse trigonometric functions.
- Solve trigonometric equations and applications.
- Apply and prove trigonometric identities.

**Course Title:- Calculus (Paper-II)**

- Verify the value of the limit of a function at a point using the definition of the limit.
- Learn to check function is continuous understand the consequences of the intermediate value theorem for continuous functions.
- To find the  $n^{\text{th}}$  derivatives of functions.
- Apply the Leibnitz's theorem for finding  $n^{\text{th}}$  derivative of product of two functions.
- Study of expansion of function, indeterminate form.
- Introduction to the partial differentiation, Euler's theorem, Jacobians.
- Study of curvature, envelopes, evolutes and asymptotes.
- Evaluate the definite integral as a limit of a sum, Reduction formula Beta and Gamma functions.
- Introduction to quadrature, rectification, volume and surfaces of solids of revolutions.
- Evaluate double and triple integral, change of order of integration.

**Course Title:- Analytical Geometry (Paper-III)**

- Introduction to the polar coordinates.
- Find the polar equation of a line, circle, tangent and normal to conic.
- Introduction to the concepts of three dimensional Cartesian coordinate systems, direction cosines of a line, plane and straight line.
- Study of Sphere, Cone and Cylinder.
- Study of central conicoids, Paraboloids, Generating lines and reduction of general equation of second degree.

**Course Title:- Assignment and viva-voce**

- Problem solving on geometry, calculus and algebra & trigonometry.

## **B. Sc. II (Mathematics)**

### **Course Title:- Linear Algebra (Paper-I)**

- Introduction to vector space and subspace.
- Introduce the concepts of the linear span, linear independence, basis, and dimension, and apply these concepts to various vector spaces and subspaces,
- Use the definition and properties of linear transformations and matrices of linear transformations and change of basis, including kernel, range and isomorphism.
- Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations.
- Solve a System of Linear equations using the inverse of a matrix
- Distinguish between consistent and inconsistent system of equations.
- Apply Cayley- Hamilton Theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods
- Learn properties of inner product spaces and determine orthogonality in inner product spaces.
- Study of the bilinear and quadratics form

### **Course Title:- Differential Equations and Vector Calculus (Paper-II)**

- Evaluate first order differential equations including separable, homogeneous, exact, and linear.
- Show existence and uniqueness of solutions.
- Explain an integrating factor, which may reduce the given differential equation into an exact one and eventually provide its solutions.
- Identify and obtain the solution of Clairaut's equation.
- Familiarize the orthogonal trajectory of the system of curves on a given surface
- Solve second order and higher order linear differential equations.
- Understand the basic knowledge of complimentary function and particular integral.
- Solve differential equations using variation of parameters

- Solve linear systems of ordinary differential equations.
- Introduction to the basic knowledge of vector differentiation and vector integration.
- Determine and apply, the important quantities associated with scalar fields, such as partial derivatives of all orders, the gradient vector and directional derivative.
- Determine and apply, the important quantities associated with vector fields such as the divergence, curl, and scalar potential.
- Evaluate line, surface, double and triple integrals and use these integrals to verify the seminal integral theorems (Green's theorem in the plane, Gauss' divergence theorem and Stokes' theorem).
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**Course Title:- Mechanics (Paper-III)**

- Introduction to the velocity and acceleration along radial and transverse directions, and along tangential and normal directions.
- Study of simple harmonic motion, earth attraction elastic string and motion in resisting medium.
- Discuss the motion on smooth and rough planes, constrained motion.
- Study of central orbits and Kepler's law.
- Study of common catenary, virtual work, and stable and unstable equilibrium.

**Course Title:- Assignment and viva-voce**

- Problem solving on linear algebra, mechanics and differential equation and vector calculus.

**B. Sc. III (Mathematics)**

**Course Title:- Real Analysis (Paper-I)**

- Define the real numbers, least upper bounds, and the triangle inequality.
- Define functions between sets; equivalent sets; finite, countable and uncountable sets. Recognize convergent, divergent, bounded, Cauchy and monotone sequences.

- Calculate the limit superior, limit inferior, and the limit of a sequence.
- Find the sequence of partial sums of an infinite series.
- Differentiate Uniform continuity from continuity and related theorems
- Explain convergence of a series
- Develop skill in checking the convergence of series using various tests of convergence.
- Explain Continuity and Discontinuity of functions of two variables.
- Expand functions using Taylor Series
- Study of sequential continuity, boundedness and intermediate value properties of continuous function.
- Study of improper integral and their convergence.

**Course Title:- Complex Analysis (Paper-II)**

- Compute sums, products, quotients, conjugate, modulus, and argument of complex numbers.
- Write complex numbers in polar form
- Introduce elementary complex functions.
- Define and analyze limits and continuity for complex functions as well as consequences of continuity
- Determine whether a given function is differentiable, and if so find its derivative.
- Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations
- Conceive the concepts of analytic functions and will be familiar with the elementary complex functions and their properties
- Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions.
- Understand the basic methods of complex integration and its application in contour integration
- Understand the theory and techniques of complex integration
- Find parameterizations of curves, and compute complex line integrals directly

- Evaluate integrals along a path in the complex plane and understand the statement of Cauchy's Theorem
- Use Cauchy's integral theorem and formula to compute line integrals
- Express complex-differentiable functions as power series
- Identify the isolated singularities of a function and determine whether they are removable, poles, or essential.
- Compute Laurent series at an isolated singularity, and determine the residue
- Apply the theory into application of the power series expansion of analytic functions
- Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem
- Understand uses of improper integrals in various situations

**Course Title: - Numerical Analysis (Paper-III)**

- Obtain numerical solutions of algebraic and transcendental equations.
- Find numerical solutions of system of linear equations.
- Learn about various interpolating and extrapolating methods.
- Study of Gauss, Stirling's and Bessel's interpolating formula.
- Solve initial value problems in differential equations using numerical methods.
- Obtained the numerical differentiation and numerical integration.
- Study of Trapezoidal and Simpson's rule.
- Study of Euler's method, Picard's method and Runge-Kutta method.
- Study of Gauss elimination method, Triangularization method, Jacobi iterative method and Gauss seidel method.

**Course Title: - Linear Programming (Paper-IV)**

- Analyze and solve linear programming problems.
- Provide graphical solutions of linear programming problems with two variables, and illustrate the concept of convex set and extreme points.

- Understand the theory of the simplex method.
- Know about the relationships between the primal and dual problems, and to understand sensitivity analysis.
- Use dual simplex method to find optimal solutions
- Learn about the applications to transportation and assignment problems.
- Understand various methods of solving Transportation and Assignment Problems
- Explain the Transportation Problem and formulate it as an LPP and hence solve the problem.
- Determine that an Assignment Problem is a special case of LPP and hence solve by Hungarian method.

**Course Title:- Assignment and viva-voce**

- Problem solving on real analysis, complex analysis and numerical analysis.

  
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