

GOVERNMENT GENERAL DEGREE COLLEGE, TEHATTA

Department of Mathematics

Name of the Programme: B.Sc. (Programme/ General) in Mathematics

Programme Specific Outcomes (PSO) and Course Outcomes (CO)

Mathematics stands as an essential pillar supporting much of science and engineering endeavors, bestowing precision upon inquiry through its explication of nature's intricacies. The mathematics program at the University of Kalyani is meticulously crafted with dual objectives: first, to lay a robust foundation for exploring mathematical frontiers through rigorous research; and second, to furnish vital quantitative skills for those pursuing related fields.

Students at the University of Kalyani now experience an education oriented around their own learning, rather than tradition's teacher-centered past. In this evolution toward student-focus, the undergraduate mathematics curriculum has adopted an outcome-based design that prioritizes what students should attain throughout their scholarly journey. This framework has been tailored specifically for cultivating both deep conceptual understanding and flexibility of thought, empowering graduates to solve complex problems through innovative reasoning.

The syllabus for each unit of this course has been carefully crafted to achieve **specific outcomes**, including:

1. Cultivating a broader global awareness of mathematics and mathematical sciences, equipping students to tackle future challenges.
2. Fostering mental discipline through effective learning methodologies.
3. Developing analytical thinking skills, enabling students to investigate and comprehend the truths about the world around them.
4. Equipping students with financial mathematics knowledge to navigate legal pathways for wealth creation.
5. Providing a comprehensive understanding of Geometry, Algebra, and Calculus, facilitating the comprehension of complex issues in the modern scientific realm.
6. Enhancing problem-solving abilities through practical application.
7. Offering insight into computer programming and technology, fostering comprehension of computational principles.
8. Upon completion of the course, students will not only sharpen their logical thinking skills in mathematics but also gain an understanding of the significance of C programming.

SEMESTER-I

Course Code	Course Title	Course Credit	Full Marks	Course Outcome
UG B.Sc- G-CC-T- 01	Algebra & Analytical Geometry	6	75	<p>This course will equip students to:</p> <ul style="list-style-type: none"> • Manipulate the coordinate system, particularly through rotation of axes, to simplify various second-degree equations into their most basic forms and classify conics using discriminants. • Gain proficiency in polar equations of conics, along with their tangents and normals. • Understand equivalent classes and cardinality of sets. • Apply modular arithmetic and grasp basic properties of congruences. • Identify mathematical objects as groups and categorize them, such as abelian and permutation groups. • Comprehend the rank of a matrix and solve systems of linear equations. • Acquire knowledge of polynomials, including the nature of roots of equations, the relationship between roots and coefficients, and Cardan's method. • Utilize De Moivre's theorem in various applications to solve numerical problems.

SEMESTER-II

Course Code	Course Title	Course Credit	Full Marks	Course Outcome
UG B.Sc- G-CC-T- 02	Calculus & Differential equation	6	75	<p>This course will empower students to:</p> <ul style="list-style-type: none"> • Develop familiarity with limits and continuity through the use of the ϵ-δ definition. • Master first, second, and higher derivative tests for relative extrema and apply this knowledge to problem-solving scenarios in business, economics, and life sciences. • Apply derivatives to real-valued functions, including Rolle's, Lagrange's, Cauchy, and Taylor's theorems, as well as determine maximum and minimum values of functions using derivatives. • Utilize reduction formulas for integration. • Apply first, second, and higher derivative tests for relative extrema to problem-solving contexts in business, economics, and life sciences. • Sketch curves in a plane by leveraging their mathematical properties in different coordinate systems of reference, particularly over cross-sectional areas. • Gain understanding of the basics of differential equations and mathematical modeling. • Formulate differential equations for various mathematical models.

SEMESTER-III

Course Code	Course Title	Course Credit	Full Marks	Course Outcome
UGB.Sc-G-CC-T-03	Theory of Real Analysis	6	75	<p>This course will enable students to:</p> <ul style="list-style-type: none"> • Gain familiarity with properties of the real numbers (R). • Understand the concepts of countable sets and uncountable sets. • Identify bounded sets, unbounded sets, supremum, and infimum. • Become acquainted with interior points, limit points, open sets, closed sets, derived sets, and their respective properties. • Learn about sequences, including bounded sequences, convergent sequences, monotonic sequences, and their properties. • Explore infinite series, series of positive terms, alternating series, and their convergence criteria.
UGB.Sc-G-SEC-T-1A	Logic & Sets	2	50	<p>This course will equip students to:</p> <ul style="list-style-type: none"> • Understand and apply the basic concepts of symbolic logic. • Define propositions and arguments within the context of logic. • Explain propositional connectives and provide examples. • Demonstrate and illustrate the truth value status of propositions. • Utilize truth tables and laws such as identity, distributive, commutative, and domination. • Compute sum of products and product of sum expansions. • Gain familiarity with sets and Venn diagrams. • Perform operations on sets including union, intersection, difference, symmetric difference, etc. • Understand relations, equivalence relations, and partitions.
UGB.Sc-G-SEC-T-1B	Vector Calculus	2	50	<p>This course will facilitate students in:</p> <ul style="list-style-type: none"> • Developing familiarity with dot product, cross product, differentiation, and partial differentiation of vectors. • Applying derivatives in contexts such as gradient, divergence, and curl, with practical applications. • Gaining proficiency in vector integration (line, surface, volume) and its application through the understanding of the Green's and Stoke's theorems.

SEMESTER-IV

Course Code	Course Title	Course Credit	Full Marks	Course Outcome
UGB.Sc-G-CC-T-04	Linear Programming Problem & Game Theory	6	75	<p>This course will empower students to:</p> <ul style="list-style-type: none"> • Acquire knowledge of the graphical solution of linear programming problems involving two variables. • Understand the relationship between basic feasible solutions and extreme points, along with the theory behind the simplex method used for solving linear programming problems. • Familiarize themselves with two-phase and big-M methods for handling problems that involve artificial variables. • Explore the connections between primal and dual problems in linear programming. • Solve transportation and assignment problems using appropriate techniques. • Apply linear programming methods to solve two-person zero-sum game problems.
UGB.Sc-G-SEC-T-2A	Graph Theory	2	50	<p>This course will empower students to:</p> <ul style="list-style-type: none"> • Grasp the fundamentals of graph theory and explore topics such as social networks, Eulerian and Hamiltonian graphs, diagram tracing puzzles, and the knight's tour problem. • Gain insight into the practical applications of graph theory, particularly in the study of shortest path algorithms.
UG B.Sc-G-SEC-T-2B	Operating System (Linux)	2	50	<p>This course will equip students to:</p> <ul style="list-style-type: none"> • Identify and utilize UNIX/Linux utilities for creating and managing simple file processing operations. • Organize directory structures with appropriate security measures. • Develop shell scripts to execute more complex tasks.

SEMESTER-V

Course Code	Course Title	Course Credit	Full Marks	Course Outcome
UGB.Sc-G-DSE-T-1A	Group theory & Linear algebra	6	75	<p>The course will empower students to:</p> <ul style="list-style-type: none"> Analyze the subgroups of cyclic groups and categorize subgroups within cyclic groups. Explain the importance of cosets, normal subgroups, and quotient groups. Gain an understanding of vector space fundamentals, including linear combinations of vectors, linear span, linear independence, basis, and dimension of subspaces. Comprehend eigenvalues and eigenvectors. Develop familiarity with linear transformations and their matrix representations, as well as concepts such as rank and nullity.
UGB.Sc-G-DSE-T-1B	Complex Analysis	6	75	<p>This course will empower students to:</p> <ul style="list-style-type: none"> Understand the importance of complex function differentiability, leading to a comprehension of Cauchy-Riemann equations. Familiarize themselves with elementary functions and evaluate contour integrals. Recognize the significance of the Cauchy-Goursat theorem and the Cauchy integral formula. Expand simple functions into their Taylor and Laurent series, classify the nature of singularities, determine residues, and apply the Cauchy Residue theorem to evaluate integrals.
UGB.Sc-G-SEC-T-3A	Theory of Probability	2	50	<p>The course will enable students to:</p> <ul style="list-style-type: none"> Acquire knowledge of probability density and moment generating functions. Familiarize themselves with various univariate distributions including Bernoulli, Binomial, Poisson, gamma, and exponential distributions. Understand distributions used to analyze the joint behavior of two random variables, measure the degree of association between them, and establish formulations for predicting one variable in terms of the other, such as correlation and linear regression.
UGB.Sc-G-SEC-T-3B	Boolean Algebra	2	50	<p>The course will empower students to:</p> <ul style="list-style-type: none"> Grasp the fundamentals of Boolean algebra, ordered sets, mappings between ordered sets, lattices as ordered sets, product and homeomorphisms. Convert Boolean expressions into logic gates and vice versa. Explore switching circuits and their applications.

SEMESTER-VI

Course Code	Course Title	Course Credit	Full Marks	Course Outcome
UGB.Sc-G-DSE-T-2A	Dynamics of a Particle	6	75	<p>Upon completing this course, students will have the ability to comprehend and articulate various concepts in Mechanics, including:</p> <ul style="list-style-type: none"> • Coplanar forces in general and an arbitrary force system in space. • Understanding the moment of a force about an axis and Varignon's theorem. • Determining resultant force and resultant couple. • Analyzing equilibrium in the presence of sliding friction force. • Exploring virtual work and stability of equilibrium in a conservative force field. • Understanding the kinematics of a particle. • Applying Newton's laws of motion and the law of gravitation. • Solving problems in particle dynamics. • Studying the motion of a projectile in a resisting medium.
UGB.Sc-G-DSE-T-2B	Numerical Methods	6	75	<p>This course will equip students to:</p> <ul style="list-style-type: none"> • Learn various numerical methods for finding the zeroes of nonlinear functions of a single variable and solving systems of linear equations up to a specified level of precision. • Understand methods for solving systems of linear equations, including Gauss-Jacobi, Gauss-Seidel, and SOR methods. • Explore interpolation techniques for computing values for a tabulated function at points not included in the table. <p>Apply numerical differentiation and integration techniques to convert differential equations into difference equations for numerical solutions.</p>
UGB.Sc-G-SEC-T-4A	Programming in 'C'	2	50	<p>Upon completion of this course, students will be able to:</p> <ul style="list-style-type: none"> • Comprehend and apply programming concepts in C, essential for mathematical investigation and problem-solving. • Gain knowledge of structured data types in C and their applications, including factorization of integers, understanding Cartesian geometry, and Pythagorean triples. • Utilize containers and templates in various algebraic applications and employ mathematical libraries for computational tasks. • Represent program outputs visually through well-formatted text and plots. • Apply programming skills to solve numerical problems effectively.

Course Code	Course Title	Course Credit	Full Marks	Course Outcome
UGB.Sc-G-SEC-T-4B	Programming in Python	2	50	<p>Upon completion of this course, students will achieve the following:</p> <ul style="list-style-type: none"> • Understand the fundamentals of the Python programming language. • Successfully install Python and write their initial program. • Effectively employ variables to store, retrieve, and manipulate information. • Utilize core programming tools like functions and loops proficiently. • Apply programming skills to solve numerical problems effectively.