PROF. S. NURUL HASAN COLLEGE, FARAKKA

P.O.- Farakka Barrage. Dist- Murshidabad. Pin-742212 (W.B)

email: prof.snhcollege@rediffmail.com.

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Department of Mathematics
UG Mathematics General Programme Outcomes (PO)

1. After completion of this programme, the students will demonstrate a strong foundational knowledge in mathematics, including understanding and applying principles in areas such as algebra, calculus, and real analysis.

2. Students will develop the ability to think critically and solve complex problems using mathematical methods, enabling them to analyze and interpret data effectively.

3. Through elective courses, students will have opportunities to specialize in various mathematical fields or explore interdisciplinary applications, enhancing their skills and knowledge base.

4. Graduates will be equipped with the skills to effectively communicate mathematical concepts and collaborate with peers on projects, important for professional success in any field.

5. After completion of this programme, the students will be prepared for further studies in mathematics or related disciplines, providing a strong academic foundation for pursuing postgraduate education.

6. Students will gain proficiency in using various mathematical software and tools essential for modern mathematical practice and research.

7. Graduates will understand the ethical implications of their work and the importance of mathematics in addressing social, scientific, and environmental issues.

Course Outcomes

SEMESTER-I

Course Code	Course Title	Course Credit	Course Outcome
MATH-G-CC-T-01	ALGEBRA & ANALYTICAL GEOMETRY	6	1. After completion of this course students will be able to apply De Moivre's theorem to compute powers and roots of complex numbers, enhancing their problem-solving skills in complex analysis.

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			2. Learners will understand and use the Fundamental Theorem of Algebra to determine the nature of polynomial roots, and solve cubic equations using Cardan's method. 3. Students will acquire skills in transforming and classifying conic sections through the reduction of the general second-degree equation, preparing them for advanced studies in geometry.

SEMESTER-II

Course Code	Course Title	Course Credit	Course Outcome
MATH-G-CC-T-02	CALCULUS & DIFFERENTIAL EQUATIONS	6	1. After completion of this course students will gain proficiency in applying concepts of limit, continuity, and differentiability to real-valued functions. They will learn to use tools such as L'Hôpital's rule and Taylor's theorem to analyze functions and solve related problems. 2. Learners will develop the ability to compute and apply various integral formulas, including definite integrals and reduction formulas, to practical problems, enhancing their analytical skills in evaluating complex mathematical expressions. 3. Learners will understand first and second order differential equations, with an ability to solve them using methods like variation of parameters and undetermined coefficients. This includes both theoretical and applied aspects of differential equations in modelling real-world phenomena.

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SEMESTER -III

Course Code	Course Title	Course Credit	Course Outcome
MATH-G-CC-T-03	REAL ANALYSIS	6	1. After completion of this course students will gain a thorough understanding of the completeness property of the real numbers, the concept of limits, and the continuity of functions. This foundational knowledge is crucial for advanced studies in analysis and is applicable in solving real-world problems where these concepts are relevant. 2. Learners will be able to analyze sequences and series, using concepts such as the Bolzano-Weierstrass theorem, Cauchy's convergence criterion, and various tests for convergence like comparison, ratio, and root tests. This skill is vital for assessing the behaviour of functions and series encountered in mathematical and applied contexts. 3. Students will understand and apply major theorems such as Rolle's Theorem, the Mean Value Theorem, and Taylor's Theorem in practical scenarios. This includes using these theorems to derive properties and solve problems related to differentiable functions, enhancing their analytical capabilities in technical and engineering fields.
MATH-G-SEC-T-1A	LOGIC & SETS	2	1. After completion of this course, students will be able to construct truth tables and apply logical operators such as negation, conjunction, and disjunction effectively. They will gain the ability to work with implications, biconditional propositions, and understand the relationships between converse, contrapositive, and inverse propositions 2. Students will develop skills in using quantifiers and understanding their scope and negations in the context of predicates. This will enable them to formulate and interpret complex logical statements within mathematical proofs and real-world scenarios. 3. Students will demonstrate the ability to perform and analyze various set operations including unions,

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			intersections, and complements. They will understand and utilize concepts such as power sets, and the differences and symmetric differences between sets, enhancing their problem-solving skills in abstract and applied mathematics contexts.
MATH-G-SEC-T-1B	VECTOR CALCULUS	2	1. Learners will gain proficiency in differentiating vector functions, including operations on sums, dot products, and cross products. They will understand and apply vector calculus concepts like gradient, divergence, and curl to various functions, enhancing their analytical skills in fields involving multidimensional spatial analysis. 2. Learners will be able to perform line, surface, and volume integrals. They will understand and apply the fundamental theorems of vector calculus, including Green's, Stoke's, and the divergence theorems, which are essential for solving complex problems in physics and engineering. 3. Students will be equipped to apply the theorems of vector calculus to real-world problems and mathematical modelling. This includes understanding and utilizing these theorems in the analysis and solution of physical problems where field, flow, and flux calculations are required.

SEMESTER-IV

Course Code	Course Title	Course Credit	Course Outcome
MATH-G-CC-T-04	LINEAR PROGRAMMING PROBLEMS & GAME THEORY	6	1. After completion of this course, students will learn and apply various linear programming methods, including the graphical solution method, simplex method, and two-phase method. They will understand how to formulate and solve optimization problems, enhancing their decision-making skills in business, economics, and engineering contexts.

			2. Students will be able to formulate dual problems and interpret the economic implications of these dual relationships. They will gain insights into how changes in input data can affect the optimal solution, essential for real-world problem-solving and decision-making. 3. Students will explore and apply the principles of game theory to formulate and solve two-person zero-sum games, including those with mixed strategies. This knowledge is crucial for strategic decision-making in competitive environments, ranging from economics to political science.
MATH-G-SEC-T-2A	GRAPH THEORY	2	1. Students will understand the fundamental concepts and properties of graphs, including types of graphs such as pseudographs, complete graphs, and bipartite graphs. They will be able to identify isomorphic graphs and understand their properties. 2. Learners will gain the ability to analyze and apply various graph algorithms, including Eulerian and Hamiltonian paths and cycles. They will understand how to represent graphs through matrices such as adjacency and incidence matrices. 3. Students will be equipped to apply graph theoretical concepts to solve practical problems like the Travelling Salesman Problem and finding shortest paths using algorithms such as Dijkstra's and the Warshall algorithm. This knowledge is crucial for solving real-world optimization and network problems
MATH-G-SEC-T-2B	OPERATING SYSTEM (LINUX)	2	1. Students will develop a comprehensive understanding of Linux operating systems, including its history, key features, and distributions. They will also gain knowledge about Linux security mechanisms, system processes, and the relationship between Linux and UNIX. 2. Learners will master managing Linux file systems, particularly Ext2 and Ext3, understanding file permissions, and user management. They will become

			adept at adding and deleting users using both command-line and GUI tools. 3. Learners will learn to effectively manage system resources in Linux, including file and directory management, process management, and memory management. They will also become familiar with inter-process communication (IPC) mechanisms like pipes, FIFOs, and message queues, and system calls related to file and memory management.

SEMESTER-V

Course Code	Course Title	Course Credit	Course Outcome
MATH-G-DSE-T-1A	GROUP THEORY & LINEAR ALGEBRA	6	1. Students will gain an in-depth understanding of group theory, including the properties of groups, subgroups, cosets, and normal subgroups. They will learn to apply concepts such as Lagrange's theorem and the operation of quotient groups, enhancing their ability to analyze algebraic structures. 2. Students will develop the ability to work with vector spaces, subspaces, and linear transformations. They will master the skills of determining bases, dimensions, and solving problems related to linear independence and dependence. This includes understanding the role of matrices in linear transformations and their applications in solving linear equations. 3. Students will learn to find eigenvalues and eigenvectors and understand their significance in various applications, including stability analysis, systems of differential equations, and optimization problems. They will also be able to apply these concepts to diagonalize matrices, facilitating easier computations and solutions in practical scenarios.

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MATH-G-DSE-T-1B	COMPLEX ANALYSIS	6	1. Students will understand the geometric and analytic structure of functions of a complex variable, including concepts of continuity, limits, and differentiability. They will be able to apply the Cauchy-Riemann equations to determine whether a function is differentiable, which is fundamental in complex function theory. 2. Students will be skilled in performing contour integrals and applying the Cauchy-Goursat theorem. They will gain experience with key results like Cauchy's integral formula, which is critical for evaluating integrals and understanding series expansions in complex analysis. 3. Students will understand the convergence properties of power series and the concept of analytic continuation. They will also learn to apply techniques involving residues for complex integration, which are essential in solving real-world problems that involve complex variable techniques.
MATH-G-SEC-T-3A	THEORY OF PROBABILITY	2	1. Students will understand and apply the fundamental axioms of probability, distinguish between discrete and continuous random variables, and utilize probability mass and density functions to solve practical problems. 2. Learners will develop the ability to analyze and compute the mathematical expectations, moments, and generating functions of various well-known probability distributions, such as uniform, binomial, Poisson, normal, and exponential. 3. Learners will gain proficiency in handling joint probability distributions, including the calculation of joint and marginal distributions and conditional expectations. They will also learn to determine the independence of random variables, equipping them with skills to tackle complex probabilistic models.

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MATH-G-SEC-T-3B	BOOLEAN ALGEBRA	2	1. Students will develop a comprehensive understanding of the basic properties and structures of lattices and ordered sets, including the concepts of maximal and minimal elements, and the duality principle. 2. Learners will master the properties and applications of Boolean algebras and Boolean polynomials, including learning how to minimize Boolean expressions using methods such as the Quinn-McCluskey method and Karnaugh diagrams. 3. Students will be equipped to apply their knowledge of Boolean algebra to design and analyze switching circuits, enhancing their ability to engage with practical electronics and logic design tasks.

SEMESTER-VI

Course Code	Course Title	Course Credit	Course Outcome
MATH-G-DSE-T-2A	DYNAMICS OF A PARTICLE	6	1. Students will understand the dynamics of particle motion, including straight-line motion, motion under gravity, and harmonic motion. They will be able to analyze and solve problems related to simple harmonic motion, damped and forced oscillations, and motion in a resisting medium. 2. Learners will gain the ability to apply the principles of work, energy, and momentum. They will understand concepts like conservative forces, energy conservation, and impulse-momentum theories, and how these principles are applied to analyze various physical systems. 3. Learners will study the dynamics of motion in a plane, including velocity and acceleration in Cartesian and polar coordinates, as well as the study of celestial mechanics such as Kepler's laws and orbital dynamics under central forces. This includes understanding the

			effects of varying forces on the stability of orbits and motion of artificial satellites.
MATH-G-DSE-T-2B	NUMERICAL METHODS	6	1. Students will gain comprehensive skills in numerical analysis, including understanding and applying numerical methods for solving algebraic and transcendental equations, such as the bisection method, Newton-Raphson method, and fixed point iteration. They will develop the ability to analyze the rate of convergence of these methods. 2. Students will master numerical techniques for integration and differentiation. They will use methods such as Newton-Cotes formulas, trapezoidal rule, and Simpson's rules to compute integrals and apply numerical differentiation techniques based on finite differences to approximate derivatives. 3. Students will be equipped to solve systems of linear algebraic equations using numerical techniques. This includes understanding and applying methods like Gaussian elimination, Gauss-Jacobi method, and Gauss-Seidel method, enhancing their capability to handle complex problems in engineering and science.
MATH-G-SEC-T-4A	PROGRAMMING IN 'C'	2	1. Students will understand the fundamental concepts of computer programming, data types, and the structure of C programs. They will gain proficiency in using basic syntax, operators, and expressions to create functional C programs. 2. Learners will be equipped to design, write, and debug programs using control structures such as loops, conditional statements, and functions. They will develop algorithms to solve mathematical and logical problems, enhancing their problem-solving and analytical skills. 3. Students will learn to implement and manipulate complex data structures such as arrays and pointers. This includes the ability to handle dynamic memory management and the creation of modular programs using

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			user-defined functions, which are crucial for managing large-scale software projects.
MATH-G-SEC-T-4B	PROGRAMMING IN PYTHON	2	1. Students will learn the basic structure and elements of Python programming, including data types, control structures, and the Python standard library. They will gain proficiency in writing Python scripts to solve mathematical and logical problems. 2. Students will develop skills in algorithmic thinking and problem-solving using Python. This includes creating algorithms, understanding their complexities, and implementing solutions to real-world problems using Python's versatile features. 3. Students will master the use of advanced Python features such as functions, handling exceptions, and working with various data structures like lists, tuples, and dictionaries. This will prepare them for complex programming tasks and data manipulation in Python.