NAME OF THE DEPARTMENT	MATHEMATICS
PROGRAMME NAME	**BSc Mathematics**
FIRST SEMESTER MTS1 B01 BASIC LOGIC & NUMBER THEORY	• Prove results involving divisibility, greatest common divisor, least common multiple and a few applications. • Understand the theory and method of solutions of LDE. • Solve linear congruent equations. • Learn three classical theorems viz. Wilson's theorem, Fermat's little theorem and Euler's theorem and a few important consequences.
SECOND SEMESTER MTS2 B02 CALCULUS OF SINGLE VARIABLE1	• Define a function, describe its characteristics, and evaluate functions. • Determine the domain of a function using the Vertical Line Test. • Understand piecewise defined functions and identify even and odd functions. • Perform arithmetic operations on functions and comprehend composition of functions. • Analyze graphs of transformed functions, including vertical and horizontal translations, stretching, compressing, and reflecting. • Develop an intuitive understanding of limits using real-life examples. • Compute limits using the laws of limits, with a focus on polynomial,

	rational, and trigonometric functions. • Grasp the precise definition of a limit using $\varepsilon - \delta$ definition and geometric interpretation. • Explore the concept of continuity, including continuity at a point, endpoint, and on an interval. • Understand tangent lines, rate of change, and the Intermediate Value Theorem.
THIRD SEMESTER MTS3 B03 CALCULUS OF SINGLE VARIABLE2	• allows us to define its inverse function namely the natural exponential function and also the general exponential function • This enables to study a related notion of convergence of a series, which is practically done by applying several different tests such as integral test, comparison test and so on • get the idea of parametrization of curves, they learn how to calculate the arc length, curvature etc • enables them to directly calculate the arc length and surface areas of revolution of a curve whose equation is in polar form. • acquired the ability to sketch curves in plane and space given in vector valued form
FOURTH SEMESTER MTS4 B04 LINEAR ALGEBRA	• become competent to perform matrix algebra and also to calculate the inverse and determinant of a matrix

	• to understand the modern view of a matrix as a linear transformation • enables the student to understand the relationship among the solutions of a given system of linear equations and some important subspaces associated with the coefficient matrix of the system. • enable them to check whether diagonalization is possible. • realize that every symmetric matrix is diagonalizable and that this diagonalization can be done in a special way ie., by choosing an orthogonal matrix to perform the diagonalization • gives the students an opportunity to learn the fundamentals of linear algebra by capturing the ideas geometrically, by justifying them algebraically and by preparing them to apply it in several different fields such as data communication, computer graphics, modelling etc.
FIFTH SEMESTER MTS5 B05 ABSTRACT ALGEBRA	• Students will be able to To engage in analyzing, solving and computing real world applications of finite and discrete mathematics • Demonstrate understanding of the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.

	• Demonstrate understanding of and the ability to work within various algebraic structures. • Describe and generate groups, rings, and fields. Relate abstract algebraic constructs to more familiar number sets and operations and see from where the constructs derive. • Identify examples of specific constructs. • Identify and differentiate between different structures and understand how changing properties give rise to new structures. • Explain the theory behind relations and functions and identify domains and images of functions, based on the structures given. • Explain how functions may relate seemingly dissimilar structures to each other and how knowing properties of one structure allows 80 us to know the same properties in the related structure, if certain functions exist between them
FIFTH SEMESTER MTS5 B06 BASIC ANALYSIS	• to learn and deduce rigorously many properties of real number system by assuming a few fundamental facts about it as axioms. In particular they will learn to prove Archimedean property, density theorem, existence of a positive square root for positive numbers and so on and the learning

	will help them to appreciate the beauty of logical arguments and embolden them to apply it in similar and unknown problems. • to know about sequences ,their limits, several basic and important theorems involving sequences and their applications . For example, they will learn how monotone convergence theorem can be used in establishing the divergence of the harmonic series, how it helps in the calculation of square root of positive numbers and how it establishes the existence of the transcendental number e (Euler constant). • to understand some basic topological properties of real number system such as the concept of open and closed sets, their properties, their characterization and so on. • to get a rigorous introduction to algebraic, geometric and topological structures of complex number system, functions of complex variable, their limit and continuity and so on. Rich use of geometry, comparison between real and complex calculus-areas where they agree and where they differ, the study of mapping properties of a few important complex functions exploring the underlying geometry

	etc. will demystify student's belief that complex variable theory is incomprehensible.c 2
FIFTH SEMESTER MTS5 B07 NUMERICAL ANALYSIS	• Understand several methods such as bisection method, fixed point iteration method, regula falsi method etc. to find out the approximate numerical solutions of algebraic and transcendental equations with desired accuracy. • Understand the concept of interpolation and also learn some well known interpolation techniques. • Understand a few techniques for numerical differentiation and integration and also realize their merits and demerits. • Find out numerical approximations to solutions of initial value problems and also to understand the efficiency of various methods.
FIFTH SEMESTER MTS5 B08 LINEAR PROGRAMMING	• solve linear programming problems geometrically • understand the drawbacks of geometric methods • solve LP problems more effectively using Simplex algorithm via. the use of condensed tableau of A.W. Tucker • convert certain related problems, not directly solvable by simplex method,

	into a form that can be attacked by simplex method. • understand duality theory, a theory that establishes relationships between linear programming problems of maximization and minimization • understand game theory • solve transportation and assignment problems by algorithms that take advantage of the simpler nature of these problems
FIFTH SEMESTER MTS5 B09 INTRODUCTION TO GEOMETRY AND THEORY OF EQUATIONS	• Understand several basic facts about parabola, hyperbola and ellipse (conics) such as their equation in standard form, focal length properties, and reflection properties, their tangents and normal. • Recognise and classify conics. • Understand Kleinian view of Euclidean geometry. • Understand affine transformations, the inherent group structure, the idea of parallel projections and the basic properties of parallel projections. • Understand the fundamental

	theorem of affine geometry. • Learn to solve polynomial equations upto degree four
SIXTH SEMESTER MTS6 B10 REAL ANALYSIS	• State the definition of continuous functions, formulate sequential criteria for continuity and prove or disprove continuity of functions using this criteria. • Understand several deep and fundamental results of continuous functions on intervals such as boundedness theorem, maximum-minimum theorem, intermediate value theorem, preservation of interval theorem and so on. • Realise the difference between continuity and uniform continuity and equivalence of these ideas for functions on closed and bounded interval. • Understand the significance of uniform continuity in continuous extension theorem. • Develop the notion of Riemann integrability of a function using the idea of tagged partitions and calculate the integral value of some simple functions using the definition. • Understand a few basic and fundamental results of integration theory. • Formulate Cauchy criteria for

	integrability and a few applications of it. In particular they learn to use Cauchy criteria in proving the non integrability of certain functions. • Understand classes of functions that are always integrable • Understand two forms of fundamental theorem of calculus and their significance in the practical problem of evaluation of an integral. • Find a justification for 'change of variable formula' used in the practical problem of evaluation of an integral. • Prove convergence and divergence of sequences of functions and series • Understand the difference between pointwise and uniform convergence of sequences and series of functions • Answer a few questions related to interchange of limits. • Learn and find out examples/counter examples to prove or disprove the validity of several mathematical statements that arise naturally in the process/context of learning. • Understand the notion of improper integrals, their convergence, principal value and evaluation. • Learn the properties of and relationship among two important improper integrals namely beta and gamma functions that frequently appear in mathematics, statistics,

	science and engineering.
Sixth SEMESTER MTS6 B11 COMPLEX ANALYSIS	• to understand the difference between differentiability and analyticity of a complex function and construct examples. • to understand necessary and sufficient condition for checking analyticity. • to know of harmonic functions and their connection with analytic functions • to know a few elementary analytic functions of complex analysis and their properties. • to understand definition of complex integral, its properties and evaluation. • to know a few fundamental results on contour integration theory such as Cauchy's theorem, Cauchy-Goursat theorem and their applications. • to understand and apply Cauchy's integral formula and a few consequences of it such as Liouville's theorem, Morera's theorem and so forth in various situations. • to see the application of Cauchy's integral formula in the derivation of power series expansion of an analytic function. • to know a more general type of series expansion analogous to power series expansion viz. Laurent's series expansion for functions having

	singularity. • to understand how Laurent's series expansion lead to the concept of residue, which in turn provide another fruitful way to evaluate complex integrals and, in some cases, even real integrals. • to see another application of residue theory in locating the region of zeros of an analytic function
SIXTH SEMESTER MTS6 B12 CALCULUS OF MULTI VARIABLE	• Understand several contexts of appearance of multivariable functions and their representation using graph and contour diagrams. • Formulate and work on the idea of limit and continuity for functions of several variables. • Understand the notion of partial derivative, their computation and interpretation. • Understand chain rule for calculating partial derivatives. • Get the idea of directional derivative, its evaluation, interpretation, and relationship with partial derivatives. • Understand the concept of gradient, a few of its properties, application and interpretation. • Understand the use of partial derivatives in getting information of tangent plane and normal line. • Calculate the maximum and minimum values of a multivariable

	function using second derivative test and Lagrange multiplier method. • Find a few real life applications of Lagrange multiplier method in optimization problems. • Extend the notion of integral of a function of single variable to integral of functions of two and three variables. • Address the practical problem of evaluation of double and triple integral using Fubini's theorem and change of variable formula. • Realise the advantage of choosing other coordinate systems such as polar, spherical, cylindrical etc. in the evaluation of double and triple integrals . • See a few applications of double and triple integral in the problem of finding out surface area ,mass of lamina, volume, centre of mass and so on. • Understand the notion of a vector field, the idea of curl and divergence of a vector field, their evaluation and interpretation. • Understand the idea of line integral and surface integral and their evaluations. • Learn three major results viz. Green's theorem, Gauss's theorem and Stokes' theorem of multivariable

	calculus and their use in several areas and directions.
SIXTH SEMESTER MTS6 B13 DIFFERENTIAL EQUATIONS	• Students could identify a number of areas where the modelling process results in a differential equation. • They will learn what an ODE is, what it means by its solution, how to classify DEs, what it means by an IVP and so on. • They will learn to solve DEs that are in linear, separable and in exact forms and also to analyse the solution. • They will realise the basic differences between linear and non linear DEs and also basic results that guarantees a solution in each case. • They will learn a method to approximate the solution successively of a first order IVP. • They will become familiar with the theory and method of solving a second order linear homogeneous and nonhomogeneous equation with constant coefficients. • They will learn to find out a series solution for homogeneous equations with variable coefficients near ordinary points. • Students acquire the knowledge of solving a differential equation using Laplace method which is especially suitable to deal with problems arising in engineering field.

	• Students learn the technique of solving partial differential equations using the method of separation of variables
SIXTH SEMESTER (Elective) MTS6 B14 (E01) GRAPH THEORY	• Able to Define a graph and comprehend its basic components. • Understand the application of graphs as models in various contexts. • Explore additional definitions related to graphs. • Analyze and compute vertex degrees within a graph. • Identify and analyze subgraphs within a larger graph. • Understand the concepts of paths and cycles in a graph. • Learn the matrix representation of a graph up to Theorem 1.6. • Able to define graphs and explore their simple properties. • Understand bridges in a graph. • Analyze and comprehend the concept of spanning trees. • Identify cut vertices and understand connectivity within a graph. • Gain insights into the definitions and simple properties of graphs, including bridges, spanning trees, and cut vertices. • able to Understand Euler Tours and their applications in graphs up to Theorem 3.2. • Explore Hamiltonian Graphs and

	their properties up to Theorem 3.6. • Gain insights into plane and planar graphs, up to Theorem 5.1. • Understand Euler's Formula and its application in graph theory.
FIFTH SEMESTER (OPEN COURSE) MTS5 D03 LINEAR MATHEMATICAL MODELS	• Understand the concepts of slopes and equations of lines. • Apply linear functions in various real-world applications. • Analyze and interpret the least squares line for data fitting. • Solve systems of linear equations using the echelon method and the Gauss-Jordan method. • Perform operations on matrices, including addition, subtraction, and multiplication. • Determine matrix inverses and apply them in solving linear systems. • Utilize input-output models to represent and analyze real-world scenarios. • Graph linear inequalities and understand the graphical method in linear programming. • Solve linear programming problems graphically using the graphical method. • Apply linear programming concepts to model and solve real-world problems. • Apply the simplex method to solve

	linear programming problems. • Understand and use slack variables and the pivot in the simplex method. • Solve maximization and minimization problems using the simplex method. • Explore duality in linear programming. • Analyze and solve nonstandard linear programming problems. •