DEPARTMENT OF MATHEMATICS

PROGRAMME OUTCOMES AND COURSE OUTCOMES OF UNDER GRADUATE & POST GRADUATE PROGRAMME (2022 ONWARDS)

NAME OF THE PROGRAMME: B.Sc MATHEMATICS – PROGRAMME OUTCOME	
PO1	Able to have a holistic understanding of English literature.
PO2	Able to develop a sense of social responsibility.
PO3	Able to have environmental awareness.
PO4	Able to preserve cultural values.
PO5	Able to develop compassion for fellow human beings.
PO6	Able to learn lessons from the prescribed texts.
PO7	Able to motivate others
PO8	Able to appreciate the positive traits
M.Sc MATHEMATICS	
PO1	Acquire in-depth knowledge of Mathematics both in theory and application
PO2	Identify mathematical and computational methods in order to solve comprehensive problems
PO3	Recognize the various specialized areas of advanced mathematics and its applications.
PO4	Analyze and interpret data to create and design new knowledge for complex problems.
PO5	Develop the mathematical models for the applications of mathematics in real life situations.
PO6	Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings
PO7	Develop the skill stocrack the various competitive examinations.
PO8	Ability to engage in life-long learning in the context of the rapid developments in the field.
PO9	Demonstrate the ability to write dissertations, reports, make effective presentations and documentation

PO10	Commitment to professional ethics and social responsibilities.

NAME OF THE PROGRAMME: B.Sc MATHEMATICS – COURSE OUTCOMES	
SEMESTER I	
ALGEBRA	1. Know the relationship between roots and coefficients. 2. Identify the nature of the roots of the given equation. 3. Evaluate sum to infinity of the given binomial, exponential and logarithmic series. 4. Identify the types of matrices and calculate the Eigen values of a given square matrix. 5. Know the number theory concepts.
TRIGONOMETRY	1. Know the expansions of cosnθ, sinnθ in powers of cosθ and sinθ 2. Expand powers of sines and cosines of θ in terms of functions of multiples of θ 3. Know the concept of hyperbolic functions 4. Know the logarithm of complex quantities 5. Find the summation of trigonometric series.
NUMERICAL METHODS – I	1. The student will be able to solve simultaneous linear equations by Gauss elimination method, Gauss-Jordan Method, and Gauss-Seidel method. 2. The student will be able to calculate interpolation values by applying Gregory-Newton‟s forward and backward formulae. 3. The student will be able to calculate the central interpolation values by applying central differences formulae. 4. The student will be able to estimate one or more missing terms of the given set of data. 5. The student will be able to estimate the interpolation value for unequal intervals based on Lagrange‟s formula of inverse interpolation
SEMESTER II	
CALCULUS	1. 1.Determine extreme values of the given function 2. Know the concept of Cartesian and polar coordinates 3. Gain the knowledge of curvature, evolutes and envelope concepts 4. Solve integration problems 5. Evaluate double and triple integrals.

ANALYTICAL GEOMETRY OF THREE DIMENSIONS	1. Know the equation of the plane and its applications 2. Gain the knowledge of straight line and its applications 3. Solve sphere related problems 4. Know the concepts of cone, right circular cone and enveloping cone 5. Know the concepts related to cylinder.
NUMERICAL METHODS – II	1. The student will be able to evaluate derivatives by applying Newton‟s forward and backward differences formulae. 2. The student will be able to evaluate integrations by applying the trapezoidal rule, Simpson‟s rules, and Weddle‟s rule. 3. The student will be able to find a complete solution to linear difference equations. 4. The student will be able to estimate approximate numerical solutions of algebraic and transcendental equations. 5. The student will be able to estimate approximate numerical solutions of ordinary differential equations by Euler, Picard, Taylor, and Runge Kutta methods.
SEMESTER III	
DIFFERENTIAL EQUATIONS	1. 1.Solve the first order higher degree differential equations 2. 2.Solve the second order differential equations 3. 3 .Know the concept of total differential equations 4. Know the applications of Laplace transform 5. 5. Solve the partial differential equations.
MATHEMATICAL STATISTICS - I	1. The student will be able to express the techniques of conditional probability and Baye’s theorem with examples. 2. The student will be able to calculate expectation, and distribution function. 3. The student will be able to express Chebyche’s inequality and its applications. 4. The student will be able to interpret the different types of correlation coefficient and lines of regression with examples. 5. The student will be able to apply domain knowledge for discrete and continuous distributions with examples
SKILL BASED SUBJECT MATHEMATICS FOR COMPETETIVE EXAMINATIONS - I	1. Know the idea H.C.F. and L.C.M. 2. Find the Average, square root and cubic root 3. Solve the problems on ages and numbers 4. Know the percentage, profit and loss 5. Analyze the proportion and partnership problems

NON-MAJOR ELECTIVE BASIC MATHEMATICS	1. The student will be able to define subset, proper subset, and equivalent sets and write sets using set notations. 2. The student will be able to describe various number systems and convert one number system into another. 3. The student will be able to express logical statements and prepares the truth tables. 4. The student will be able to find the determinant values 2x2, and 3x3 matrices and solve a system of equations by applying Crame's rule. 5. The student will be able to get a strong background in matrices and be able to solve a system of non-homogeneous equations.
SEMESTER-IV	
VECTOR ANALYSIS AND FOURIER SERIES	1. Know the physical and geometrical meaning of the derivative 2. Know the physical and geometrical meaning of the divergence and curl 3. Evaluating line, surface and volume integrals 4. Know the applications of Stoke's Theorem, Gauss Divergence Theorem and Green's theorem 5. Analyze the Fourier series in both theory and application level
MECHANICS	1. Provides basic knowledge of Resultant of forces and Equilibrium of a particle 2. Knowledge pertaining to Parallel forces and coplanar forces 3. To know about Center of mass 4. Gain the knowledge of projectile and its applications 5. Understand the concept of impact
MATHEMATICAL STATISTICS -II	1. The student will be able to demonstrate sampling, parameter, and significance with examples. 2. The student will be able to know about Chi-square distribution and its applications. 3. The student will be able to illustrate Students t-distribution and the applications of F-distribution. 4. The student will be able to state null and alternate hypotheses to the given problem and test the hypothesis. 5. 5. The student will be able to apply ANOVA techniques.
SKILL BASED SUBJECT MATHEMATICS FOR COMPETETIVE EXAMINATIONS	1. Know the idea of ratio and proportions 2. Find the percentages 3. Profit and loss problems 4. Know the simple and compound interest problems 5. Analyze the time and distance problems
SEMESTER-V	

ABSTRACT ALGEBRA	1. Students able to identify groups and subgroups 2. Students able to understand homomorphism and isomorphism. 3. Students able to do the problems in permutation. 4. Students able to study the basics of rings, ideals and integral domain. **5.** Students able to apply Euclidean rings in theorems**.**
REAL ANALYSIS I	1. Know the concept count ability 2. Identify convergent, divergent sequences 3. 3.Solve conditional convergence and absolute convergence problems Evaluate limit of a function 4. Know the concepts of open, closed sets.
COMPLEX ANALYSIS - I	1. The students can gain knowledge about Complex functions and its nature, limits and Analytic functions. 2. The students can gain knowledge about elementary transformations. 3. 3.The students can gain knowledge about line integrals and techniques for solving problems
PROGRAMMING IN C LANGUAGE	1. The student will be able to demonstrate „c“ tokens, keywords, the basic structure of C programs and the execution of a „C“ Program. 2. The student will be able to express the nature of constants, variables, data types, declaration of variables, and assigning values to variables. 3. The student will be able to describe valuation of expressions and usage of various operators. 4. The student will be able to express the logic using control statements. 5. The student will be able to demonstrate knowledge pertaining to arrays.
ELECTIVE LINEAR PROGRAMMING	1. Formulate any real world problem as LPP 2. Understand various techniques of simplex method. 3. Understand analogies between transportation problem and assignment models 4. Interpret the solutions in game theory. 5. 5. Know the concept of simulation.
ELECTIVE	1. The student will be able to acquire the concept of linear operators, and solve simultaneous linear differential equations. 2. The student will be able to interpret Adams and Modified Adams method and extrapolation techniques.

SPECIAL FUNCTIONS	3. The student will be able to understand the concept of power series solution. 4. The student will be able to explain the concepts of Bessel functions, Legendre functions, and their properties. 5. The student will be able to analyze term-by-term differentiation of the Fourier series and Legendre series.
SKILL BASED SUBJECT MATHEMATICS FOR COMPETETIVE EXAMINATIONS - III	1. Aspirants preparing for the upcoming competitive examinations will be able to answer such questions in a faster way. 2. The student will be able to carry out problems related to compound interest. 3. Aspirants preparing for the upcoming competitive examinations will be able to answer such questions in a faster way. 4. The student will be able to demonstrate knowledge of area-related problems. 5. The student will be able to carry out surface area and volume - related problems.
SEMESTER –VI	
LINEAR ALGEBRA	1. Beginning with Linear Dependence and Linear Independence on Vector Space 2. Knowing about Dual spaces and Inner product spaces on Vector space 3. Learning to study about Algebra of Linear transformations and its characteristic roots 4. Converting Linear equations of Vector space to Matrices its canonical and triangular forms 5. Deriving Trace and Transpose of Matrices.
REAL ANALYSIS II	1. Understand the concept of complete metric space 2. Know the difference between continuity and uniform continuity 3. Know Riemann integration and its properties 4. Solve problems related to Rolle's theorem , law of mean 5. Know the convergence of sequences of functions.
COMPLEX ANALYSIS II	1. The students can gain knowledge about Contour integration and problem solving techniques. 2. The students can learn about singularities and Residues. 3. The students can gain knowledge about power series expansions of analytic functions.
ELECTIVE GRAPH THEORY	1. The student will be able to know various graph structures and isomorphism between graphs. 2. The student will be able to know the representation of the graphs in matrix form. 3. The student will be able to know the concepts of connected graph, component, cut point, and bridge of a

	graph. 4. The student will be able to know about trees and their applications. 5. The student will be able to demonstrate knowledge of Eulerian and Hamiltonian graphs.
DISCRETE MATHEMATICS	1. The student will be able to demonstrate knowledge of recurrence relations and generating functions. 2. The student will be able to form a truth table and know the concepts of tautological implications and equivalence of formulae. 3. The student will be able to know the concepts of functionally complete sets of connectives and duality law. 4. The student will be able to demonstrate knowledge of modular and distributive lattices and the properties of lattices. 5. The student will be able to understand the concepts of Boolean Algebra, Boolean polynomials, and Karnaugh Maps.
FUZZY MATHEMATICS	1. The student will be able to know fuzzy sets and their operations. 2. The student will be able to know the addition and product of two fuzzy sets. 3. The student will be able to demonstrate knowledge of fuzzy relations and logic-connectives. 4. The student will be able to express about fuzzy subgroup, homomorphic image, and pre-image of subgroupoid. 5. The student will be able to demonstrate knowledge of fuzzy invariant subgroups and subrings.
SKILL BASED SUBJECT OPERATIONS RESEARCH	1. Interpret the solutions in network analysis 2. Knowledge about optimal use of resources 3. Understand to sequence the machines to do the job effectively 4. Analyze the system given and interpret the solutions

NAME OF THE PROGRAMME : M.Sc MATHEMATICS - COURSE OUTCOMES	
SEMESTER –I	
ALGEBRA I	1. Demonstrate ability to think group actions critically by Cayley's theorem and apply the Sylow's theorems to describe the structure of certain finite abelian groups. 2. Know the internal and external direct product of groups. also, apply the structure theorem on abelian groups to find the non-isomorphic abelian groups of certain orders. 3. Check the irreducibility of a given polynomial

	4. Know about module and difference between the algebraic structures, group, ring and module. 5. Know the linear transformation in canonical forms. also, the matrix form of linear transformation and its properties.
REAL ANALYSIS I	1. Understand the concept of functions of bounded variation. 2. Discuss the Riemann integration and to solve its related problems. 3. Analyze the sequences and series of function and their limits 4. Acquire the knowledge of infinite series and infinite products. 5. Have knowledge of uniform convergence of sequence and series
ORDINARY DIFFERENTIAL EQUATIONS	1. Solve second order linear differential equations. 2. Solve nth order differential equations. 3. Solve differential equations with variable coefficients. 4. Solve differential equations with regular singular points. 5. Examine the existence and uniqueness of solutions of Differential equations. 6. Apply ode problems for real time applications.
PROBABILITY THEORY	1. Know the basic notions of experiments, events, probability, random variables and probability distributions. 2. Comprehend the various parameters and measures of the probability distributions 3. Understand the characteristic functions and its properties. 4. Acquire the special types of discrete and continuous probability distributions. 5. Procure the strong theoretical background about the limit theorems and its consequences.
MECHANICS	1. Know mechanical systems under generalized coordinate systems. 2. Know the derivation of Lagrange's equations. 3. Know the Hamilton's principle. 4. Know the Hamilton-Jacobi equation and separability. 5. Know The Lagrange And Poisson Brackets.
GRAPH THEORY	1. Grasp features and properties of special graphs 2. Check the given graph is Eulerian or not. also able to find the Eulerian circuit and Hamiltonian paths of the given graph. 3. Find the matching/perfect matching, connectivity of given graphs 4. Find independent sets and chromatic number of a given graph 5. Apply coloring and planarity of graphs in real life problems.
BASIC MATHEMATICS	1. Acquire the knowledge of exponential and logarithmic series 2.Understanding about matrices and its applications 3.Formulate and solve the partial differential equations 4.Apply the results on Laplace transform 5. Learn the techniques on Fourier series.
MATHEMATICAL FOUNDATIONS	1. Understand mathematical logical operators. 2. Gain knowledge in set theory, binary operations with Some Problems. 3. Solve problems on applications of differentiation and two dimensional geometry
MATHEMATICAL	1. Understand concept of modeling and simulation

MODELING	2. Construct mathematical models of real world problems 3. Solve the mathematical models using mathematical techniques
SEMESTER II	
ALGEBRA II	1. Demonstrate ability to find the extension field of polynomials. also, gets the clear understanding of algebraic extensions and algebraic closures. 2. Work with the consequences of Galois theory such as insolubility of certain classes of equations. 3. Work with finite fields and certain important theorems related to finite division ring 4. Use of Frobenius integral quaternions and the four square theorem.
REAL ANALYSIS II	1. Understand the concept of Fouier series and Fourier integrals 2. Analyze the functions of several variables. 3. Discuss the inverse function theorem and implicit function theorem 4. Acquire the knowledge of Lebesgue measure 5. Analyze the concept of inner and outer measure
PARTIAL DIFFERENTIAL EQUATIONS	1. Formulate and solve partial differential equations (PDE) and apply PDE problems for real time applications. 2. Solve partial differential equations of first and second order. 3. Classify the partial differential equations 4. Identify the canonical forms of the partial differential equations. 5. Analyze the solution of Laplace, diffusion and wave equations in cylindrical and polar coordinates 6. Discuss the existence and uniqueness of solutions and Duhamel's Principle
MATHEMATICAL STATISTICS	1. Know the basic notions of sample, population, sample moments and their functions. 2. Comprehend the parametric and non-parametric tests for small and large samples 3. Understand the various measures of estimation theory. 4. Acquire the concepts of ANOVA test and hypothesis testing. 5. Procure the strong background about the sequential analysis and its consequences.
FUZZY SET THEORY	1. Understand the basic concepts of fuzzy sets and the difference between the fuzzy sets and crisp sets. 2. Analyze the fuzzy sets and additional properties of 3. Discuss the operations on fuzzy sets and fuzzy complements 4. Acquire the knowledge of various norms on fuzzy sets and combination of operations 5. Visualize the fuzzy sets as fuzzy numbers 6. Analyze the linguistic variables, arithmetic operation on intervals, arithmetic operation on fuzzy numbers 7. Apply the concepts of fuzzy mathematics in real life situation.
DIFFERENCE EQUATIONS	1. Solve problems on linear difference equations of higher order 2. Understand the system of Linear Difference Equations 3. Apply Z-Transform Techniques in Difference Equations 4. Solve problems on oscillation theory and asymptotic behavior of

	difference equation
FUNDAMENTALS OF INSURANCE	1. Understand the principles and regulations of insurance 2. Analyze the benefits of life insurance policies 3. Discuss the marine insurance and its benefits 4. Discuss the fire insurance and its benefits 5. Analyze the various insurance sector 6. Understand the duties of an agent and procedure to get license.
NUMERICAL METHODS	1. Solve the algebraic and transcendental equations 2. Understand the concept of interpolation with equal and unequal intervals 3. Analyze the properties of divided difference 4. Study the various methods for numerical differentiation 5. Discuss the various methods for numerical integration 6. Gain the knowledge of Euler's Method, modified Euler's Method and Runge-Kutta Method.
FUNDAMENTALS OF BUSINESS STATISTICS	1. Know about the partial and Multiple Correlation 2. Understand the basics concepts of Probability and Theoretical Distributions. 3. Identify the educated guess (Hypothesis) 4. Analysis the statistical inferences – Test of Hypothesis, Chi square and Goodness of Fit and F – Test 5. Design and discuss the Analysis of Variance.
SEMESTER III	
COMPLEX ANALYSIS 1	1. Understand the differentiability and analytic functions. 2. Comprehend the elementary functions and complex integration. 3. Acquire the knowledge of conformal mappings and Mobius Transformations 4. Discuss the Maximum Principle, Schwarz' Lemma and Liouville's Theorem. 5. Procure the applications of the classification of Singularities.
TOPOLOGY	1. Know the basics of open and closed sets and the significance of the topological spaces. 2. Comprehend the continuous functions on Topological Spaces, Product Topology and Topology induced by the metric. 3. Understand the Connected Spaces, Connected Subspaces, Components and Local Connectedness. 4. Acquire the notions of compactness, compact subspaces, limit point compactness and local compactness. 5. Understand the Various countability axioms and the separation axioms.
DIFFERENTIAL GEOMETRY	1. Understand the characteristics of curves and surfaces in space and also the fundamental existence theorem for space curves. 2. Discuss the Intrinsic Properties Of Surface. 3. Analyze the Geodesics And Its Normal Properties And Familiar With Gauss bonnet Theorem. 4. Discuss the Developable. 5. Understand Hilbert's Lemma and the fundamental existence theorem for

	Surface Theory.
LATEX	1. Prepare the Latex Document And The E-Contents. 2. Able to Construct Structures, Tables Inclusions, Header and Footer, Bibliography Management, Etc. 3. Understand About The Mathematics Document Preparation.
DISCRETE MATHEMATICS	1. Understand about Lattices, Applications of Lattices 2. Discuss the Boolean algebras and polynomials 3. Procure Strong Theoretical Background on Finite Fields and Polynomials. 4. Analyses the Concept of Coding Theory And Factorization of Polynomials 5. Identify the Various Types of Codes
OPERATIONS RESEARCH	1. Analyze Various Inventory Control Modules 2. Understand the Concepts of Network Techniques 3. Discuss the Maintenance Models in Replacements 4. Understand Inventory Control and Functional Role of Inventory 5. Analyze Various Performance of Queuing Models
MATHEMATICAL BIOLOGY	1. Formulate the Mathematical Models for Real World Problems 2. Understand the Concepts of Discrete Population Growth Models 3. Discuss the Continuous Growth Models 4. Analyze the Qualitative Behavior of Populations and Mathematical Models in Epidemiology
QUANTITATIVE TECHNIQUES	1. Understand the Linear Programming Problems(LPP) 2. Discuss the Simplex Method to Solve LPP 3. Analyze the Transportation And Assignment Problems 4. Acquire the Knowledge of Resource Leveling 5. Study Inventory Control and Functional Role of Inventory. 6. Learn PERT-CPM Technique for Project Management
SCILAB	1. Acquire the Practical Knowledge Of SCILAB 2. Analyze the Matrices, Polynomials In SCILAB 3. Solve the Solutions Of Differential Equations 4. Visualize the Mathematical Objects In 2D And 3D
SEMESTER IV	
COMPLEX ANALYSIS II	1. Understand The Concepts Of Residues 2. Evaluate The Integrals Using Cauchy Residue Theorem. 3. Comprehend The Harmonic Functions And Its Consequences.

	4. Understand The Conformal Mappings, Normal Families And Riemann Mapping Theorem. 5. Acquire The Concepts Of Entire And Meromorphic Functions. 6. Procure The Applications Of Analyticity and Special Functions
FLUID DYNAMICS	1. Understand the concepts of kinematics of fluids in motions. 2. Analyze the examples related to the equation of continuity and acceleration of a fluid 3. Discuss two-dimensional flows, the stream function and the Milne Thompson circle theorem. 4. Acquire the concept of three-dimensional flows and derive Stoke's stream function 5. Discuss The Viscous Flows And Navier – Stokes Equations Of Motion Of A Viscous Fluid
FUNCTIONAL ANALYSIS	1. Analyse the Banach Space With Examples 2. Understand the Natural Embedding N In N** 3. Discuss Banach Spaces with the Hilbert Spaces 4. Acquire the Open Mapping Theorem, Orthonormal Complements and Orthonormal Sets 5. Derive Gelgand-Neumark Theorem 6. Prove the Structure Theorems
NUMBER THEORY AND CRYPTOGRAPHY	1. Discuss the elementary number theory 2. Understand the quadratic, residues and reciprocity 3. Develop the idea of public key cryptography, rsa and discrete law 4. Solve problems using the continued fraction method and the quadratic sieve method 5. Analyze Knapsact, zero knowledge 6. Discuss Fermat factorization and factor bases.
ADVANCED NUMERICAL ANALYSIS	1. Compute the solutions of transcendental and polynomial equations 2. Understand the system of linear algebraic equations 3. Analyze Interpolation and Extrapolation 4. Derive Numerical Differentiation and Integrations 5. Evaluate double integrals 6. Solve Differential Equations by Single and Multi Step Method.
CALCULUS OF VARIATION AND	1. Understand theconcept of calculus of variation and its applications 2. Discuss the various types of integral equations

INTEGRAL EQUATIONS	3. Analyze the methods of successive approximations and Fredholm theory 4. Acquire knowledge on Applications to Ordinary differential equations.
MATHEMATICAL ECONOMICS	1. Understand the knowledge of firm theory and perfect competition 2. Analyze the CES Production 3. Acquire the knowledge of market equilibrium 4. Control the stability of equilibrium 5. Discuss the welfare economics, taxes and subsidies
ENTREPRENEURIAL DEVELOPMENT	1. Understand the Knowledge of Entrepreneurship 2. Analyze the entrepreneurial finance and role of various government agencies 3. Develop the idea generation, creating awareness of business opportunities, and familiarizing them with formal practices 4. Discuss the government policies and benefits
PROGRAMMING IN C++	1. Understand the concept of Tokens Expressions and control Structures 2. Analyze the types of functions and classes used in C++ 3. Discuss the inheritance and various types of inheritance 4. Acquire the knowledge of Polymorphism in C++