B.Sc. Mathematics (Hon's)

PROGRAME OUTCOME	COURSE NAME	COURSE CODE	COURSE OUTCOME
❖ Communicate mathematics effectively by written, computational and graphic means. ❖ Create mathematical ideas from basic axioms. ❖ Gauge the hypothesis, theories, techniques and proofs provisionally. ❖ Utilize mathematics to solve theoretical and applied problems by critical understanding, analysis and synthesis. ❖ Identify applications of mathematics in other disciplines and in the real-world, leading to enhancement of career prospects in a plethora of fields and research.	1. Calculus-I	BSc-H-Math-101	❖ To have a rigorous understanding of the concept of limit of a function.
			❖ The geometrical properties of continuous functions on closed and bounded intervals.
			❖ Extensively about the concept of differentiability using limits, leading to a better understanding for applications.
			❖ The applications of mean value theorems and Taylor's theorem.
	2. Algebra	BSc-H-Math-102	❖ Employ De Moivre's theorem in a number of applications to solve numerical problems.
			❖ Use Modular arithmetic and basic properties of congruences.
			❖ Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
			❖ Find eigenvalues and corresponding eigenvectors for a square matrix.
	3. Statistical Methods	BSc-H-Math-104	❖ Introduction to Statistics, definitions and data classification, types of studies and types of samples. Graphical displays of data, frequency distributions, analyzing graphs.
			❖ Numerical descriptions of data, measures of center tendency, measures of dispersion. skewness and kurtosis.
			❖ Correlation and regression.
			❖ Theory of attributes.
	4. Differential Equations	BSc-H-Math-201	❖ Formulate the differential equations for various mathematical models and solve first order non-linear differential equation.
			❖ Solve linear differential equations of higher order using various techniques.
			❖ Solve differential equations in series using various methods.
			❖ Formulate the partial differential equations and solve first order linear partial differential equation.
	5. Partial	BSc-H-Math-202	❖ Formulate and classify partial differential equations.

	Differential Equations		❖ Transform partial differential equations into canonical form
			❖ Solve linear and non-linear partial differential equations using various methods
			❖ Apply the methods in solving some physical problems
	6. Introductory Probability	BSc-H-Math-204	❖ The fundamental concepts of Probability Theory.
			❖ Solving probabilistic problems
			❖ Random variables and computing properties of distribution they follow.
			❖ Different probability distributions and their implementation at realistic models.
	7. Group Theory - I	BSc-H-Math-301	❖ Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc;
			❖ Link the fundamental concepts of Groups and symmetrical figures
			❖ Analyze the subgroups of cyclic groups
			❖ Explain the significance of the notion of cosets, normal subgroups, factor groups and group isomorphisms
	8. Calculus II	BSc-H-Math-302	❖ Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference.
			❖ Apply derivatives in Optimization, Social sciences, Physics and Life sciences etc
			❖ Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.
			❖ Understand the calculus of vector functions and its use to develop the basic principles of planetary motion
	9. Multivariable Calculus	BSc-H-Math-303	❖ The conceptual variations when advancing in calculus from one variable to multivariable discussion.
			❖ To understand the maximization and minimization of multivariable functions subject to the given constraints on variables
			❖ Inter-relationship amongst the line integral, double and triple integral formulations
			❖ Applications of multivariable calculus tools in physics, economics, optimization, and understanding the architecture

			of curves and surfaces in plane and space etc
10. Latex and HTML	BSc-H-Math-304	❖	Typeset mathematical formulae, use nested list, tabular & array environments.
		❖	Create or import graphics
		❖	Use beamer to create presentation and HTML to create a web page.
11. Basics of Statistical Inferences	BSc-H-Math-306	❖	The fundamental concepts of Probability Theory.
		❖	Solving probabilistic problems
		❖	Random variables and computing properties of distribution they follow
		❖	Different probability distributions and their implementation at realistic models
12. Real Analysis	BSc-H-Math-401	❖	Understand many properties of the real line and learn to define sequences in terms of functions.
		❖	Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence
		❖	Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers
13. Riemann Integration & Series of functions	BSc-H-Math-402	❖	Some of the classes and properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.
		❖	Beta and Gamma functions and their properties.
		❖	The constraints for the inter-changeability of differentiability and integrability with infinite sum
		❖	Approximation of transcendental functions in terms of power series.
14. Ring Theory & Linear Algebra-I	BSc-H-Math-403	❖	The fundamental concept of Rings, Fields, subrings, integral domains and the corresponding homomorphisms.
		❖	The concept of linear independence of vectors over a field, and the dimension of a vector space.
		❖	Basic concepts of linear transformations, dimension theorem,

			matrix representation of a linear transformation, and the change of coordinate matrix
	15. Computer Algebra Systems and Related Softwares	BSc-H-Math-404	❖ Use of computer algebra systems (Mathematica/MATLAB/Maxima/Maple) as a calculator, for plotting functions, animations and various applications of matrices.
			❖ Understand the use of the statistical software R for entry, summary calculation, pictorial representation of data and exploring relationship between data
			❖ Analyze, test, and interpret technical arguments on the basis of geometry
	16. Applied Statistics	BSc-H-Math-406	❖ The fundamental concepts of Probability Theory.
			❖ Solving probabilistic problems
			❖ Random variables and computing properties of distribution they follow.
			❖ Different probability distributions and their implementation at realistic models.
	17. Metric Spaces	BSc-H-Math-501	❖ Learn various natural and abstract formulations of distance on the sets of usual or unusual entities.
			❖ Analyse that how a theory advances from a particular frame to a general frame.
			❖ Appreciate the mathematical understanding of various geometrical concepts, viz. balls or connected sets etc. in an abstract setting.
			❖ Know about one of the beautiful results in analysis– Banach fixed point theorem, whose far reaching consequences have resulted into an independent branch of study in analysis, known as the fixed point theory
	18. Group Theory II	BSc-H-Math-502	❖ Automorphisms for constructing new groups from the given group.
			❖ External direct productapplies to data security and electric circuits
			❖ Group actions, Sylow theorems and their applications to

			check nonsimplicity.
19. Numerical Methods	BSc-H-Math-503		❖ Some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
			❖ Interpolation techniques to compute the values for a tabulated function at points not in the table
			❖ Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions
20. Mathematical Modeling & Graph Theory	BSc-H-Math-504		❖ The use of mathematics software to observe the implementations of the above mentioned methods efficiently, and to enhance the problem solving skills.
			❖ To solve physical problems using differential equations.
21. C++ Programming	BSc-H-Math-505		❖ Understand and apply the programming concepts of C++ which is important to mathematical investigation and problem solving.
			❖ Use mathematical libraries for computational objectives
			❖ Represent the outputs of programs visually in terms of well formatted text and plots.
22. Mathematical Finance	BSc-H-Math-506		❖ Financial markets and derivatives including options and futures.
			❖ Pricing and hedging of options, interest rate swaps and no-Arbitrage pricing concept
			❖ Stochastic analysis (Ito formula and Ito integration) and the Black-Scholes model.
23. Discrete Mathematics	BSc-H-Math-507		❖ Ordered sets, lattices, modular and distributive lattices, sublattices and homomorphisms between lattices.
			❖ Boolean Algebra, Disjunctive and conjunctive normal form, Switching circuits and their applications
			❖ Graphs, Paths and circuits, Eulerian graphs, Hamiltonian graphs, Applications in the study of shortest path algorithms.
24. Cryptography	BSc-H-Math-508		❖ Understand the fundamentals of Cryptography and Network

	&Network Security		Security, including data and advanced encryption standard (DES & AES), RSA and elliptic curve cryptography.
			❖ Encrypt and decrypt messages using block ciphers, sign and verify messages using well known signature generation and verification algorithms
			❖ Acquire knowledge of standard algorithms that can be used to provide confidentiality, integrity and authentication of data
	25. Complex Analysis	BSc-H-Math-601	❖ Understand the significance of differentiability of complex functions leading to the understanding of Cauchy-Riemann equations.
			❖ Evaluate the contour integrals and understand the role of Cauchy-Goursat theorem and the Cauchy integral formula
			❖ Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals
	26. Ring Theory & Linear Algebra-II	BSc-H-Math-602	❖ Appreciate the significance of unique factorization in rings and integral domains.
			❖ Compute with the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result
			❖ Compute inner products and determine orthogonality on vector spaces, including Gram-Schmidt orthogonalization to obtain orthonormal basis.
	27. Probability Theory & Statistics	BSc-H-Math-603	❖ To write the probability distribution of a given problem.
			❖ Distributions to study the joint behavior of two random variables
			❖ To measure the scale of association between two variables, and to establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.
			❖ Central limit theorem, which helps to understand the remarkable fact that: the empirical frequencies of so many natural populations, exhibit a bell shaped curve, i.e., a normal

			distribution.
	28. Introduction to Information & Coding Theory	BSc-H-Math-604	❖ The output of the channel, a received signal is observed.
			❖ The detection & correction of errors while transmission
			❖ Representation of a linear code by matrices and its encoding and decoding
	29. Bio Mathematics	BSc-H-Math-605	❖ Learn the development, analysis and interpretation of bio mathematical models.
			❖ Reinforce the skills in mathematical modeling
			❖ Appreciate the theory of bifurcation and chaos
			❖ Learn to apply the basic concepts of probability to molecular evolution and genetics
	30. Number Theory	BSc-H-Math-606	❖ Some fascinating discoveries related to the properties of numbers, and some of the open problems in number theory, viz., Goldbach conjecture etc.
			❖ About number theoretic functions and modular arithmetic
			❖ To solve linear, quadratic and system of linear congruence equations
			❖ Public key crypto systems, in particular, RSA
	31. Linear Programming & Theory of Games	BSc-H-Math-607	❖ Analyze and solve linear programming models of real life situations.
			❖ The graphical solution of LPP with only two variables, and illustrate the concept of convex set and extreme points. The theory of the simplex method is developed.
			❖ The relationships between the primal and dual problems and their solutions with applications to transportation, assignment and two-person zero-sum game problem.
	32. Mechanics	BSc-H-Math-608	❖ The significance of mathematics involved in physical quantities and their uses.
			❖ To study and to learn the cause-effect related to these
			❖ The applications in observing and relating real situations/structures.