PROGRAM OUTCOMES (POS), PROGRAM SPECIFIC OUTCOMES (PSOS) AND COURSE OUTCOMES (COS) OF MATHEMATICS HONOURS (B. SC.)

FOR THE ACADEMIC SESSION 2018-19.

Vision:

To become a premier center, promoting Mathematics locally and globally

Mission:

To materialize the vision, the Department of Mathematics focuses on the following:

- To provide necessary background
- For producing a meaningful career in Mathematics and related fields
- For acquiring, Mathematical skills and employability skills

Program Outcomes (POs):

Program Name	Program Outcomes	
Mathematics Honours (B. Sc.)	PO.1.	Acquires the ability to understand and analyze the problems.
	PO.2.	Develops the skill to think critically on abstract concepts of Mathematics.
	PO.3.	Acquires the ability to apply independently paving way for life long learning
	PO.4.	Analyses the situation, make a mathematical problem and find its solution.
	PO.5.	Enhances Logical reasoning skills, arithmetic skills, aptitude skills computational skills, computer skill, programming, self confidence for better employability.
	PO.6.	Formulates and develops mathematical arguments in logical manner.
	PO.7.	Provides a systematic understanding of the concepts and theories of mathematical and computing their application in the real world.

Program Specific Outcomes (PSOs):

Program Name	Program Specific Outcomes	
Mathematics Honours (B. Sc.)	PSO.1.	Understands the basic concepts of advanced Mathematics.
	PSO.2.	Develops the problem solving skill.
	PSO.3.	Develop various computational techniques.
	PSO.4.	Realize the idea of modern mathematics through mathematical structures and problems
	PSO.5.	Creates Mathematical Models (along with solution) for various physical needs.
	PSO.6.	Idea of application of mathematics in inter disciplinary matters
	PSO.7.	Develop the computer programming skill for solving various physical problems.

Course Outcomes (COs):

Paper	Subject Area		Outcomes
Paper-C1	Differential and integral calculus	**CO.1.**	Understand the basic concepts of differential calculus and integral calculus, technique of plotting various curves, Applications of differential calculus to geometry, Economics, biology and many other real life examples.
	Analytic geometry	**CO.2.**	Concept of graphs of quadratic in 2D and 3D, classification of quadratic using the discriminant as well as using transformation of coordinate axes. Concept and properties of various well known curves and surfaces.
	Introduction to Differential equation	**CO.3.**	Concept of Differential equation and their solutions, Idea Mathematical Models using differential equations.

Paper	Subject Area		Outcomes
Paper-C2	Number Theory	**CO.4.**	Concept of integers and their properties, Concept of complex number and various complex functions, idea of inequality and various standard inequalities.
	Classical Algebra	**CO.5.**	Idea of algebraic equation and their solving techniques along with root-coefficient relations.
	Introduction to Modern Algebra	**CO.6.**	Developed the concept of set, relation and function
	Introduction to Linear Algebra	**CO.7.**	Solve linear system of equation, idea of linear transformations, inverse of matrices. Idea of vector space, Subspaces and dimension of subspace, idea of Eigenvalues, Eigenvectors.

Paper	Subject Area		Outcomes
Paper-C3	Real numbers	**CO.8.**	Concept of real numbers and real line, algebraic and analytic properties of real numbers and real line, idea of open and closed set along with their properties.
	Real sequences	**CO.9.**	Idea of sequence of real numbers and their convergence. (Realize the convergency of sequences through computer demonstration)
	Series of real numbers	**CO.10.**	Idea of series of real numbers and their convergence along with various convergency test. (Realize the convergency of series through computer demonstration)

Paper	Subject Area		Outcomes
Paper-C4	Ordinary Differential equations	**CO.11.**	Existence and uniqueness of solution of a differential equation, Concept of Wronskin, Solution of linear differential equation using various techniques.
	System of linear differential equations	**CO.12.**	Systems of linear differential equations and their solution using various technique, Phase plane analysis
	Vector Analysis	**CO.13.**	Idea of various vector operations along with their geometric meaning, Concept of limits, continuity and differentiability of vector valued functions and their applications

Paper	Subject Area		Outcomes
Paper-C5	Limit, continuity and differentiability	**CO.14.**	Realize the definition of limit, continuity and differentiability using (ε- δ)-definition as well as geometric point of view, properties of limit of a function and continuous functions.
	Mean Value theorem	**CO.15.**	Properties of differentiable function and various mean value theorem, Expansion of function and its applications.
	Metric space	**CO.16.**	Idea and example (realistic and abstract) of metric spaces, Concept of open and closed sets of metric spaces and their properties along with their realization through their geometric representations.

Paper	Subject Area		Outcomes
Paper-C6	Introduction to group theory	**CO.17.**	Developed the idea of symmetry of various objects, Realize the symmetries as transformation (especially as bijection), Understanding of symmetric group, dihedral group and quaternion group, Understand the concept of group form various physical group.
	General properties of groups	**CO.18.**	Idea and realization of abstract definition of group and the individual group axioms. To familiar with general properties of group and their applications
	Permutation and permutation groups	**CO.19.**	Idea of permutation and properties of permutation, representation of various groups in terms of permutations.
	cyclic groups	**CO.20.**	Idea of cyclic groups and cyclic subgroups and their realization through graph.
	Cosets, normal subgroup	**CO.21.**	Ideas of cosets, quotient group and their application, Concept of normal subgroup from different point of view, Lagrange theorem and its converse results and their application
	Homomorphism	**CO.22.**	Idea of homormorphism and isomorphisms to better understanding of structures of various groups. Results on isomorphism theorems.

Paper	Subject Area		Outcomes
Paper-C7	Errors in numerical methods	**CO.23.**	Idea of errors occurs in numerical calculation, grow the technique of solving a problem, i.e., algorithms and convergence problems in this methods.
	Solution of transcendental or polynomial equations	**CO.24.**	Developed the concept various technical methods of finding roots of a transcendental or polynomial equations (also from geometric viewpoint). Understand these methods from analytic point of view (along with rate of convergence and error estimation).
	solving system of linear algebraic equations	**CO.25.**	Idea and mechanical technique (along with their convergence) of solving system of linear algebraic equations
	Finite differences and interpolation	**CO.26.**	Developed the idea and the application of finite differences. Understand the concept of interpolation (equi-spaced and unequi-spaced). Learn about various interpolation method form analytic and application viewpoint.
	Numerical differentiation	**CO.27.**	Learn some techniques of differentiation based on interpolation.
	Numerical Integration	**CO.28.**	Learn various techniques of numerical Integration: development of the techniques from various directions, geometric representation, error estimation and applications.
	Eigenvalues and least square polynomial approximation	**CO.29.**	Idea of numerical method for finding eigenvalues and eigenvectors (Power method). Idea of least square polynomial approximation of various data.
	Numerical solution of ODE	**CO.30.**	Make the concept of numerical solution technique of Ordinary Differential Equations: mechanical idea, geometry and application.

Paper	Subject Area		Outcomes
Paper-C7	Commuter aided numerical practical C-Programming language	**CO.31.**	Developed the computer programming skill.
		CO.32.	Better understanding of solving various numerical methods from their algorithms, flowcharts and programs.
		CO.33.	Grow the idea and understanding of C-language
		CO.34.	Solve many more problems on various numerical methods using computer (by writing programs in C-language)

Paper	Subject Area		Outcomes
Paper-SEC1	Computer Language	**CO.35.**	Developed the concept of programming languages.
	Basic of c-Language	**CO.36.**	Systematic study of the c-language
	Sub-program	**CO.37.**	Understanding the programs and subprograms in c
	Some c-programs	**CO.38.**	Developed the writing capacity of various programs in c

Paper	Subject Area		Outcomes
Paper-V	Analysis-III	**CO.39.**	Understanding the concept of convergence sequence ,limit superior, limit inferior and application of Bolzano-Weierstrass theorem, Heine-Borel theorem
		CO.40.	Some useful application of Comparison test, Ratio test, Cauchy's root test and Leibnitz's test
		CO.41.	Study the concept of sequence and series of functions and their convergence along with their geometrical interpretation.
		CO.42.	Understand the convergence, interpretation and application of Fourier series and power series.
		CO.43.	Study the calculus of function of several variables from both analytic and geometric point of view along with applications.
		CO.44.	Understand the concept of differentiation under integral sign and their application.
	Complex Analysis	**CO.45.**	Make the basic understanding on complex numbers, various complex functions along with their geometric and topological aspects
		CO.46.	Understand the concept of limit, continuity, differentiability and analyticity of complex function
		CO.47.	Study power series and its properties
		CO.48.	Understand the concept of Möbius transformations and related problems
	Metric spaces	**CO.49.**	Understand the concept of metric metric space through various examples and their geometric realization and conception.
		CO.50.	concept of some elementary object of a metric space charges open ball closed ball open set set limit point along with their properties and examples
		CO.51.	Concept of sequence Cauchy sequence and convergence on metric space and study the concept of completeness of a metric space along with some example and their geometric realization.
		CO.52.	Understand the concept of continuity on a metric space along with some examples and various applications
		CO.53.	Study the concept of compactness and its analytical importance along with various examples
		CO.54.	Understand various type of compactness and their interrelations and equivalence on a metric space.

Paper	Subject Area		Outcomes
Paper-VI	Elements of Continuum Mechanics	**CO.55.**	Study the idea of continuum mechanics, idea of strain and stress, viscosity along with their physical realizations
	Classical Dynamics	**CO.56.**	Enlighten on various ideas and concepts of classical dynamics, such as inertial frame, absolute time, Galilean transformation etc.
	Dynamics of a system of particles	**CO.57.**	Understand the basic concept of system of particle and various related terms, such as linear momentum kinetic energy etc.
	Dynamics of a rigid body	**CO.58.**	Understand the concept of moment of inertia and product of inertia radius of gyration etc. along with some techniques of finding such quantities for various well known objects.
		CO.59.	Study the two dimensional motion of various rigid bodies under various restrictions and constraints.
	Statics	**CO.60.**	Revisit on concept of physical quantities, such as concurrent forces parallel forces moment of force etc.
		CO.61.	Study the equilibrium of a system, stability of equilibrium and various test regarding stability
	Hydrostatics	**CO.62.**	Understand the basic concept of fluid and fluid pressure and its elementary properties.
		CO.63.	Analyze the stability and equilibrium of a fluid under various conditions
		CO.64.	Study the various properties and related problem of gases.

Paper	Subject Area		Outcomes
Paper-VII	Probability	**CO.65.**	Introduction to probability theory along with the classical notion as well as modern notion. Idea of probability space and random variable.
		CO.66.	Notion of probability distribution (from geometric view point also) along with examples especially discrete or continuous as well as mixed distribution. Study the idea of distribution function probability mass function probability density function along with their various properties Study some important probability distributions
		CO.67.	Grow the concept of multidimensional probability distribution along with examples and related distribution function density function and mass functions Concept of marginal distribution and conditional distribution from physical and geometrical point of view.
		CO.68.	Introduction to probability expectation variance and various other characteristic related to a probability distribution. Study the concept of probability expectation of a multidimensional distribution and related characteristics
		CO.69.	Study Chebyshev's inequality large number of central limit theorem.
	Statistics	**CO.70.**	Study the basic concept of statistics and various characteristics of a statistical sample. Study sample population parameter estimation and testing a hypothesis of a statistical data.
	Operation Research	**CO.71.**	Study the basic concept of linear programming problem along with its solution using graphical method.
		CO.72.	Study the concept of simplex method and its various applications to solve a LPP. Study other techniques of solving LPP such as two phase method, Big-M method.
		CO.73.	Concept of dual problem of an LPP along with its economic interpretation and relation with the primal problem.
		CO.74.	Study the transportation problem and assignment problem along with their mathematical formation and various technique of solving
	Game theory	**CO.75.**	Study the concept of game theory along with various technique of solving.

Paper	Subject Area		Outcomes
Paper-VIII	Numerical Analysis	**CO.76.**	Idea of errors occurs in numerical calculation, grow the technique of solving a problem, i.e., algorithms and convergence problems in this methods.
		CO.77.	Developed the concept various technical methods of finding roots of a transcendental or polynomial equations (also from geometric viewpoint). Understand these methods from analytic point of view (along with rate of convergence and error estimation).
		CO.78.	Idea and mechanical technique (along with their convergence) of solving system of linear algebraic equations
		CO.79.	Developed the idea and the application of finite differences. Understand the concept of interpolation (equi-spaced and unequi-spaced). Learn about various interpolation method form analytic and application viewpoint.
		CO.80.	Learn some techniques of differentiation based on interpolation.
		CO.81.	Learn various techniques of numerical Integration: development of the techniques from various directions, geometric representation, error estimation and applications.
		CO.82.	Idea of numerical method for finding eigenvalues and eigenvectors (Power method). Idea of least square polynomial approximation of various data.
		CO.83.	Make the concept of numerical solution technique of Ordinary Differential Equations: mechanical idea, geometry and application.
	Computer programming	**CO.84.**	Concept of positional number systems and related problems
		CO.85.	Developed the concept of programming languages.
		CO.86.	Grow the idea and understanding of C-language and systematic study of the c-language
		CO.87.	Solve many mathematical problems using computer (by writing programs in C-language)

Paper	Subject Area		Outcomes
Paper-IX	Computer added numerical methods: practical	**CO.88.**	Developed the computer programming skill.
		CO.89.	Better understanding of solving various numerical methods from their algorithms, flowcharts and programs.
		CO.90.	Developed the writing capacity of various programs in c