

**Courses Offered by Department of Mathematics for Program Outcome of B.Sc.
(Hon's) Mathematics**

Program Outcomes, Program Specific Outcomes, Course Outcomes

Program Outcomes	Program Outcome of B.Sc. (Hon's) Mathematics
PO1.	Graduating with Honours in Mathematics allows to be eligible for M.Sc. in Mathematics program.
PO2.	Brief knowledge in Mathematics and understanding of research area in mathematics or statistics.
PO3.	Developed the confidence and ability to work independently and be able to recognize a given real world mathematical problem in which domain of mathematics it falls.
PO4.	Learned to evaluate relevant literature and incorporate it appropriately when introducing the background to a piece of work
PO5.	Developed the ability to communicate technical ideas effectively, both in writing and also in an oral or in writing presentation
PO6.	They will be able to write computer program in C Language and be able to apply in solving real world problem
PO7.	They will be able to formulate and solve mathematical model of a real-world problem.
PO8.	Completion of the Honours program should also enhance job prospects.
Program Specific Outcomes	PSOs of B.Sc. (H) Mathematics Program
PO1.	Demonstrate proficiency in writing proofs
PO2.	Investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods
PO3.	Investigate and solve unfamiliar math problems

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Course Outcomes	<p>Algebra (MATH-122)</p> <p>CO 01: Students will be able to recognize different type of Matrices.</p> <p>CO 02: They will be able to find out Eigen Values and Eigen Vectors</p> <p>CO 03: Students will be able to solve system of linear equations.</p> <p>CO 04: Students will be able to apply the knowledge of solving cubic and biquadrate equations in practical problems.</p> <p>CO 05: Students will know the property of bilinear and quadratic forms.</p>
Credits	LTP:3/1/0
Course Outcomes	<p>Calculus (MATH-123)</p> <p>CO 01: Students will be able to understand limit, continuity, and able to apply differentiation in different type practical problems.</p> <p>CO 02: They understand different properties of curves.</p> <p>CO 03: Students will be able to draw different type Cartesian and polar curves.</p> <p>CO04: Students will be able to know how to calculate area, volume and length of different shapes.</p>
Credits	LTP:3/0/1
Course Outcomes	<p>Advanced Calculus (MATH-211)</p> <p>CO 01: Student understand the concept of Continuity, Sequential continuity, properties of continuous functions uniform continuity</p> <p>CO 02: Understand the basic knowledge of Chain rule of differentiability, Mean value theorems Rolle's theorem and Lagrange's mean value theorem and their geometrical interpretations.</p> <p>CO 03: Application of Taylor's theorem with various form of remainders, Darboux intermediate value theorem for derivatives Indeterminate forms.</p> <p>CO 04: Basic idea of Limit and continuity of real valued functions of two variables, Partial differentiation, Total differentials, Composite functions and implicit functions, change of variables,</p> <p>CO 05: Application of Homogeneous functions and Euler's theorem on homogeneous functions.</p> <p>CO 06: Application Taylor's theorem for functions of two variables Differentiability of real valued functions of two variables,</p> <p>CO 07: Learn about Implicit function theorem, Maxima, Minima and saddle points of two variables, Lagrange's method of multipliers Curves,</p> <p>CO 08: Learn about Tangents, Principal normal, Binomials, Serret-Frenet formulas,</p>

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	Locus of the centre of curvature, Spherical curvature, Locus of centre of spherical CO 09: Learn about curvature, Involutives, Evolutes, Bertrand curves, Surfaces, Tangent planes, one parameter family of surfaces.
Credits	TP:3/1/0
Course Outcomes	Linear Algebra (MATH-212) CO 01: Student will be able to apply basic arithmetic operations on vectors and matrices, including inversion and determinants, using technology where appropriate; CO 02: Able to solve systems of linear equations, using technology to facilitate row reduction; CO 03: Know the basic terminology of linear algebra in Euclidean spaces, including linear independence, spanning, basis, rank, nullity, subspace, and linear transformation; CO 04: The abstract notions of vector space and inner product space; CO 05: Able to find eigenvalues and eigenvectors of a matrix or a linear transformation, and using them to diagonalize a matrix; CO 06: projections and orthogonality among Euclidean vectors, including the Gram-Schmidt orthonormalization process and orthogonal matrices;
Credits	LTP:3/1/0
Course Outcomes	Ordinary Differential Equation (MATH-213) CO 01: They will be able to solve homogeneous and non-homogeneous linear differential equation and its application. CO 02: They will be able to solve different type differential equations. CO 03: students will be able to apply Variation of Parameter for solving differential equations. CO 04: students will be able to apply Method of Undetermined Coefficient for solving differential equations. CO 05: They will be able to apply Lagrange's Method for solving linear differential equation.
Credits	LTP:3/0/1
Course Outcomes	Mathematical Modeling - I (MATH-214) CO 01: Student understand about Equilibrium point, node, saddle points, focus Centre with examples and figures.

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	<p>CO 02: Students learn about linearization of non-linear problems.</p> <p>CO 03: Students learn about Modeling of blood flow, oxygen transfer in red cells and other mathematical formulations of real-life problems.</p> <p>CO 04: Formulation and Analysis of Single species model, Logistic model.</p> <p>CO 05: Understand the two-competing species Lotaka-Volterra models and its analysis.</p> <p>CO 06: Formulation and analysis of different type epidemic models.</p> <p>CO 07: Through this course students learn about different type real life mathematical models and their analysis.</p>
Credits	LTP:3/0/1
Course Outcomes	<p>Boolean algebra (MATH-215)</p> <p>CO 01: Student will learn about fundamentals of set theory.</p> <p>CO 02: Student will learn Lattice theory.</p> <p>CO 03: Student will learn logic gate and switching circuits and its applications</p>
Credits	LTP:3/1/0
Course Outcomes	<p>Numerical Methods (MATH-221)</p> <p>CO 01: Explain the consequences of finite precision and the inherent limits of the numerical methods considered.</p> <p>CO 02: Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.</p> <p>CO 03: Demonstrate they understand the mathematics concepts underlying the numerical methods considered.</p> <p>CO 04: Demonstrate understanding and implementation of numerical solution algorithms applied to the following classes of problems:</p> <p>CO 05: Student will be able to apply different numerical techniques to solve real world problems through programming in C.</p>
Credits	LTP:3/0/1
Course Outcomes	<p>Sequence and Series (MATH-222)</p> <p>CO 01: Students will be able to understand different characteristics of set theory.</p> <p>CO 02: At the end of this course the students will be able to apply the convergence and divergence of a given series by using different tests.</p>

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	CO 03: Students will be able to understand about arbitrary series and their condition of convergence and divergence.
Credits	LTP:3/1/0
Course Outcomes	Solid Geometry (MATH-223) CO 01: They will be able to recognize different type of three-dimensional geometric objects. CO 02: They will be able to understand basic three-dimensional objects like plane, sphere, conicoid and different type equations of these objects. CO 03: They will be able to transform objects from one system to another.
Credits	LTP:3/1/0
Course Outcomes	Vector Calculus (MATH-224) CO 01: They understand about scalar, vectors and their different properties. CO 02: They will be able to apply different type operators in practical problems. CO 03: They will be able to solve vector integration, CO 04: Students will be able to apply Greens, Stokes and Divergence theorem. CO 05: Students will be able to transform problems from one system to another.
Credits	LTP:3/1/0
Course Outcomes	Mathematical Modeling -II (MATH-225) CO 01: Students will learn behavior of fluid flow. CO 02: Student will understand the behavior of heat flow in different geometries. CO 03: Student will understand the behavior of application of wave equation CO 04 Student will be able to formulate mathematical models in electrical circuit theory.
Credits	LTP:3/0/1
Course Outcomes	Groups and Rings (MATH-311) CO 01: Students will be able to understand different type of theorems in algebra. CO 02: students will be able to apply Group, Ring and Field theory in practical applications.

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	<p>CO 03. They apply the knowledge of Groups and Rings in coding theory, quantum mechanics and many other fields.</p> <p>CO 04: They understand about Unique Factorization Domain, Euclidean Domain and Principle Ideal Domain.</p>
Credits	LTP:3/1/0
Course Outcomes	<p>Partial Differential Equations (MATH-312)</p> <p>CO 01: They will understand basic knowledge of Partial Differential Equations.</p> <p>CO 02: Most of the real-world problems are formulated in Mathematical models, which are formulated in the form of partial differential equations.</p> <p>CO 03: They will be able incorporate this knowledge in mathematical models.</p> <p>CO 04: They will be able to classify partial differential equations and change into canonical form.</p> <p>CO 05: Students will be able to solve one- and two-dimensional Heat equation, Wave equation and Laplace equations.</p>
Credits	LTP:3/0/1
Course Outcomes	<p>Real Analysis (MATH-313)</p> <p>CO 01: They understand about basic idea of integration of functions.</p> <p>CO 02: They will be able to understand application of Mean value theorems.</p> <p>CO 03: students will be able to analyze convergence and divergence of improper integrals through different tests.</p> <p>CO 04: Students will apply this knowledge in boundedness, finite intersection property, compactness, connectedness, components, continuity in relation with continuity in relation connectedness in Metric Space.</p>
Credits	LTP:3/1/0
Course Outcomes	<p>Special functions and Integral Transforms (MATH-314)</p> <p>CO 01: Students will be able to apply series solution method to solve practical problems of differential equations</p> <p>CO 02: students will understand the application of Laplace; inverse Laplace transform and Fourier transforms.</p> <p>CO 03: They will recognize and solve different type differential equations.</p> <p>CO 04: Students will be able to apply convolution theorem.</p>

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Credits	LTP:3/1/0
Course Outcomes	Statics (MATH-315) CO 01: They understand about static forces and its resolution. CO 02: They understand about equilibrium of forces. CO 03: They apply the knowledge of friction, Centre of gravity, virtual work in real life situation. CO 04: They will understand about Stable and unstable equilibrium position. CO 05: Students will be able to apply the knowledge of forces in three dimensions.
Credits	LTP:3/1/0
Course Outcomes	Combinatorial Mathematics (MATH-316) CO 01: Student will learn basic counting principle. CO 02: Student will learn Recurrence relation and Generating function. CO 03: Student will learn Polya's counting theory.
Credits	LTP:3/1/0
Course Outcomes	Multivariate calculus (MATH-317) CO 01: Student will be able to understand point set topology. CO 02: Student will be able to learn linear transformation from R^m to R^n . Student will learn Riemann Integral and its properties. Student will learn Lebesgue's integral and its properties.
Credits	LTP:3/0/1
Course Outcomes	Graph Theory (MATH-318) CO 01: Student will be able to understand basic properties of graph and trees. CO 02: Student will learn Walk path and circuit. CO 03: Student will be able to solve Travelling salesman problem though graph path and circuit.
Credits	LTP:3/1/0
Course Outcomes	Automata Theory (MATH 319) CO 01: Student will learn Finite Automata.

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	CO 02: Student will be able to understand Languages and Grammar. CO 03: Student will learn Turing Machines.
Credits	LTP:3/1/0
Course Outcomes	Portfolio optimization (MATH-320) CO 01: Student will learn financial markets and types of risk and mutual funds. CO 02: Student will be able to understand Mean Variance Portfolio optimization techniques. CO 03: Student will learn capital market theory and security market lines.
Credits	LTP:3/1/0
Course Outcomes	Industrial Mathematics (MATH330) CO 01: Students will be able to medical imaging and inverse problems based on the calculus. CO02: Students will learn about X-Ray behavior Radon transform and back projection. CO 03: They will learn Fourier and Inverse Fourier transform and their properties in image reconstructions.
Credits	LTP:3/1/0
Course Outcomes	Bio Mathematics (MATH-326) CO 01: Students will be able to understand mathematical biology and their modelling process. CO02: Students will learn about the different epidemic models. CO 03: They will learn spatial and discrete models.
Credits	LTP:3/1/0
Course Outcomes	Applied Statistics (MATH-331) CO 01: Students will be able analyse time series and index number. CO02: Students will learn Statistical Quality Control. CO 03: They will learn to measure mortality rate, standardize death rate.
Credits	LTP:3/1/0
Course Outcomes	Cryptography and Network security (MATH-328) CO 01: Students will be able to understand Cryptography principles and its applications.

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	CO02: Students will be able to understand Network attacks and IP spoofing. CO 03: Students will be able to understand IP security architectures.
Credits	LTP:3/1/0
Course Outcomes	History of Mathematics (MATH-329) CO 01: Students will be able to learn various branches of mathematics. CO02: Students will be able to understand geometry and history of ancient mathematics (Hindu and Arabic). CO03: Students will be able to understand geometry and history of Greek mathematics.
Credits	LTP:4/0/0
Course Outcomes	Statistics (MATH-311) CO 01: Students will be able to analyze the raw data. CO02: Students apply the concept of sampling theory. CO 03: They will apply different type of tests like chi square test, t-test, Z-test and F- tests, CO 04: They will be able to apply correlation and regression in practical problems. CO 05: They will understand different type of distributions such as Normal, Binomial, Poisson.
Credits	LTP:3/1/0
Course Outcomes	Linear Programming (MATH - 322) CO 01: Student will understand about formulation of Linear Programming problem and its graphical solution. CO 02: They will analyze the basic property of convex and concave functions. CO 03: Student will understand about solution of Linear programming problem by Simplex method. CO 04: They will apply the big M- Technique, The two-phase method, Principle of duality in linear programming problem. CO 05: Student will be able to solve Transportation and Assignment problems.
Credits	LTP:3/1/0
Course Outcomes	Dynamics (MATH321) CO01: Basic terminologies of Dynamics

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	<p>CO02: Understand General motion of a rigid body, and apply in practical problems</p> <p>CO03: Able ability to apply knowledge of Dynamics in science and engineering</p> <p>CO04: Be proficient in the use of mathematical methods to analyze the forces and motion a system.</p> <p>CO05: Be able to identify, formulate, and solve science and engineering problems.</p>
Credits	LTP:3/1/0
Course Outcomes	<p>Number theory and trigonometry (MATH-323)</p> <p>CO 01: Students will gain the knowledge about g.c.d, l.c.m., fundamental theorem of arithmetic, linear congruence, Fermat's theorem, Wilson's theorem.</p> <p>CO 02: Students will gain the knowledge about the area complete residue system, Euler's theorem, Fermat's theorem, Chinese remainder theorem, gauss lemma.</p> <p>CO 03: Students will apply their knowledge in the field of greatest integer function, Moebius function, Moebius inversion formula.</p> <p>CO 04: Students will get the knowledge in the area De-Moivre's theorem, trigonometric function, hyperbolic function.</p> <p>CO 05: Students will get the knowledge in the area inverse circular and hyperbolic function, logarithmic of a complex quantity Gregory's series.</p>
Credits	LTP:3/1/0
Course Outcomes	<p>Programming in C and Numerical Techniques (MATH-324)</p> <p>CO 01: Student will understand about the basic concept of C language.</p> <p>CO 02: They will apply C language in solution of different practical problems.</p> <p>CO 03: Students will be able to solve problems through programming in C and also handling functions</p> <p>CO 04: They will solve linear and nonlinear problems using C language.</p> <p>CO 05: They will be able to solve Integration, and solution of ordinary differential equations with C programming.</p>
Credits	LTP:3/0/1
Course Outcomes	<p>Real and complex analysis (MATH-325)</p> <p>CO 01: Students will get the knowledge about the area Jacobeans, beta and gamma functions, double and triple integral</p> <p>CO 02: Students will get the knowledge in the field Fourier series, Fourier transform, half range series.</p>

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	<p>CO 03: Students will get the knowledge in the field of stereographic projection of complex number, continuity and differentiability of complex function, analytic function, and harmonic function.</p> <p>CO 04: Students will gain the knowledge in the area of conformal mapping, mobius transformation, fixed points, critical mapping.</p>
Credits	LTP:3/0/1