

DEPARTMENT OF MATHEMATICS

Programme Outcome

On completion of the B.Sc-Mathematics, (CBCS) programme, the student will be able to:

- Communicate mathematics effectively by oral, written, computational and graphic means.
- Create mathematical ideas from basic axioms.
- Utilize mathematics to solve theoretical and applied problems.
- Identify applications of requirement of Mathematics in other disciplines and in real world.
- Appreciate the requirement of lifelong learning through continued education.
- Ability to learn and apply the computer programming in C.
- Ability to undertake project work.

BSc Mathematics (Honours) Syllabus (CBCS)

1st Semester (Honours)

Paper Name: Calculus

Paper Code: MAT-HC-1016

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Learn first and second order derivative tests for relative extrema and apply the knowledge in problems in business, economics and lifesciences. ii) Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference. iii) Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas. iv) Understand the calculus of vector functions and its use to develop the basic principles of planetary motion.	UNIT 1: Higher order derivatives and its application, geometrical interpretation.	Remember, Understand, apply, evaluate
	UNIT 2: Reduction formulas for integration and application of integration in geometry	Remember, Understand, apply, evaluate
	UNIT 3: Vector functions and its applications	Remember, Understand, apply, evaluate

Paper Name: Algebra

Paper Code: MAT-HC-1026

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Employ De-Moivre's theorem in a number of applications to solve numerical problems. ii) Learn about equivalent classes and cardinality of a set. iii) Use modular arithmetic and basic, properties of	Unit 1: Generalization of complex numbers	Remember, Understand, evaluate
	Unit 2: Statements and Logic, Functions	Remember, Understand, evaluate
	Unit 3: Relations Induction Principle and number system	Remember, Understand, evaluate

<p>congruence.</p> <p>iv) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.</p> <p>v) Learn about the solution sets of linear systems using matrix method and Cramer's rule</p>	<p>Unit 4: System of linear equations and matrix operations</p>	<p>Remember, Understand, evaluate</p>
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2nd Semester (Honours)

Paper Name: Real Analysis

Paper Code: MAT-HC-2016

Course Outcome	Unit No. And Name	Bloom's Taxonomy Level
This course will enable the students to: i) Understand many properties of the real line R , including completeness and Archimedean properties. ii) Learn to define sequences in terms of functions from N to a subset of R . iii) 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.	UNIT 1: Algebraic and order properties of R ,	Remember, Understand, evaluate
	UNIT-2: Real sequences	Remember, Understand, evaluate
	UNIT 3: Infinite series	Remember, Understand, evaluate

Paper Name: Differential Equation

Paper Code: MAT-HC-2026

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Learn basics of differential equations and mathematical modelling. ii) Formulate differential equations for various mathematical models. iii) Solve first order non-linear	UNIT 1: Differential equations and mathematical models	Remember, Understand, apply, evaluate
	UNIT 2: Application of differential equations in Modelling	Remember, Understand, apply, evaluate

differential equations and linear differential equations of higher order using various techniques. iv) iv) Apply these techniques to solve and analyse various mathematical models.	UNIT 3: Solutions and properties of Differential equations.	Remember, Understand, apply, evaluate
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3rd Semester (Honours)

PAPER NAME: Theory of Real Functions

PAPER CODE: MAT-HC-3016

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Have a rigorous understanding of the concept of limit of a function. ii) Learn about continuity and uniform continuity of functions defined on intervals. iii) Understand geometrical properties of continuous functions on closed and bounded intervals. iv) Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications. v) Know about applications of mean value theorems and Taylor's theorem	Unit1: Limits of a Function.	Remember, Understand, evaluate
	UNIT 2: Continuous functions	Remember, Understand, evaluate
	UNIT 3: Differentiability of a function and related properties.	Remember, Understand, evaluate

Paper Name: Group Theory

Paper Code: MAT-HC-3026

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc. ii) Link the fundamental concepts of groups and symmetrical figures. iii) Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups. iv) Explain the significance of the notion of cosets, normal subgroups and factor groups. v) Learn about Lagrange's theorem and Fermat's Little theorem. vi) Know about group homomorphisms and group isomorphisms.	Unit1: Introduction to symmetry and different forms of groups and its different properties.	Remember, Understand, evaluate
	Unit2: Quotient groups and related properties	Remember, Understand, evaluate
	Unit3: Group Homomorphisms, its properties and related theorems.	Remember, Understand, evaluate

Paper Name: Analytic Geometry

Paper Code: MAT-HC-3036

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Learn conic sections and transform co-ordinate systems ii) Learn polar equation of a conic, tangent, normal and properties iii) Have a rigorous understanding of the concept of three-dimensional coordinates systems	UNIT 1: Transformation of coordinates, Conic sections.	Remember, Understand, evaluate
	Unit2: Study of Planes	Remember, Understand, evaluate

4th Semester (Honours)

Paper Name: Multivariate Calculus

Paper Code: MAT-HC-4016

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Learn the conceptual variations when advancing in calculus from one variable to multivariable discussion. ii) Understand the maximization and minimization of multivariable functions subject to the given constraints on variables. iii) Learn about inter-relationship amongst the line integral, double and triple integral formulations. iv) Familiarize with Green's, Stokes' and Gauss divergence theorems	UNIT 1: Functions of several variables,	Remember, Understand, evaluate
	UNIT 2: Extrema of functions of two variables, Method of Lagrange multipliers	Remember, Understand, apply, evaluate
	UNIT 3: Double integration over rectangular and nonrectangular regions,	Remember, Understand, evaluate
	UNIT 4: Line integrals and its applications	Remember, Understand, apply, evaluate

Paper Name: Numerical Method

Paper Code: MAT-HC-4026

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Learn 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. ii) Know about methods to solve system of linear equations, such as False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition.	Unit1: Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition	Remember, Understand, apply, evaluate
	UNIT 2: Lagrange and Newton interpolation: linear and higher order, finite difference operators.	Remember, Understand, evaluate

iii) Interpolation techniques to compute the values for a tabulated function at points not in the table.	UNIT 3: Numerical differentiation: forward difference, backward difference and central difference. Integration: trapezoidal rule, Simpson's rule, Euler's method.	Remember, Understand, evaluate
iv) Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.		

Paper Name: Ring Theory Paper

Code: MAT-HC-4036

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Appreciate the significance of unique factorization in rings and integral domains. ii) Learn about the fundamental concept of rings, integral domains and fields. iii) Know about ring homomorphisms and isomorphisms theorems of rings. iv) Learn about the polynomial rings over commutative rings, integral domains, Euclidean domains, and UFD.	Unit1: Rings, field, Ideals and their properties.	Remember, Understand
	Unit 2: Polynomial Rings, PID, homomorphism isomorphism and related theorems	Remember, Understand, evaluate

5th Semester (Honours)

Paper Name: Complex Analysis

Paper Code: MAT-HC-5016

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
The completion of the Course will enable the students to: i) Learn the significance of differentiability of complex functions leading to the understanding of Cauchy–Riemann equations.	UNIT 1: Properties of Complex Numbers	Remember, Understand
	UNIT 2: Analytic Functions	Remember, Understand, Evaluate
(ii) Learn some elementary functions and evaluate the contour integrals. (iii) Expand some simple functions as Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy residue theorem to evaluate integrals.	UNIT 3: Contours, Contour Integrals and Its Examples	Remember, Understand, Evaluate
	UNIT 4: Anti-derivatives, Proof of Anti-derivative Theorem and Other Related Theorems	Remember, Understand, Apply, Evaluate

Paper Name: Linear Algebra

Paper Code: MAT-HC-5026

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space. ii) Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation, and the change of coordinate matrix. iii) Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as	Unit 1: Vector spaces and subspaces	Remember, Understand
	Unit 2: Eigenvectors and eigenvalues of a matrix, the characteristic equation, diagonalization, eigen-vectors of a linear transformation, complex eigenvalues,	Remember, Understand, evaluate

<p>well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.</p> <p>iv) Compute inner products and determine orthogonality on vector spaces, including Gram–Schmidt orthogonalization to obtain orthonormal basis.</p> <p>v) Find the adjoint, normal, unitary and orthogonal operators.</p>	<p>Unit 3: Inner product, length, and orthogonality, orthogonal sets, orthogonal projections, the Gram–Schmidt process, inner product spaces; Diagonalization of symmetric matrices, the Spectral Theorem</p>	<p>Remember, Understand, apply, evaluate</p>
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Paper Name: Number Theory

Paper Code: MAT-HE-5016

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
<p>This course will enable the students to:</p> <p>i) Learn about some fascinating discoveries related to the properties of prime numbers, and number theory, viz., Goldbach conjecture etc.</p> <p>ii) Know about number theoretic functions and modular arithmetic.</p> <p>iii) Solve linear, quadratic and System of linear congruence equations.</p>	<p>Unit 1: Linear Diophantine equation, prime counting function and related theorems</p>	<p>Remember, Understand, evaluate</p>
	<p>Unit 2: Number theoretic functions, sum and number of divisors, totally multiplicative functions and other functions</p>	<p>Remember, Understand, evaluate</p>

PAPER NAME: Programming in C (Including Practical)

PAPER CODE: MAT-HE-5066

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
<p>This course will enable the students to:</p> <p>i) Understand and apply the programming concepts of C which is important to mathematical investigation and problem solving.</p> <p>ii) Learn about structured data-types in C and learn about applications in factorization of an integer and understanding Cartesian geometry and Pythagorean triples.</p>	<p>Unit 1: Variables, constants, reserved words, library functions, structure of a C program, input/output functions and statements</p>	<p>Remember, Understand, evaluate</p>
	<p>Unit 2: Control Statements</p>	<p>Remember, Understand, apply, evaluate</p>

<p>iii) Use of containers and templates in various applications in algebra.</p> <p>iv) Use mathematical libraries for computational objectives.</p> <p>v) Represent the outputs of programs visually in terms of well formatted text and plots.</p> <p>vi) In practical students learn about the roots of a quadratic equation, solution of an equation using N-R algorithm, $\sin(x)$, $\cos(x)$ with the help of functions</p>	<p>Unit 3: Arrays and subscripted variables, Functions</p>	<p>Remember, Understand, apply, evaluate</p>
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6th Semester (Honours)

PAPER NAME: Riemann Integration and Metric Space

PAPER CODE: MAT-HC-5016

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
<p>This course will enable the students to:</p> <p>i) Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental theorems of integration.</p> <p>ii) Know about improper integrals including, beta and gamma functions.</p> <p>iii) Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.</p> <p>iv) Analyse how a theory advances from a particular frame to a general frame.</p> <p>v) Appreciate the mathematical understanding of various geometrical concepts, viz. Balls or connected sets etc. in an abstract setting.</p> <p>vi) Know about Banach fixed point theorem, whose far-reaching consequences have resulted into an independent branch of study in analysis, known as fixed point theory.</p> <p>vii) Learn about the two important topological properties, namely connectedness and compactness of metric spaces.</p>	Unit 1: Riemann integration	Remember, Understand, evaluate
	Unit 2: Metric spaces and their properties	Remember, Understand, evaluate
	Unit 3: Continuous mappings in metric spaces and other mappings related to metric spaces	Remember, Understand, evaluate

Paper Name: Partial Differential Equations**Paper Code: MAT-HC-6026**

Course Outcome	Unit No. and Name	Bloom's Taxonomy Level
This course will enable the students to: i) Formulate, classify and transform first order PDEs into canonical form. ii) Learn about method of characteristics and separation of variables to solve first order PDE's. iii) Classify and solve second order linear PDEs. iv) Learn about Cauchy problem for second order PDE and homogeneous and non-homogeneous wave equations. i) Apply the method of separation of variables for solving many well-known second order PDEs.	Unit 1: Introduction, Construction of first order partial differential equations (PDE). Cauchy's problem for first order equations and related methods	Remember, Understand, evaluate
	Unit 2: Canonical form of first order PDE, Method of separation of variables for first order PDE.	Remember, Understand, evaluate
	Unit 3: Reduction to canonical forms, Equations with constant coefficients, General solution.	Remember, Understand, evaluate

Paper Name: Mathematical Modelling**Paper Code: MAT-HE-6036**

Course Outcome	Unit No. And Name	Bloom's Taxonomy Level
This course will enable the students to: i) Know about power series solution of a differential equation and learn about Legendre's and Bessel's equations. ii) Use of Laplace transform and inverse transform for solving initial value problems. ii) iii) Learn about various models such as Monte Carlo simulation models, queuing models, and linear programming models.	Unit 1: Power series solution of a differential equation about an ordinary point, solution about a regular singular point, The method of Frobenius; Legendre's and Bessel's equation.	Remember, Understand, evaluate
	Unit2: Laplace transform and inverse transform, application to initial value problem up to second order.	Remember, Understand, evaluate
	Unit 3: Monte Carlo Simulation Modelling, Generating Random Numbers	Remember, Understand, apply, evaluate

